Implications for Trade – Weights from Tell el-Dabʿa as Indicators of Eastern Mediterranean Influence on Egypt

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Within the archaeology of Ancient Egypt there has been little to no focus on balance weights. Weights dating from Egypt's Middle Kingdom are mainly parallel-epipeds; the common unit is called *dbn* and weighs, as was the case in the Old Kingdom, c. 13–14 grams. In the New Kingdom, the metrological system changed whereby a *dbn* weighed c. 91–94 grams, which was then subdivided into ten *ḳdt*. Along with the system, both shape and material were subject to change. Weights dating to the New Kingdom are often termed 'sphendonoids' (sling-bullets). These frequently consist of dark iron-rich sedimentary rock like hematite, a distinctive material apparently not used for weights in Egypt before the Second Intermediate Period. However, such shapes and materials were typical for weights in Syria and Mesopotamia from the Early Bronze Age (EBA). It is therefore a likely hypothesis that the fundamental change in Egypt can be linked to the rule of the so-called Hyksos kings during the Second Intermediate Period. This assumption is further supported by the fact that the *dbn* of the New Kingdom, divided by ten, corresponds with the 'Syrian *shekel*' of c. 9.1–9.4 g. This mass-unit was widely used in the eastern Mediterranean and facilitated international trade. Excavations in Tell el-Dabʿa/Avaris, the capital of the Hyksos kings located in the Eastern Delta, recovered approximately 50 weights. Made of iron-rich minerals such as hematite, these weights are often sphendonoid in shape and support the use of both the 'Syrian' and 'Mesopotamian' (c. 8.3–8.4 g) *shekel* weighing system. Of special interest is one particular assemblage including two sets of weights, deriving from a tomb dated to the later Hyksos period. Weights are not known from other grave assemblages during the Old and Middle Kingdom in Egypt whereas they occur in burials in Syro-Mesopotamia, the Levant, Anatolia, the Aegean and the Gulf region. The findings from Tell el-Dabʿa and the comparison to these regions contribute to our understanding of the time of the Hyksos kings as a period of change. The innovations which reached Egypt from the East consisted not only of tools for warfare, but also of tools for trade like the new type of weights presented here.

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1 Introduction

Within the archaeology of Ancient Egypt, balance weights and the associated metrological systems never received much attention. Petrie's nearly 100 year old book 'Ancient Weights and Measures' remains the main publication on the material.[1] Nearly 30 years ago, M.-A. Cour-Marty evaluated 3411 Egyptian weights from different periods, however, only a small amount of them are provenanced or can at least be dated by an inscription.[2]

At present, the origins of weight use in Egypt are hard to trace. For some isolated stone objects dating to the Naqada period (Fig. 1a) it remains to be proven that they are indeed weights as suggested by Petrie.[3] These objects, recovered from graves during Petrie's excavations,[4] are few and were mostly found individually in the tombs.[5] A hemispherical stone object with the cartouche of King Narmer, now kept in the "Staatliches Museum für Ägyptische Kunst" in Munich, is likely a weight, but has no context (Fig. 1b).[6] A stone balance beam (Fig. 1a) without provenance was dated by Petrie to the Predynastic period because of its distinctive material.[7] There is, however, a high probability that it dates to the early or mid-third millennium BCE as a similar depiction from the 3rd dynasty tomb of Hesy-Ra in Saqqara implies (Fig. 1c).

With the emergence of the third Dynasty, a canonical shape of balance weights had developed in Egypt (Fig. 2a). They show a parallelepiped form, a dominant shape that continues to be popular during the Middle Kingdom (Fig. 2b).[8] A wide variety of types of stone were used, but iron-rich sedimentary rocks, like hematite, are only documented in extremely rare cases during the Old and Middle Kingdom. The inscribed and marked weights imply different weight units. One of these units, which is difficult to define precisely, weighs c. 13–14 grams.[9]

During the period of the New Kingdom, several considerable changes occurred: hematite became the dominant material; the parallel-epiped shape declined in popularity and became replaced by various shapes: they are often 'sphendonoid' (sling-bullet, Fig. 3),[10] but also in the shape of animals or even of human heads.[11] The theriomorphic weights were predominantly made of bronze.[12] The metrological system also changed in the New Kingdom to a *dbn* weighing c. 91–94 grams (the range of error can be much higher), subdivided into ten *ḳdt* (c. 9.1–9.4 g).[13] These multiple changes to the Egyptian weight tradition seem to have occurred during the Second Intermediate Period. It is a likely hy-

1 Petrie 1926.

2 Cour-Marty 1990; only 238 of these can be securely dated to different periods before the New Kingdom.

3 According to the enquiries' coordinator of the Science Museum London (email 28.05.2019), where the objects used to be on display, they were transferred to the Petrie Museum at the University College London in 2005.

4 Petrie 1926: 18, pl. V.456, 458, pl. VI.646, pl. VIII.881, 883.

5 Rahmstorf 2007: 13–14; Petruso 1981: 44.

6 It would be worth going through the inventories of stone objects from early settlements like Hierakonpolis in order to identify weights from the crucial time span of the late Pre-Dynastic period.

7 Petrie 1926: 42; Petrie 1920: 29, pl. XLVI.36.

8 Cour-Marty 1990: 54, fig. 26.

9 Rahmstorf 2007: 14–16.

10 The term was introduced by Evans 1906: 348.

11 Hafford 2002: 505–506.

12 Squatted quadrupeds are usually made from bronze, duck-shaped weights often from stone, see Hafford 2002: 505.

13 Petruso 1981: 37, fn. 13 for further literature.

