Weights and Marketplaces from the Bronze Age to the Early Modern Period.
Proceedings of Two Workshops
Funded by the European Research Council (ERC)

Edited by Lorenz Rahmstorf and Edward Stratford

Weight & Value

Edited by Lorenz Rahmstorf
Seminar für Ur- und Frühgeschichte
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Weights and Marketplaces

from the Bronze Age to the Early Modern Period

Edited by

Lorenz Rahmstorf and Edward Stratford

with contributions from

Enrico Ascalone, Grégory Chambon, Jessica Dijkman, Gary M. Feinman, William B. Hafford, Hans Peter Hahn, Edward M. Harris, Kenneth Hirth, Thomas Höltken, Fang Hui, Nicola Ialongo, Jane Kershaw, Stephen A. Kowalewski, Lionel Marti, Anna Michailidou, Juan Carlos Moreno García, Linda M. Nicholas, Adelheid Otto, Karl M. Petruso, Luca Peyronel, Lorenz Rahmstorf, Felix Rösch, Edward Stratford, David A. Warburton, Elsbeth M. van der Wilt

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Cover:
Front cover (top left): Reconstruction of the scale from Bordjoš, Banat, Serbia, ca. 1200 BC (modified after Medović 1995, fig. 5, cf. p. 124).
Front cover (top right): Spool-shaped balance weights with markings from Tiryns, Argolid, Greece, mid and later third millennium BC. Courtesy of Lorenz Rahmstorf.
Front cover (bottom left): A cubo-octahedral weight from Cttam, East Yorkshire, England, ca. 9th century AD. Courtesy of Jane Kershaw.
Front cover (bottom right): A stone ´amulet` from Tepe Gawra, northern Iraq, ca. mid fifth millennium BC (Speiser 1935, pl. XLIIIb, cf. p. 30).
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Preface by the editor of the series

The Seminar für Ur- und Frühgeschichte (Institute for Prehistory and Early Historical Archaeology) at the Georg-August-University of Göttingen has been publishing archaeological research for over more than half a century. Within the „Göttinger Schriften zur Vor- und Frühgeschichte" monograph series, 35 volumes – mostly PhD and Habilitation theses – have appeared since 1961, original archaeological data are presented and analysed in detail. The more recent „Göttinger Forschungen zur Ur- und Frühgeschichte" (three volumes so far), appeals also to a wider public and presents specific research areas of the Institute. „Neue Ausgrabungen und Forschungen in Niedersachsen", is a series designed to bring smaller studies such as MA theses from the region of Lower Saxony to publication. Within the monograph series „Studien zur nordeuropäischen Bronzezeit", which is funded by the Academy of Sciences and Literature in Mainz, the results of a research project directed by my predecessor, Karl-Heinz Willroth, are presented. Now, a new series „Weight & Value" – of which this is the first volume – sets a new and additional focus on weights, scales and weight regulated artefacts in prehistoric and early historical archaeology and the relevance of these objects for the reconstruction of ancient concepts of material value. The title was inspired by two books by Anna Michailidou with the same title. First and foremost, the results of the ERC-2014-CoG ‚WEIGHTANDVALUE: Weight metrology and its economic and social impact on Bronze Age Europe, West and South Asia' [Grant no. 648055] will be presented in the new series. However, as no series exists so far for the publication of detailed studies on early metrology and the material evidence, we hoped to establish this series for publications even after the ERC project has come to an end. There is a substantial need for a such a publication series dealing with issues of „weight and value" for the whole time-span from the Chalcolithic period and Bronze Age to the Medieval and early modern period. To attract an international author- and readership, the peer-reviewed series will be published in English (Current guidelines for submission can be found at the back of this volume).

This first volume presents two workshops in a series of workshops funded by the ERC-2014-CoG ‚WEIGHTANDVALUE'. The workshop „Weights and their identification. Methodological challenges in the study of ancient weights and metrological systems" was hosted at the Institut für Vorderasiatische Archäologie (Institute for Near Eastern Archaeology) at the Ludwig-Maximilians-University, Munich, which took place on 25-26 June 2016. I would like to thank Adelheid Otto and her team for their great hospitality in Munich. Most of the papers presented at this workshop are published in the first part of this book with the very welcome addition of Karl Petruso's paper who unfortunately was unable to attend. The workshop „Weights and marketplaces. The phenomenology of places of exchange within a diachronic and multi-cultural perspective" took place over a year later at the Seminar für Ur- und Frühgeschichte in Göttingen on October 19-21 2017. Not only nearly all participants submitted papers for the proceedings volume, but with Juan Carlos Moreno García, Felix Rösch, Gary M. Feinman, Fang Hui and Linda M. Nicholas, further renowned specialists, contributed to the theme of the workshop in the present volume, though they could not attend the event itself. I would like to thank all authors for their contributions and my co-editor Edward Stratford for his support. Editing and layout lay in the hands of Heinz-Peter Koch with the help of Sandra Busch-Hellwig. The printing and the open access of this publication has been financed by the ERC Grant.

Göttingen, July 2019

Lorenz Rahmstorf

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Part II "Weights and marketplaces: The phenomenology of places of exchange within a diachronic and multi-cultural perspective"

Weighing silver on the scales. An overview of silver hoards and balance weights during the Middle Bronze Age (*ca.* 2000-1600 BC) in the Near East

by Luca Peyronel

Middle Bronze Age, Ancient Near East, scale weights, silver bullion

Silver was the main medium of exchange and standard of value in the ancient Near East. Written documents inform that when it passed through hands it was always weighed on a balance. However, texts are less informative regarding practical operations involving such exchange. On the contrary, coherent assemblages of balance weights reveal much about official standards, how widely were they acknowledged within a given territory and how far were different official systems reciprocally interconnected, and they can also offer precious information on the practical weighing operations. A first evaluation of sets of Near Eastern weights and silver hoards from sites dated to the Middle Bronze Age is here presented together with the methodological approach for the analysis of silver bullion elaborated by an interdisciplinary research group of Italian archaeologists, assyriologists and numismatics.

Silber auf der Waage wiegen. Ein Überblick über Silberhorte und Gewichte während der mittleren Bronzezeit (ca. 2000-1600 v. Chr.) im Vorderen Orient

Mittelbronzezeit, Alter Orient, Gewichte, Silberbarren

Silber war im Vorderen Orient das hauptsächliche Austauschmittel und ein Wertmaßstab. Aus den schriftlichen Quellen wissen wir, dass Silber beim Austausch immer gewogen wurde. Die Texte sind weniger informativ, wenn es um die praktischen Vorgänge geht, die hierbei abliefen. Im Gegensatz dazu können kohärente Assemblagen von Gewichten viel zur Frage von offiziellen Standards, ihrer Verbreitung in einem bestimmten Territorium und ihrem reziproken Zusammenspiel mit anderen offiziellen Systemen beitragen. Eine erste Auswertung von vorderasiatischen Gewichtssets und Horten mit Silber aus Fundplätzen der Mittelbronzezeit wird hier zusammen mit der methodologischen Herangehensweise für die Auswertung von Silberbarren präsentiert, die aus einer interdisziplinären Zusammenarbeit von italienischen Archäologen, Assyriologen und Numismatikern hervorgegangen ist.

Introduction

From the mid-3rd millennium BC onwards silver (Sum. kù-babbar; Akk. *kaspu*) became a standard of equivalence in the economy according to a system which selected certain specific materials and products, taken as reference for others. In Mesopotamia the system became structured early on with silver and barley used as standards of equivalence for other goods and materials (at the beginning also together with copper); reciprocal values became fixed and remained largely unchanged over time, with a shekel of silver corresponding to one gur of barley (Milano 2003; Pomponio 2003; Monaco/Pomponio 2009). In Syria, according to the evidence from Ebla, instead of barley, wool was used as a standard of value, although silver largely predominated, and a specific series of wool measures was also adopted by the palace administration (Biga 2011; 2014).

In the absence of explicit, unequivocal indications in the oldest texts, the exact meaning of silver being referred to as the 'equivalent/corresponding', 'value', or 'price' (of purchase) of goods remains uncertain. In terms of financial practice, it is therefore difficult to assess the effective extent of circulation of metals of equivalent value. However it is a matter of fact that in Early Dynastic IIIa-b written economic records of sales of houses, land and slaves, the 'value' is expressed in silver (and also in copper and barley). At the end of the 3rd millennium BC (Ur III) written sources unambiguously record the use of silver as a currency that functioned as a means of equivalence, exchange/payment and wealth accumulation (Paoletti 2008; Mander/Notizia 2009), and at the same time the control of weights and measures by the political authority through their standardization and the manufacture of official standards (Chambon 2011, 38-40; Peyronel 2012a, 23-26).

The process must have started well before, probably already at the time of the urban revolution, and developed through the Early Bronze Age, culminating in a series of normative interventions at the time of the Akkad and Ur III kingdoms. Silver (and gold) circulation in objects (ingots, bowls, bracelets, daggers, rings) of standardized weight was already carefully registered in the economic accounts of Ebla, whatever the modes of their movement (redistributive, gift-giving, ceremonial) (Maiocchi 2010), possibly indicating that the process of normative regulations of standard values began earlier in larger territorial entities in the northern regions with respect to the city-states of Early Dynastic Mesopotamia, where balance weights display a greater variability of values (Peyronel 2012a, 10-13).

As recent trends in ancient metrology suggest, however, the normative aspect is but a part of the problem. Norms attempt to regulate instances of human behaviour, which do not necessarily conform to the theoretical exactness that is inherent in normative systems. In order to address the question of the relationship between practice and institutional norms, as well as the operative modes of silver circulation in the Bronze Age Near East, an interdisciplinary group of Italian archaeologists, numismatics, assyriologists and economists started in 2017 a research project, under the scientific coordination of the Author ('Silver Circulation in the Ancient Near East', SCANE; Peyronel 2018).

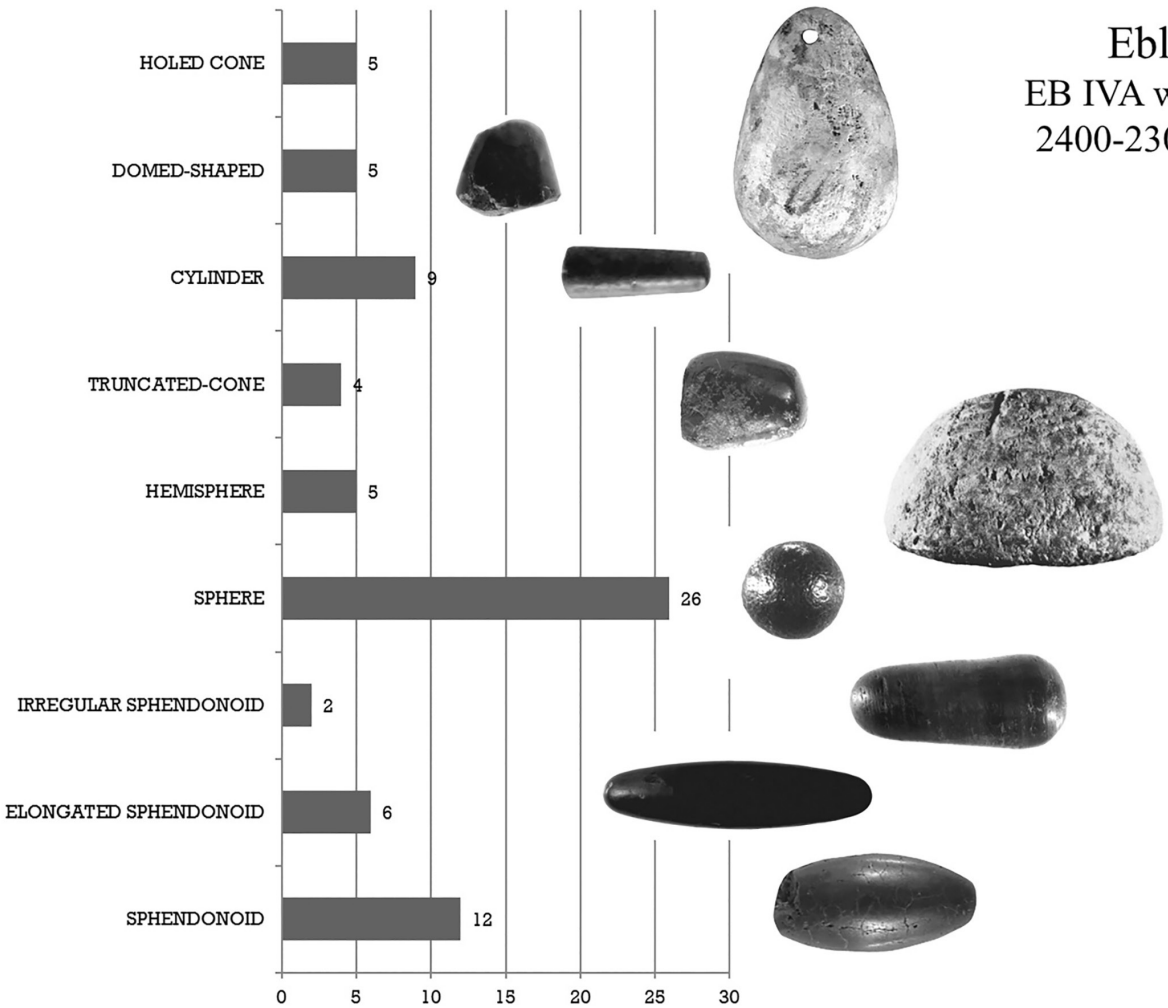
Thus, the occasion of the workshop that marks the beginning of the important multi-year ERC project headed by L. Rahmstorf comes at the right moment to present as a material for discussion an overview on some sets of weights and silver hoards dating to the Middle Bronze Age (hereafter MBA) and a preliminary analysis related to an on-going study carried out together with N. Ialongo and A. Vacca, which attempts to address the relation between hacksilver circulation and weight standards (Ialongo *et al.* 2018a).

The late 3rd-millennium prelude

Metrological research usually focuses on reconstructing standard units that operated within a system of established ratios. The general approach often aims to characterize differences and peculiarities between different official systems as well as continuity and changes over time (Powell 1990; Alberti/Parise 2005). The official acknowledgement of a standard unit by a state administration in fact reflects an attempt to establish political control over an economic system, also provided a tool to negotiate exchange politics at an inter-state level, as reflected in the huge amount of administrative cuneiform documents from the 3rd millennium BC onwards, and was the result of a process that included the quantification and commensuration of different commodity values (Rahmstorf 2010). The historical and culturally oriented study of ancient metrology should always begin with an archaeological evaluation of the weights, as careful as any other class of artefact, taking into account their intrinsic features, provenance, and context (Alberti *et al.* 2006). As a result, this socio-political implication of inter-state exchange translates into the search for recurrent modules in the distribution of weight values in a spatially and chronologically defined set of balance weights, establishing correlation between the exemplars and the units in use of a certain historical metrological system (Ascalone/Peyronel 2006a, 23-49). The most common statistical/mathematical procedure currently adopted for identifying 'quanta' related to the theoretical units is the modular or 'quantal' approach (the so-called Kendall formula, or cosine quantogram analysis, hereafter CQA), which is specifically tailored for the identification of a norm

(Pakkanen 2011, with previous references). This statistical method might reliably be used to test proposed standards obtained through empirical evaluation of masses against fixed norms known from texts and marked/inscribed exemplars. Texts in fact attest the principal metrological units in Mesopotamia from the late 26th century BC (Fara texts, Powell 1990, 510; *cf.* Krebernik 1998) and in Syria from the 24th century BC (Ebla archives, Archi 1987). Meanwhile, although some stone objects dated to the 4th and early 3rd millennium could be considered possible scale weights (Rahmstorf 2014; Hafford in this volume), the first inscribed Mesopotamian royal weight is from the reign of Uruinimgina of Lagash, and the earliest set of proper weights, *i. e.* marked/inscribed exemplars, in Syria in a well-dated context comes from the Royal Palace G of Ebla, both dating to the 24th century BC (Peyronel 2012a, 11-13).

The case of Ebla shows the political control as evidenced by metrological reconstruction. Out of 79 Early Bronze Age weights 47 have been retrieved on the floor level of Royal Palace G and 3 in Building P4, a multifunctional public complex to the north of the palace (Ascalone/Peyronel 2006a, 80-121, 179-207). A modular approach to the empirical evaluation of those weights suggests that several systems of unit measure were present in the city. Spherical and ovoidal shapes (more or less elongated and without bases) made from iron oxides (hematite and goethite) predominate, with masses ranging from 1 to 150 g and clustered on values of multiples and sub-multiples of the local unit of 7.8 g (Ascalone/Peyronel 2006a, 82-84, tab. 3.1) (Fig. 1). Some exemplars can be also related to the 9.4 g and 11.7 g units systems, showing that the sub-regional systems related to the Western mina of *ca.* 470 g were already in use during the Early Bronze Age (hereafter EBA). Moreover a group of small weights, mainly of spherical shape, have masses fitting well with a unit of 6.6 g and its decimal multiple, and a scale set of fractional mina multiples composed of limestone and basalt weights bearing marks of debated metrological interpretation come from a small archive-room opening onto the palace courtyard (Peyronel 2014b, 126-128; 2016, 58-61). Some conical limestone weights, pierced atop and carefully worked, always corresponding to a double mina (local or foreign, including the only inscribed EBA Eblaite weight),

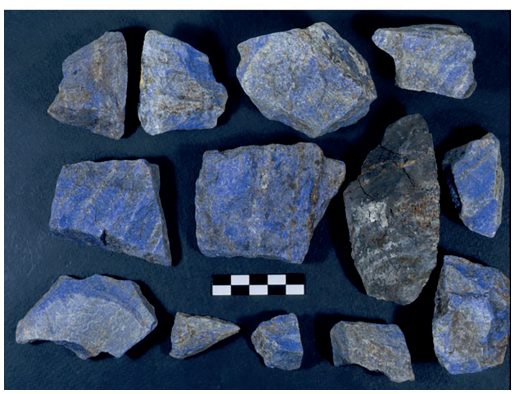


▼*Fig. 1. Quantitative distribution of the EB IVA (ca. 2400-2300 BC) scale weight's types from Ebla (© Italian Archaeological Expedition to Ebla).*

were associated without doubt with weighing operations related to precious raw materials, and specifically to lapis lazuli, as demonstrated by the presence of a wooden beam found together with a weight of this type and unworked pieces of lapis in a room at the back of the reception room in the Administrative Quarter (Peyronel 2011, 110-111; 2016, 60-62) (Fig. 2).

Of paramount importance, the state archives of Ebla give us the possibility to match data recovered from the balance weights with those from the economic and administrative records. The Eblaite system was sexagesimal and different terms were employed to indicate the main metrological values (*e. g. ma-na* = 1 mina, *ša-pi* = ⅔ of a mina or 40 shekels, TAR = ½ of a mina or 30 shekels, gur_8 = ⅓ of a mina = 20 shekels, gín-DIL-MUN = 1 shekel) and a series of shekel sub-multiples (2-NI, 3-NI, 4-NI, 5-NI, 6-NI, respectively ⅔, ⅓, ¼, ⅕ and ⅙ of a shekel) (Pomponio 1980; Archi 1987, 67-83; Chambon 2011, 58-61).

The complex system of precious metal accumulation and circulation evidenced by the written sources seems to have been based on importing quantities of silver and gold and redistributing manufactured items in standardized masses. An object's weight was carefully recorded by the administration and weighing operations were certainly carried out under the control of the palace bureaucracy, as revealed by the official weight sets found in the Royal Palace (Archi 2011; Peyronel 2014a, 362-365).



▲▶ *Fig. 2. Conical weight and lapis lazuli from room L.2982 in the Royal Palace G of Ebla (© Italian Archaeological Expedition to Ebla).*

Middle Bronze Age scale weights

The largest variety of groups of weights from individual sites in the ancient Near East are dated to the Middle Bronze Age (*ca.* 2000-1600 BC). They come from some of the major urban centres of Mesopotamia, the Levant, Anatolia and Western Iran, and allow the mensuration systems used at both local and interregional levels to be evaluated. Middle Bronze Age metrology is much better evidenced than in later periods. For the subsequent Late Bronze Age, (*ca.* 1600-1200 BC) few large groups of weights have been published. Two groups stand out: Ras Shamra/Ugarit – more than six hundred scale weights, mostly dating to the 13th century BC (Courtois 1990; Bordreuil 2006), and the Uluburun shipwreck (early 13th century BC) – 103 stone, 38 bronze, and 8 lead exemplars pertaining to different scale sets (Pulak 2000; Pakkanen 2011). Later periods do not offer significantly better evidence. Our knowledge of 1st millennium metrology – in particular the systems employed by the Neo-Assyrian and Neo-Babylonian empires – is derived from written evidence and a small number of published inscribed or marked weights (see recently Peyronel 2015 and Fales 2016 for Assyria). The numerous exemplars discovered at Assur lack reliable contexts and consequently their chronology is uncertain (see, however, Ascalone/Peyronel 2006a, 423-430). The situation in the Northern Levant and Anatolia is even worse, with little published material (*e. g.* Zincirli: Archi/Klengel-Brandt 1984), making impossible an in-depth evaluation of the systems used by the Neo-Syrian and Neo-Hittite kingdoms.

Within the variety offered during the Middle Bronze Age, not all evidence is equally valuable, but the corpus is robust. Notwithstanding the hundreds of weights discovered in several large Mesopotamian urban centres (such as Ur, Nippur, Uruk, Shuruppak, Kish, Neribtum, Eshunna, Tutub, see Powell 1979 and Karwiese 1990 for a list), exemplars without inscription collected during excavations carried out before World War II are not chronological reliable, with the exception of sets from funerary assemblages. However, new data come from a recent analysis of the Ur and Nippur groups by W. Hafford (2005; 2012).

Woolley reported *ca.* 500 weights found at Ur during his excavations and Hafford identified 370 proper weights, 270 kept in the University Museum of Philadelphia and the British Museum and one hundred in Baghdad (Hafford 2012; Peyronel in press). Moreover, several exemplars – still unpublished – have been found during the renewed American investigation in Area AH (*cf.* Stone/Zimansky 2016, fig. 12, 18, 23).

Most of the material from Woolley's excavations can be dated to the Ur III and Old Babylonian periods, although the contexts are not always reliable or precisely indicated. 255 weights are sphendonoids,

with several sub-types (a basic distinction is made between flattened and unflattened types), and 59 are ducks (against 92 reported by Woolley, several of which must therefore be scattered in other institutions and museums: Hafford 2012, tab. 2-3). The only other zoomorphic shape is the boar's head (one example: U.1202/116791; Hafford 2012, 29-30), although it is probable that small precision weights shaped like frogs and shells are catalogued in the museum's collections as amulets/figurines. One cube of chert noticed by S. Ratnagar (1981, 186) is a weight imported from the Persian Gulf or more probably from the Indus Valley (Woolley also mentioned in his weight shape chart other two exemplars). Beside sphendonoids and ducks, stele (6), domed (18), and loaf (10) types are also attested.

The materials predominantly used are hematite/goethite (155 exemplars), diorite/gabbro (77 exemplars) and limestone (31 exemplars). A small group of semi-precious stones (chalcedony, banded agate and carnelian) with 18 small weights and 4 specimens of shell complete the inventory (Hafford 2012, 31-32).

The Mesopotamian sexagesimal system largely predominates with 244 weights, and Hafford´s (2012, 32-36) CQA on sphendonoids and duck-shaped weights reveals a quantal base of 8.3. The different units of the local system are specified by a considerable number of marked and inscribed weights (*ca.* 50 according to Woolley and 32 analyzed by Hafford), including the Neo-Sumerian series with royal inscriptions guaranteeing the established value (Peyronel 2012a, 17-24, tab. 1 no. 1-2, 4, 6, 8-11), while other inscriptions are always very short, expressing the unit (shekel or mina), and/or the owner's name (Hafford 2012, 40-43, tab. 7). Metrological signs comprise parallel lines, strokes, grooves, sometimes associated with a winkelhaken, crossed incisions and dots (indicating the numeral ten). Most of the weights bear an indication of the Mesopotamian unit, but some exemplars have marks which could be considered indications of equivalence with foreign units (in particular the Levantine unit of *ca.* 9.4 g). A unique specimen (U.18778C, mass 314.3 g) could be associated with the western mina of *ca.* 470 g, bearing the inscription '⅔ ma-na'. It was found together with inscribed weights (⅙, ⅓, 2 and 5 minas) clearly belonging to the Mesopotamian system and therefore may be part of the same set as a 'foreign' exemplar (Hafford 2012, 42).

Taking into account the masses, the presence of western standards ('Syrian' and 'Levantine' units, *ca.* 7.8 and 9.4 g) occurs at Ur with *ca.* 60 weights, although the distinction between the shekels of 7.8 g and 8.4 g is problematic as rightly pointed out by Hafford (2012, 37-39, fig. 8). However, the fact that eight exemplars of 7.6-8.0 g possibly correspond to one 'Syrian' shekel, while no units between 8.8 and 11.3 g are documented, strongly suggests knowledge of that standard (Peyronel in press; *contra* Hafford 2012, 43). Moreover, the CQA carried out on unbroken specimens confirms the empirical evaluation, revealing peaks at 7.7 and 8.3 and significant quanta in the range of 9.4 (Ialongo *et al.* 2018a, 26-27, tab. 1, fig. 3-4).

It is thus very probable that people involved in economic affairs and long-distance exchange at Ur may have possessed Syrian and Levantine scale-sets, as also suggested by some weights from funerary assemblages at the site (Peyronel 2000; in press). The presence of the decimal system of the Indus Valley, besides the unique cubical weight, is doubtful (only four weights), as are the standards of *ca.* 6.6 g and 11.7 g.

Hundreds of balance pan weights were discovered at Nippur, the holy city of the Sumerian chief-god Enlil, and those kept in the university museums of Philadelphia and Chicago have been studied by Hafford (2005). Unfortunately, most of the 261 exemplars included in the analysis lack precise contexts, and the long-lasting chronological sequence of the site prevents a reliable chronological attribution, with the exception of the specimens found after World War II.

The main shapes and materials are the same as in the Ur set, with a predominance of sphendonoids (163) and ducks (23) in hematite/goethite (85 % of Hafford's 126 precision weights). Limestone, diorite/gabbro and agate/carnelian exemplars also occur and two hematite boar's head weights testify to the diffusion of this rare type in Mesopotamia (Hafford 2005, 352, fig. 4). According to the CQA applied to unbroken precision weights, the Mesopotamian unit with its common fractional and multiple values is almost exclusive at Nippur, although some minor differences in the limits of the unit can be recognized by type (Hafford 2005, 354-358, tab. 2, fig. 7). However some pieces have masses that might be indicative of the Western mensuration sub-systems of *ca.* 7.8 g and 9.4 g (Hafford 2005, 361, tab. 3, fig. 9) and a CQA conducted on complete specimens shows marked quanta peaks at 7.9 and 8.3 (Ialongo *et al.* 2018a, 26-27, tab. 1, fig. 3-4).

Compared with Ur, the number of inscribed/marked weights (19 specimens) is quite low: 12 unbroken weights are certainly related to the Mesopotamian system, and only two have masses and metrological indications compatible with the Syrian system (a pebble weight of 78.4 g marked with ten strokes, and a hematite sphendonoid of 79.1 g inscribed 'ten shekels').

The impressive collection of weights found at Susa in Khuzestan and kept in the Louvre Museum, with *ca.* 600 exemplars retrieved during de Morgan's and de Mecquenem's excavations, is the only evidence available for reconstructing Elamite metrology (Soutzo 1911; Belaiew 1934). With the exception of several sets from burials and tombs dating to the late 3rd millennium and the end of the Middle Elamite period, the other exemplars cannot

be assigned to archaeological contexts. However, 245 specimens selected by Ascalone/Peyronel from Belaiew's catalogue are seemingly related to funerary assemblages spanning from 2100 to 1550/1500 BC (Ur III, Simashki or Sukkalmakh periods) and their analysis allows a definition of the weight system/s adopted during the MBA in Western Iran (Ascalone/Peyronel 1999; Basello/Ascalone 2018, 708-712; Peyronel in press).

The group basically conforms with the Mesopotamian tradition, following shapes, materials and the metrological standard used in the alluvial plain. Notwithstanding this, some differences reflect a local Elamite re-elaboration, for instance the use of bitumen compound, widely adopted also for the manufacture of cylinder-seals, objects and containers, which is not attested elsewhere (Connan/Deschesne 1996, 269-273, no. 248-256). Taking into account Belaiew's sample, the predominance of hematite/goethite is outstanding with 179 weights (73 %), but Soutzo and Belaiew's rather vague classification of materials needs to be accurately verified, especially in order to distinguish between limestone, diorite, basalt and bitumen compound (Peyronel in press). According to Belaiew diorite is very rare, while Soutzo's catalogue reports this material in 29 cases (10 inscribed duck-shaped weights, 5 marked sphendonoids and 9 ducks and sphendonoids): since diorite is an imported material, while bitumen compound is manufactured locally, it is important establish a petro-mineralogical classification of the Susian weights, still not available. Some small weights attest the use of semi-precious stones (agate/carnelian), showing again a situation very similar to the Mesopotamian sets of Ur and Nippur.

The sphendonoid is attested in several sub-types (flattened, without base, with cut or elongated edges) and is the most common type, constituting 58 % of the MBA group (142 exemplars), followed by the duck-shape with 27 exemplars (17 in hematite). Other zoomorphic shapes are adopted for rare small precision weights: frog (2), insect (4), shell (2), and lion (1) (Ascalone/Peyronel 2006a, 457-458, tab. 8.43). One cube-shaped weight of 26.5 g (Amiet 1986, 143, fig. 93) is certainly related to the Indus Valley tradition (2 units of 13.25 g) and might have been imported from a Harappan centre or from the Persian Gulf.

At Susa (Ascalone/Peyronel 1999, 366-367, tab. 5), the standard of 8.3-8.4 g is the system most used during the MBA, with 133 specimens out of 245 weights (53.6 %, with the percentage rising to *ca.* 60 % if all of Belaiew's corpus is considered). The shekel and the double shekel are present with 22 (between 8.1 and 8.6 g) and 16 exemplars (between 16.2 and 17.1 g), and ⅔ (17 specimens), ½ (12 specimens), and ⅓ (11 specimens) shekels are the most common fractions, revealing a homogeneous frequency distribution of multiples and sub-multiples of the Mesopotamian unit. Inscribed/marked weights (62 specimens published by Soutzo and Belaiew in their catalogues) confirm the predominance of the Mesopotamian system (from the EBA to the Iron Age) at Susa, as well as the use of the same kind of metrological notations and short inscriptions attested in Mesopotamia, although no weights with royal inscriptions have been found in Elam (Peyronel in press).

Interestingly, at Susa the Syrian and Levantine base units also seem to be documented by quite a large number of weights (respectively 55 and 32 weights; Ascalone/Peyronel 1999, tab. 6). It is noteworthy that the Syrian system may be represented by 55 exemplars, which have masses compatible with fractions (1/16, ⅛, 1/6, ¼, ½, ⅔) and multiples (2, 3, 4, 10, 20) of the 7.8 g shekel (documented by 7 weights), showing a situation quite different from the contemporary Mesopotamian sites, where the Syrian unit is represented by small numbers of pieces.

Moreover – and this is another striking difference from the groups of weights from Ur and Nippur – 17 weights could be assigned to the Harappan system on the basis of their masses, but these are 'Mesopotamian' in shape and materials (Ascalone/Peyronel 1999, 367, tab. 6). However, it should be noted that these weights represent mostly fractions or multiples of the Harappan unit and the unit or double unit – which are the most frequent weights documented in the Indus Valley settlements – are attested only by two weights, one of which is the imported cubical weight already mentioned. Unlike Belaiew, who recognized in his catalogue a large number of 'Harappan' weights, Hemmy (1938) denied any metrological connection between Elam and the Indus Valley, pointing to the fact that many of the masses can be also explained as values referring to other systems. In my opinion it seems reasonable that the Harappan system was known at Susa, given the intense cultural and commercial interactions with the Indus and the Gulf regions; the manufacture of weights related to a foreign system, but following the local traditions of shape and material, is quite common in the Near East.

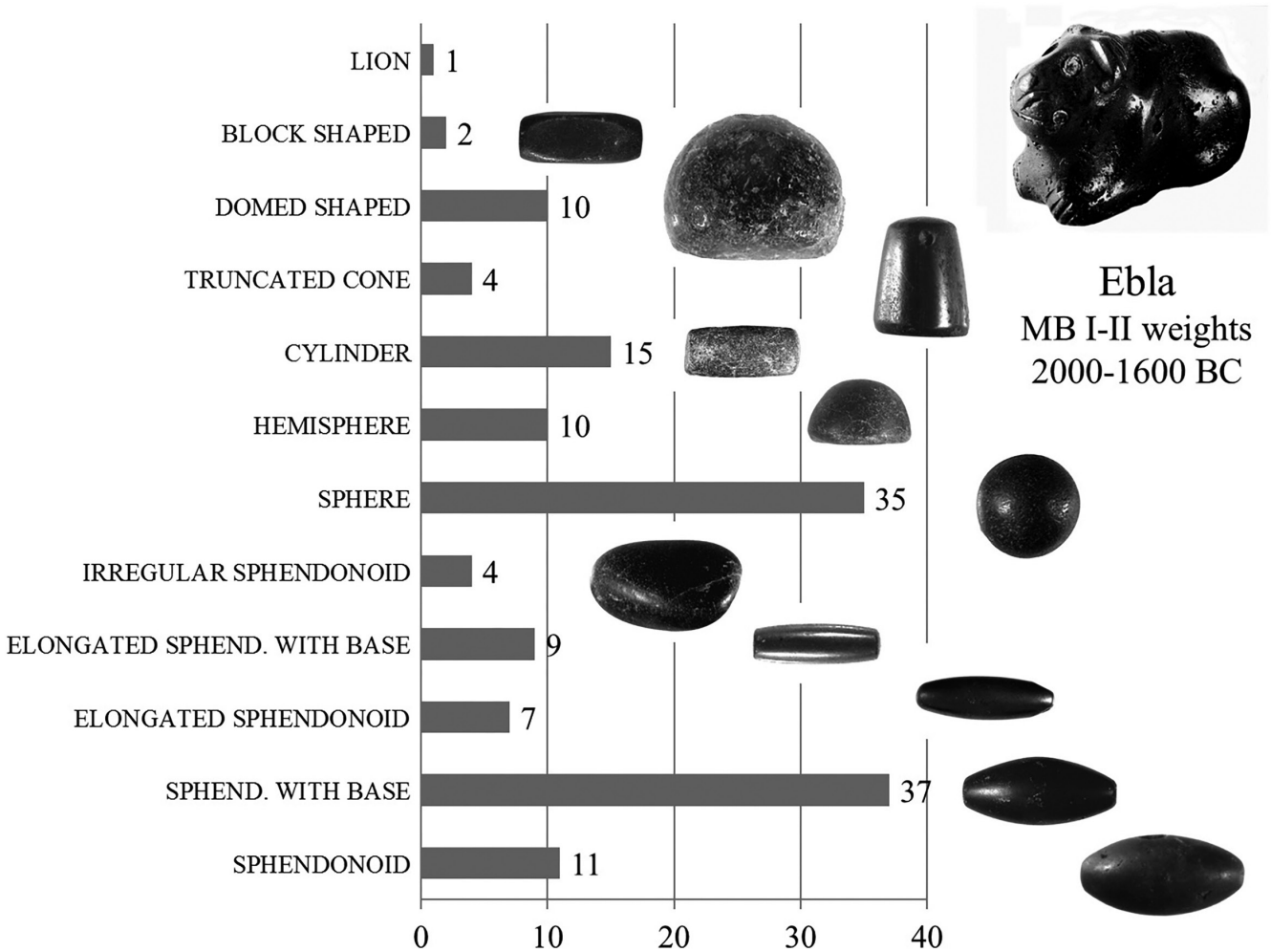
According to the available evidence – but the lack of any documentation from other Elamite sites, and from Tal-i Malyan/Anshan in primis, must be underlined – the local system used at Susa during the late Early and Middle Bronze Age was the Mesopotamian one, while the presence of some weights possibly related to the 'western' units and the Indus Valley/Dilmun system can be explained by the city's strategic position at the junction of various trade routes linking the Mesopotamian lowlands, the Persian Gulf and the Iranian plateau.

In Northern Levant it is Ebla, where two hundred weights were discovered in different buildings (palaces, temples, defensive buildings, houses), that gives a detailed picture of metrology during the Middle Bronze Age (Ascalone/Peyronel 2006a, 125-178, 209-247). More than half of these finds come from primary contexts and their distribution shows widespread weighing activities, both

in official buildings and private households, and some specimens associated with cultic buildings also suggest the ideological value of metrological practice (Ascalone/Peyronel 2001; 2006b). The sphendonoid – usually with a flattened long side and cut edges – was the most frequent type, followed by spherical and domed weights, whereas surprisingly the duck shape so common in Mesopotamia is not attested in the Eblaite Middle Bronze corpus (Fig. 3). A striking agate weight found in a building next to the Temple of the Rock cultic area dates to the end of the 3rd millennium BC and was probably imported from a Mesopotamiam centre (Ascalone/Peyronel 2011) (Fig. 4). The only other zoomorphic weight is lion shaped and corresponds to a double western mina. It was found in the Western Palace – probably the Crown Prince's residence – and has been interpreted as a unique 'royal' weight (Mazzoni 1980) (Fig. 5).

As a consequence of the new interregional economic and political relations established in the Amorite period, involving trade with southern Mesopotamia on the one hand and with Northern Mesopotamia and Cappadocia on the other, the most striking change between the metrology of the EBA and MBA is the spread of the Mesopotamian system in the latter period at Ebla. The shekel of *ca.* 8.4 g and its multiples and sub-multiples are well represented, with a number of attestations similar to the local system based on a shekel of *ca.* 7.8 g (respectively 37 and 29 exemplars), although the two systems partially overlap in the lower values taking into account an accuracy threshold of ±5 % (Ascalone/Peyronel 2006a, 142-152). It seems that the other common sub-multiples of the western mina (the Levantine shekel of 9.4 g and the Anatolian one of *ca.* 11.7 g) were also used (Ascalone/Peyronel 2006a, 152-159). It is interesting to note that the only MBA Eblaite marked weights are two small exemplars both weighing 5.9 g (one bearing a single straight groove and the other with two oblique incisions), corresponding to half a unit of 11.8 g. Together with other 18 specimens which can be ascribed to the Anatolian system, they point to direct relations with the northern region (Peyronel 2017, 206, fig. 13).

Another notable group of weights (33 specimens) is related to a unit of *ca.* 6.6 g with its binary and decimal multiples (Ascalone/Peyronel 2006a, 160-164). The widespread diffusion of this 'international' unit in the Near East and its relation with the Aegean system on one side and with a spe-



▼*Fig. 3. Quantitative distribution of the MB I-II (ca. 2000-1600 BC) scale weight's types from Ebla (© Italian Archaeological Expedition to Ebla).*

cific metrological system created to weigh wool and textiles on the other side has been suggested especially by C. Zaccagnini (2000; 1999-2001). The presence of the unit during the MBA in the Levant and Anatolia seems indisputable (*e. g.* at Kültepe, see *infra*), while it is rarely attested in Mesopotamia and the East, thus reinforcing the possibility of an 'Aegean' connection developed during the MBA after its first, independent establishment in Syria and Mesopotamia during the 3rd millennium BC.

The CQA shows a breakdown of quanta confirming the presence of different units, with four high values (6.8, 7.4, 8.3 and 9.1), which can be assigned to known theoretical shekels (Ialongo *et al.* 2018a, tab. 1, fig. 3).

The epigraphic documentation from Mari is very informative especially on the different weighing procedures, weight qualification, and the craft and economic activities involving weight specifications (Joannès 1989; Chambon 2006; Arkhipov 2012; Chambon and Marti in this volume), but since very few MB weights from the site have been published a comprehensive evaluation of the metrology of the kingdom is not possible (Ascalone/Peyronel 2006a, 354-356).

Another MBA set of weights from the region comes from Alalakh, with ten weights dated to Level VII (6 from the Palace of Yarim-Lim) (Arnaud 1967; Ascalone/Peyronel 2006a, 356-363). Similarly to Ebla, a variety of systems – with the predominance of 7.8 g and 9.4 g units together with the Mesopotamian shekel of 8.4 g – appear to have been employed at the site.

In Anatolia, the largest group of balance pan weights of this period comes from the Lower Town of Kültepe, where the weights have been found scattered in the houses and workshops of *kārum* level Ia-b and II and in funerary assemblages in burials. These are clear evidence of the business and craft activities carried out by Assyrians and Anatolians in Cappadocia, and also reflect the wider geographic horizon of the long-distance direct trade conducted by Assyrian merchants.

An updated catalogue of Kültepe balance weights found during the Turkish excavations has been recently published (Kulakoğlu 2017), giving complete information on the masses and measurements of 168 exemplars, as well as information on their discovery contexts. A fresh evaluation is therefore possible, integrating previous analyses (Özgüç 1986, 77-81; Dercksen 1996, 80-89, 251-253, app. 5; 2016; Zaccagnini 2000; Ascalone/Peyronel 2006a, 410-422), which reported an expected predominance of Mesopotamian weights, but also the presence of Syrian and Levantine exemplars and a puzzling low number of specimens based on Anatolian units. Old Assyrian merchant's documents relate that beside the system pertaining to their motherland, testified by the use of private weight-stones and official exemplars (property of the 'house of the *kārum*', which was the office of the colony, and of the 'house of the City' of Assur) and widely used to regulate transactions from and to Northern Mesopotamia, another system was also employed ('the weight of the land'). The local unit is only mentioned in a dozen transactions involving copper-trading activities in the Anatolian circuit (Dercksen 1996, 86-88; 2016, 15-17; Peyronel 2017, 206-207). While the former is evidently the Mesopotamian sexagesimal system, the latter might be an indigenous standard presumably established by the palace of Kanesh and adopted by the local people/institutions, as also suggested by ref-

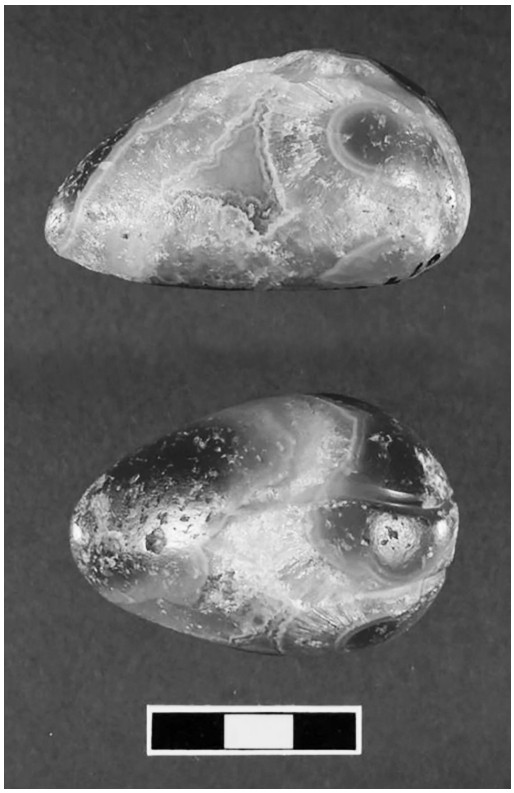


Fig. 4. Duck weight in agate from Area HH at Ebla (© Italian Archaeological Expedition to Ebla).

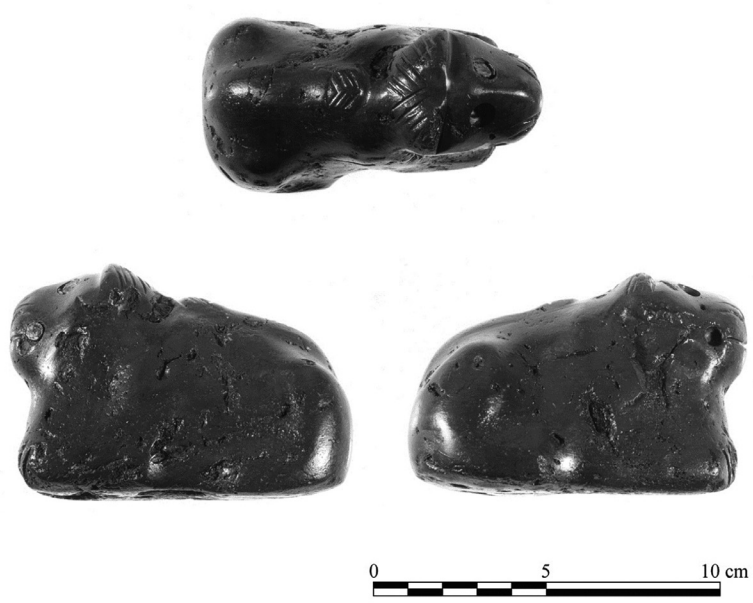


Fig. 5. Lion weight in hematite from the Western Palace of Ebla (© Italian Archaeological Expedition to Ebla).

erences to weights of the towns of Durhumit, Tuhpiya and Purushhattum (Dercksen 2016, 15). On the basis of some documents in which quantities of metals and wool are expressed in both the standards, it has been suggested that the absolute value of the local mina was *ca.* 10 % less than the Assyrian one. The latter being *ca.* 500 g, the weight of the local mina would thus have been *ca.* 450 g (with a ¼₀ sub-multiple of 11.25 g). If this is the case, the local mina was 20 g less than the 'Western mina' of *ca.* 470 g, widely attested since the mid-3rd millennium, and the shekel unit *ca.* 0.5 g less than the 'Anatolian' unit of *ca.* 11.7 g. However, the lack of exemplars related to a unit of between 11.2 and 11.7 g is puzzling and no satisfactory explanation has been proposed. In contrast, 'foreign' systems seem to be documented by dozens of weights, indicating that the Assyrian merchants were well aware of these metrological interactions and were equipped to check goods coming from the Levant. It is interesting to note that 17 weights have masses that fit well with the 'Syrian' system (7.8 g unit), making this system the most attested at Kanesh after the Mesopotamian one. A unit of *ca.* 6.1-6.6 g (mean value 6.44 g) and its decimal multiple are also widely attested, with 16 exemplars indicating a system well known at Kültepe and revealing metrological interactions with Western Anatolia and the Aegean. The unit is also clearly indicated by a sphendonoid of 24.6 g, bearing four dots (÷ 4 = 6.15 g) and thus indicating that the exemplar is a 4x multiple of that system, corresponding also to 3 Mesopotamian shekels of 8.25 g (Kulakoğlu 2017, 345-346).

Statistical analysis of Kültepe data with CQA confirms the picture, with four high values (6.9, 7.5, 8.2 and 9.0), which can be assigned to known theoretical shekels (Ialongo *et al.* 2018a, 26-27, tab. 1, fig. 3-4).

The commercial system highlighted by the weights worked basically through the exportation of tin and textiles from Assyria and the importation of precious metals (silver and gold), and was also accompanied an inner Anatolian circuit involving wool and copper (Dercksen 1996). Cappadocian trade is thus well known and widely discussed, especially in relation to the lively debate revolving around the role of private business and economic assets in ancient Mesopotamia. It is undeniable that the Kültepe texts show that silver and gold represented for the Assyrian merchants both their 'profit' and the 'capital' that was re-invested in Assur, although we should always take into account that we lack the documentation from the capital as well as the documents produced and kept by the official institutions.

Silver was therefore the pillar of the system from the Assyrian perspective and its circulation was regulated by a careful recording of its weight according to the Mesopotamian standard (Dercksen 2005, 21-24; Veenhof 2014). The metal circulated in ingots of various shapes, rings/coils, lumps and scraps and its quality was also indicated by terms such as 'fine' (*dammuqum*) and 'refined' (*ṣarrupum*), although the difference between the two types may not be understood from the texts, and 'checked' (*ammurum*), the latter perhaps meaning a quantity of sealed/marked or verified silver. The metal obtained by selling tin and textiles was re-melted and refined at Kanesh (with a mean loss of *ca.* 4 %) and again at Assur; additional evidence comes from several metal workshops excavated in Kültepe Lower Town, with a wide range of working facilities and implements, including a large number of stone moulds (Lehner 2014).

The most informative direct evidence of weights and silver from a single closed context is the so-called 'goldsmith's hoard' found in the Ebabbar of Larsa, buried under a room joined to courtyard I of the temple complex of the sun-god (Arnaud *et al.* 1979; see also Bjorkman 1993; Huot 1995). The hoard was hidden at a time pre-dating the raid against the town by Babylon in 1738 BC, and contained 67 balance weights (including the item considered a touchstone by Arnaud *et al.* 1979), administrative/economic instruments other than weights (one inscribed hematite seal, 18 sealings with cylinder seal impression and one small cuneiform tablet), semiprecious stone beads end faience micro-beads, some precious gold and silver ornaments (medallions and earrings), silver bullion (with fragments, small lumps, sheets and broken pieces of ornaments, but no rings/coils or ingots), and craftworking tools (an anvil and three probable bronze design-blocks, according to the hypothesis of Bjorkman 1993, 10-13).

Ilshu-Ibinishu, possibly a temple goldsmith, has been proposed as the hoard owner, since his name is written on the seal legend (Arnaud *et al.* 1979; Huot 1995), although this attribution is questionable, and other officials that sealed the small *cretulae* found inside the jar – Sîn-uselli, a high official responsible for weighing operations in the Egina (a weights bureau, according to Arnaud *et al.* 1979) of Ur, Bēlānum and Ishtar-ilum, priests of Shamash, and the head of the stone-cutters (name missing) – are also good candidates (especially Sîn-uselli).

13 sealings bearing short cuneiform inscriptions with weights indicated in shekels (from ⅓ to 20 verified shekels) testify in fact to metrological operations carried out by Sîn-uselli, who sealed all of these. Moreover, on the small tablet the total amount is given (½ mina, 4 shekels and ⅙ shekel), precisely the sum of the weights recorded on the sealings. It is very probable that the total weight written on the tablet indicates the jar's precious metal contents (that would therefore have been *ca.* 285 g), with the 13 sealings recording the different metrological 'operations', thus suggesting that it contained several quantities collected together in the weights bureau (Ascalone/Peyronel

2006a, 451-455; Peyronel 2010, 932-933). It must be underlined that a further 5 *cretulae* with cylinder seal impressions were found in the hoard: they do not bear any numerical indications and possibly refer to bundles of items grouped inside the jar (the weights?).

A recent re-analysis of the written documents from the hoard in an enquiry into the functions of Mesopotamian temples by D. Charpin (2017, 86-99) argued that the Egina in which Sîn-uselli performed his official activity as assayer was the ceremonial name of the temple of Kittum of Ur, and not a simple weights bureau. This interpretation is very convincing, since Sîn-uselli (likely the same official of the Larsa hoard sealings) is said to be an official of the Kittum's house in a document of the dossier of Shep-Sîn, chief of the Larsa merchants (Stol 1982, 150-151). Kittum was a god/goddess said to be Shamash's son/daughter, representing divine justice and worshipped in a temple/shrine attested at Ur, as well as in other towns (Klein 2001). According to Földi (2014, 102-109) the *bīt Kittim* was rather an office working under divine protection and not a sacred building. Whatever the case, several administrative documents seem to indicate that inside the 'house' of Kittum a verified set of weights was kept, silver was weighed and sealed in bags certifying its quantity. A small tablet kept in the British Museum bearing only three lines with the Sumerian text 'one mina, weights of Shamash, Egina', could have been a model for official weight inscription, adding a further interesting piece of evidence about the relation between the great sanctuary of Shamash and the shrine/chapel (?) of Kittum (Stol 1999; Charpin 2017, 97-99, fig. 3.6).

The 67 balance weights in the Larsa hoard are all without marks or metrological inscriptions (11 agate, 53 hematite and 3 shell; 38 sphendonoids and 25 ducks, plus 2 shell-shaped, one frog and one boar's head) and do not include different coherent balance sets, on the basis of their fractions or multiples, shapes or material (Ascalone/Peyronel 2006a, 455-464). 48 weights (71.6 %) can be easily related to the Mesopotamian system (with fractions of ⅓, ⅛, ⅕, ¼, ⅓, ½ and multiples of 2, 3, 5, 10, 20, with 3 exemplars of one shekel), and two small groups of weights could be linked to Western standards (7 to the 7.8 g unit and 11 to the 9.4 g unit) possibly used to check material coming from the Levant (Ascalone/Peyronel 2006a, tab. 8.44-49). The Syrian group is constituted of a set of ⅛, ⅙, ¼, ⅓ and ⅔ (2 specimens) shekel (mean value 7.6 g) and it seems quite coherent with the agate and hematite ducks (from ⅛ to ⅓), a shell-shaped and a sphendonoid weight. The Levantine set cannot be referred to a clear series, including ducks and sphendonoids in agate and hematite, and frog-shaped weights related to ⅙ (2 exemplars), ⅓ (2), ½ (4), ⅔ (2) and 2 units (mean value 9.2 g).

The CQA analysis gives a peak at 8.3, but the results are probably altered by the unusually high number of ⅔ shekel weights (*ca.* 5.6 g), and it does not confirm the presence of western units (Ialongo *et al.* 2018a, 26-27, tab. 1, fig. 3-4).

The co-occurrence of weights, sealings and silver in the Larsa hoard is an extraordinary archaeological indication of silver circulation under the control of the Mesopotamian administration during the Old Babylonian period. Notwithstanding the presence of several silver hoards in the Near East from the 3rd millennium BC to the Achaemenid period, the role of silver in the embedded economies of the ancient Near East – widely discussed on the basis of the written sources (see *e. g.* van der Spek *et al.* 2018) – has been surprisingly neglected in recent years by archaeologists.

Silver hoards during the Middle Bronze Age

Silver makes its first appearance in the Near East in the 4th millennium BC when the technology of cupellation allowed the extraction of the metal from silver-lead ore. It has been rightly observed that the great increase in quantity of the metal in Mesopotamia during the Late Uruk and Early Dynastic period would be connected with the economic functions silver acquired as the standard of equivalence and means of wealth accumulation (Helwing 2014). The sign KU_3 in the archaic Uruk texts (Eanna IVa and III) resembles half a ring and indicates (among other meanings) the noun 'shining/precious metal'. Therefore a pictogram for silver might be found in the first written sources of the 4th millennium BC, and it has been suggested that its shape derived from the silver ring that was one of the main forms in which the metal circulated from the 3rd millennium onwards (Krispijn 2016).

The prominent role of silver in Near Eastern economies also left a meaningful echo in the literary production: the Sumerian poem 'Silver and Copper', which is a so-called 'debate poem' composed at the beginning of the 2nd millennium BC, exhibits the complementary practical and 'cultural' functions of the two metals through the rhetorical fiction of a dispute between them that emphasizes their complementary spheres of use (Vanstiphout 1990; 1992). Unfortunately the poem's end is lost, making impossible to know several crucial passages as well as the final solution of the dispute, although the importance of these metals – which were considered materials characteristic of cultural life and urban society – is nevertheless clear.

In the very fragmentary segments A-B silver's shape is said to be 'in small pieces', alluding to fragmented ingots and scrap silver, put into reed boxes, and among silver's achievements making lead shine is mentioned. A reference to silver's value is made

in segments E-F, where a one-shekel piece of silver is equated to 3-4 minas (of copper?) and 10-shekel silver pieces are also mentioned. The following two passages from segment D are particularly interesting since they reveal how silver was perceived in the Mesopotamian world:

18-23: Copper says: ... Men caulk tiny, very strong boxes for you, as they do a boat. They cover you over with their oldest rags, and someone digs a hole for you in the middle of the cattle-pen. Or they pour clay on top of you, as on a jar with a sealed mouth, and then, in the darkest place inside the house, someone buries you in the most obscure corner of a grave.

38-46: Silver, you are forgotten in the soil inside the house. A scared mouse in a silent house, ... -- Silver, the palace is not your station! An obscure place, a grave, such is your station. Silver, banquets are not your assigned task -- fasting is your assigned task. Silver, to make lead shine (?) is not an important achievement. The task of making divine statues is not likely to fall within your capabilities. Why do you keep attacking me like a dog? You snake, get back in the darkest part of the house and lie down in your grave!

(translation from the Electronic Text Corpus of Sumerian Literature: http://etcsl.orinst.ox.ac.uk/section5/tr536.htm).

Thus, first of all silver is characterized by its primary function of wealth accumulation and the way in which it was kept is clearly stated: 'in the soil inside the house', that is buried under the floor, in 'an obscure place, a grave', the poem says. The description of the hidden silver hoard is very precise and also the use of sealing is mentioned. Silver's task is 'fasting' (as opposed to 'banqueting' for copper), that means that it was basically perceived more as having 'value' in relation to its weight than as a precious metal to be transformed into finished objects.

However, it is clear that this was not the only use of silver and the simplification serves the purpose of the poem. From the Early Bronze Age onwards silver is in fact attested in the form of finished objects of various types, including standardized vessels, as well as metal made into more or less regular shapes to be exchanged and/or transformed later into finished items, and scraps of metal to be recycled and/or exchanged. These silver items are also mentioned in economic and administrative documents, making it possible to compare archaeological and epigraphic data. Of course, the distinction between these categories is not always easy, as in the case of coils and rings. I do not here develop an answer to this question, which has been discussed by several scholars, especially taking into account the written sources of the late 3rd and 2nd millennium BC (Paoletti 2008, 150-152 with references), but far less so the archaeological evidence (Peyronel 2010, 933-934; 2014a, 367-368). I would like only to remark that silver rings/coils are mostly found hoarded together with other silver items (ingots of various shapes, pieces of scrap) and therefore might be studied as single items *and* together with the other silver material forming the hacksilver bullion. The large number of silver rings/coils kept in the Oriental Institute of Chicago and preliminarily published by M. A. Powell (1978, app.) was considered a direct link with the objects called ḪAR/*šewirum* in the Ur III and Old Babylonian texts, suggesting their use as 'ring-money' in the Mesopotamian economies. They were purchased all together by H. Frankfort in Baghdad in 1930 and are only alleged to have come from the Diyala region, specifically from Khafaja/Tutub. Consisting of items without decoration and with the edges twisted, beaten off or cut, with masses ranging from 0.55 g to 75.4 g (beside three exceptional coils of 241 g, 470 g, 492.5 g), they seem quite different from rings and coils found in archaeological contexts. Moreover, their weights do not fit well with the epigraphic evidence mentioning the *šewirum*, whose standardized manufacture shows a predominance of 5-shekel pieces.

The fact is that, in order to obtain a well founded reconstruction of silver circulation during the Bronze Age, we need a carefully oriented enquiry, choosing first of all dated contexts which offer the lowest risk of interpretative mistakes and at the same time give the largest amount of information on silver use. The only contexts in which we find together different kinds of silver items are hoards or 'treasures', usually buried or hidden under floors. After a first reconnaissance of the available published data regarding Bronze Age silver hoards (Peyronel 2010), I have proposed a distinction between (a) hoards with only silver items (perhaps with a few gold objects, and with further subdivisions if the metal was kept in a perishable bag or a ceramic container, and if impressed bullae sealed the hoard), (b) hoards with silver items included among various items, together with other precious materials and objects, and (c) hoards with silver, precious materials and craft objects or administrative economic tools (sealings, balance weights, metalworking or seal-cutting implements).

As far as I know, 35 Bronze Age silver hoards from the Near East have been reported in publications, and type (a) with only silver items (25 hoards) have been found mainly hidden under the floors of private dwellings (EBA: Khafaja, Taya, Chuera; MBA: Acemhöyük, Ebla, Terqa, Shiloh, Megiddo, Gezer; LBA: Ugarit, el-Qitar, Munbaqat, Ajjul, Shechem, Beth Shean), while the mixed caches and hoards containing silver together with administrative/economic tools (b-c) may be related either to domestic or public buildings (temples and palaces) (Peyronel 2010, fig. 1; Eshel *et al.* 2018, 220, tab. 1). Silver hoards of Middle Bronze Age date come from Ebla (Peyronel 2010, 930, fig. 3-8; 2012b, 480, fig. 6; Ialongo *et al.* 2018a), Terqa (Rouault 2001, 10,

fig. 9), Kültepe (Gates 1997, 257), Acemhöyük (Özgüç 1995; Öztan 1997), Larsa (Arnaud *et al.* 1979, see *supra*) and in the Southern Levant from Gezer, Megiddo, Shiloh, Nahariya (Eshel *et al.* 2018, tab. 1). However, notwithstanding their outstanding importance for the investigation of ancient Near Eastern economies, to date complete catalogues of silver pieces from Bronze Age hoards is available only for Ebla (MBA; Ialongo *et al.* 2018a, app. A), Acemhöyük (MBA; Öztan 1997) and Munbaqat (LBA; Czichon/Werner 1998, 191-225, pl. 130-139, 213-216). The evidence from Anatolia is particularly interesting, since it should be indicative of silver exploitation and circulation at the time of the Assyrian trade in Cappadocia: the Kültepe hoard (*ca.* 2 kg of hacksilver) was found in a jar associated with stone moulds and crucibles, near a furnace in a metalworking atelier of the Lower Town Level II (20th-19th century BC) and those from Acemhöyük (210 silver pieces for a total of 1.8 kg, kept in a trefoil jug, and 250 g of small silver ingots in a broken jar) come from two houses of level III, contemporary with the Sarıkaya palace and dating to the 18th century BC (corresponding to Kültepe Lower Town Ib).

The partial, insufficient documentation of Bronze Age silver hoards contrasts with the detailed analysis and publication of the evidence from the Southern Levant dating to the Iron Age (Kletter 2003; Thompson 2003; Eshel *et al.* 2018; Heimans 2018). These differences in information availability have resulted in research mainly focused on the silver question in the Levant during the 1st millennium BC, which has been investigated without taking adequately into account the general phenomenon in the whole Near East, or its diachronic range. It has been suggested that the presence of hacksilver in some sites can be explained by economic changes related to Neo-Assyrian control (Gitin/Golani 2001), or by the Phoenician commercial network, postulating an increase of the silver due to the exploitation of the Iberian sources (Thompson/Skaggs 2013). Moreover, the specific regional type of cut square ingots ('chocolate-bar' ingots) have been assumed to have been chiselled off from pre-portioned bar-ingots in order to obtain pieces of standardized mass, then grouped in bundles sealed to assure quality and checked weight (Thompson 2003; Gitin/Golani 2004). The hypothesis that this pre-formed money was a decisive step in a linear development towards coinage must be rejected (see in particular the criticisms of Kletter 2003; 2004), although the explanation that the 'chocolate-bar' pieces were chiselled off for quality control is not fully convincing (Eshel *et al.* 2018, 221). Even if some local features – such as the predominance of the distinctive type of hacked ingots, the use of sealed bundles of silver, a high gold content (up to 5 % in the Tel Miqne hoards) – are possibly related to regional socio-economic trends and historic developments, the Levantine Iron Age silver hoards cannot be correctly understood if they are not studied in a long-term historical perspective, as a part of the process of silver circulation attested all over the Near East from the Early Bronze Age onwards. Silver bullion appeared in the Southern Levant in the 2nd millennium BC (MBA: Megiddo, Nahariya, Gezer, Shiloh; LBA: 'Ajjul, Beth-Shean) and the phenomenon is the same as that attested in Syria and Mesopotamia from the Early Bronze Age, which then spread into other regions (Anatolia and Southern Levant). The presence of silver with sealings was introduced into Mesopotamia in the 3rd millennium; the evidence from the Southern Levant should be therefore considered in relation to the administrative and economic procedures adopted for silver circulation from this perspective. The Old Babylonian texts reporting the circulation of 'sealed silver' (*kaspum kinkum*) as opposed to 'loose' silver (*kaspum piṭrum*) clearly indicate the existence of a system guaranteed by the administration in which sealings (with indication of the weight, as testified by the Larsa hoard) were attached as a kind of tag to small perishable bags, assuring that the quantity of silver was checked and verified. The most interesting document comes from the Sinkashid Palace at Uruk and deals with metals, reporting a large number of *kinkum*-bags of one, half and one third of a shekel, for a significant total amount of more than 14 silver minas (Sanati-Müller 1990). The critical point is to understand the mode of exchange of these sealed bags: did they circulate without any need of further weight verification? If this was the case they constituted a kind of currency, possessing the features of proper money. Conversely, if the system was basically an adaptation of the Near Eastern administrative sealing practices, which guaranteed the provenance of and responsibility for the administrative procedure – limited in time and space (the MBA in Syria-Mesopotamia), we cannot be sure that the bags were passed unconditionally from hand to hand.

The Italian SCANE Project's precise aim is to fill the documentary gap concerning silver finds, and has started by analyzing the hoard found at Ebla in order to establish a documentation protocol and test appropriate tools of statistical analysis (Peyronel 2018).

The silver hoard was found in an unsealed MB IIA ovoid jar discovered under a floor (L.3702) of a poorly preserved house located at the edge of the southern Acropolis (Peyronel 2012b, 480) (Fig. 6). The small circular pit in which the jar was buried was located near an adult under-floor pit burial containing five pottery vessels (D.3765=D27). The excavators initially saw it as being related to the funerary assemblage (Baffi 1988, 4, fig. 2.6-11; Baffi in Matthiae *et al.* 1995, 430, no. 308), but more probably the jar is a silver hoard hidden under the floor and not a part of the grave assemblage. The stratigraphy seems consist-

◀*Fig. 6. Silver hoard from Area G at Ebla (© Italian Archaeological Expedition to Ebla).*

ent with the former interpretation, and – as far as I know – silver hoards are not attested in any other funerary contexts in the Near East during the Bronze and Iron Ages. In the same area a further six burials were excavated, all dating to the beginning of the MB II (1900-1800 BC) (Polcaro 2014-2015, 208-209), including one with unusual grave goods related to metalworking activities (a large stone anvil, two striking pairs of moulds for fenestrated axes) (Nigro 2003). This peripheral part of the Acropolis was occupied by houses and working places suggesting the existence of a 'specialized' domestic quarter, in which productive activities for the nearby Royal Citadel were carried out.

The jar, with the mouth deliberately broken, was completely filled with 172 silver objects weighing 5043.5 g, silver bullion roughly corresponding to 10 Mesopotamian minas. The hoard includes complete or fragmented ingots of different sorts with masses ranging from 1.3 g to a maximum of 285 g: more than half are fragments clustering between 1.3 and 20 g (94 specimens), and the heavier pieces are complete bar and discoid ingots of 160 g, 173 g, 223 g and 285 g. Small irregular flat discoid ingots, both complete and – mostly – fragmentary, constitute the majority, but larger elongate ingots (complete, halves or fragments) with round or straight ends also occur (20 specimens, 40.7-223 g) (Fig. 6). Some thick lengths of wire and rod (cut, folded or twisted, masses 7-82 g), several small rings, 8 thin sheets (13.6-35.9 g), a large biconical bead (8.6 g), and several irregular lumps of different sizes and weights complete the inventory (Fig. 7). The set does not include fragmentary jewels or objects to be recycled, beside the sheets and the bead. The presence of items melted together as a result of post-depositional metal alteration could be indicative of the presence of different bundles inside the hoard, although no evidence of textiles or organic materials was noted at the time of excavation, nor when the hoard was studied by the Author in 2008-2009.

Thirteen pieces from different morphological groups have been selected for surface analysis of chemical composition (2 rods, 4 elongated bar ingots, 6 discoid ingots and the bead) using a portable XRF spectrometer. The most interesting result is that all the samples were made from silver alloyed with copper, the latter ranging from 2 to more than 30 % (Peyronel 2012b, 480, fig. 6). However, it is difficult to reliably assess copper percentage only through XRF surface measurements (3-6 per item performed on different parts), since surface composition may differ greatly from that of the core, due to several factors (corrosion, bulk inhomogeneity). The trace amounts of gold and lead detected were always very low (Au max 0.5 % and Pb max 1.3 %); quite similar results have been obtained from selected samples of the Acemhöyük silver (Yener 2015, 3-4). Data from Southern Levantine silver hoards differ significantly, however, usually with a relatively high gold percentage (2-5 %) indicating gold-rich silver sources located either in Egypt or Iberia (Shalev *et al.* 2014; Eshel *et al.* 2018, 209-210, 214-220).

Hacksilver and weights – towards an integrated approach

The interpretation of silver hoards as means of wealth accumulation, which is suggested by the debate poem 'Silver and Copper' is clearly indicated by the presence of a number of hoards containing only ingots and scrap metal associated with households. The circulation of hacksilver as bullion, the deliberate fragmentation of the metal pieces, the textual evidence suggesting the presence of standardized silver ingots as well as 'sealed silver' of verified quality and weights, raise the question of the

Fig. 7. Silver items from the Ebla hoard (© Italian Archaeological Expedition to Ebla).

relation between the mass values of silver fragments and standard weights. Is it possible that silver items are related in any way to known systems of units? In general terms, could the metrological analysis of silver shed light on the relation between norm and practice, between administrative trade and private exchange?

The study of the Ebla hoard, with a detailed description of each silver item, gave the opportunity to build up a statistical methodology useful for a metrological evaluation of the silver pieces (Ialongo *et al.* 2018a). The silver dataset has been compared with the contemporary group of weights from Ebla (94 complete specimens), and also with the weights from Kültepe/Kanesh in Cappadocia (162 specimens), and with weight sets from Mesopotamian centres dating to the MBA (Larsa hoard, 67 exemplars, Nippur, 132 exemplars, and Ur, the largest group with 327 weights). The comparison was aimed at testing the statistical properties of fragmented silver as a form of bullion currency; in particular, the enquiry focused on testing whether balance weights and silver fragments share similar quantitative properties. As already remarked, we can count on a number of effective approaches to identify norm-dependent regularities in arrays of balance weights, and CQA was performed on the different datasets, giving interesting results (see *supra*). Additionally, shifting from the modular approach, frequency distribution analysis (FDA) of weight values was also carried out, in order to obtain a more nuanced picture.

CQA has shown that the distribution of quanta in the datasets corresponds well with the values of the ponderal systems adopted in the Near East during the Bronze Age, indicating the presence at the sites of the main metrological units and the contemporary use of different systems. Moreover, the compatibility of the groups has been tested using quantogram correlation analysis: the Eblaite hacksilver sample shows a good correlation with Ebla and Kültepe groups especially, and also Ur and Nippur weights show scores beyond the significance threshold, a clear signal of the strong interaction and integration of the Levantine and Mesopotamian metrological spheres (Ialongo *et al.* 2018a, 25-27).

FDA allowed assessment of the convergence of hacksilver and weights on certain values ('standard average quantities', SAQs) that occurred more often than others. The analysis tests the working hypothesis that commerce and exchange beyond the regional sphere of interaction can produce a convergence between different normative systems, resulting in certain values being more frequently used than others. Following a methodology already applied to Italian metal hoards and Early Bronze Age weight sets from the Levant and Anatolia (Ialongo *et al.* 2018b), significant concentrations (or "peaks") were identified in the frequency distribution of the weight values of the silver items contained in the Ebla hoard, and these were compared with similar analytical results obtained from the sets of balance weights. The FDA shows that the peaks of the two Eblaite sets (silver and weights) match almost perfectly and that the peaks of the other weight sets also show a strikingly similar distribution (with some differences

for the Larsa group). The average values of such peaks correspond precisely to a series of sub-multiples and multiples of the alleged Mesopotamian shekel of *ca.* 8.4 g (½, ⅔, 1, 2, 3, 5, 10, 20). What produces such a convergence between balance weights and hacksilver? The combined statistical analysis of CQA and FDA seems to reveal that the variability of masses found in silver and weights is related to the multitude of normative systems adopted at a local level, while the convergence of SAQs is the result of the predominance of the Mesopotamian units at the global scale. Moreover, the frequency of the use of certain weight values might be somehow related to the economic demand curve: the more frequently a certain amount was exchanged, the higher its occurrence in the archaeological record. The occurrence of the same cluster of values in different contexts should not have been a problem for each specific administrative organization, since each mass value could be easily converted into any existing system of measurement, represented by the nearest integer multiple of the different units, even if it circulated mainly checked and weighted according to the most-used Mesopotamian system. The convergence of silver and weights on these SAQs might therefore be the consequence of a long-lasting practice of interregional exchange in which it was necessary to minimize the dispersion between different standards.

Evaluating silver circulation between norm and practice during the Bronze Age is a subject that impacts the general debate about economic procedures and exchange systems in the ancient Near East, and undoubtedly requires more reflection. As a next step, the SCANE project is analyzing data from other silver hoards (including archeometric studies), to be managed in an open-source database, and plans the development of a comprehensive vocabulary for silver terminology in the various textual corpora in order to cross-check archaeological and epigraphic information.

In general, these preliminary results seem to indicate that pieces of silver and scale balance weights exhibit the same statistical behaviour, and therefore imply that silver fragmentation practices could have been designed to obtain pre-determined quantities. Weighed silver used as an economic and financial commodity that was accepted throughout the whole ancient Near East, easily transported and with a convenient value-to-weight ratio, may thus have been the best means for the circulation of fixed quantities that could readily be converted into diverse ponderal systems used by different economic and administrative systems. The presence of a sort of meta-system that the SAQs appear to reveal would have greatly facilitated above all interregional and long-distance exchange, offering an effective compromise between the requirements of trade and those of the bureaucracy and administration of the Bronze Age public authorities.

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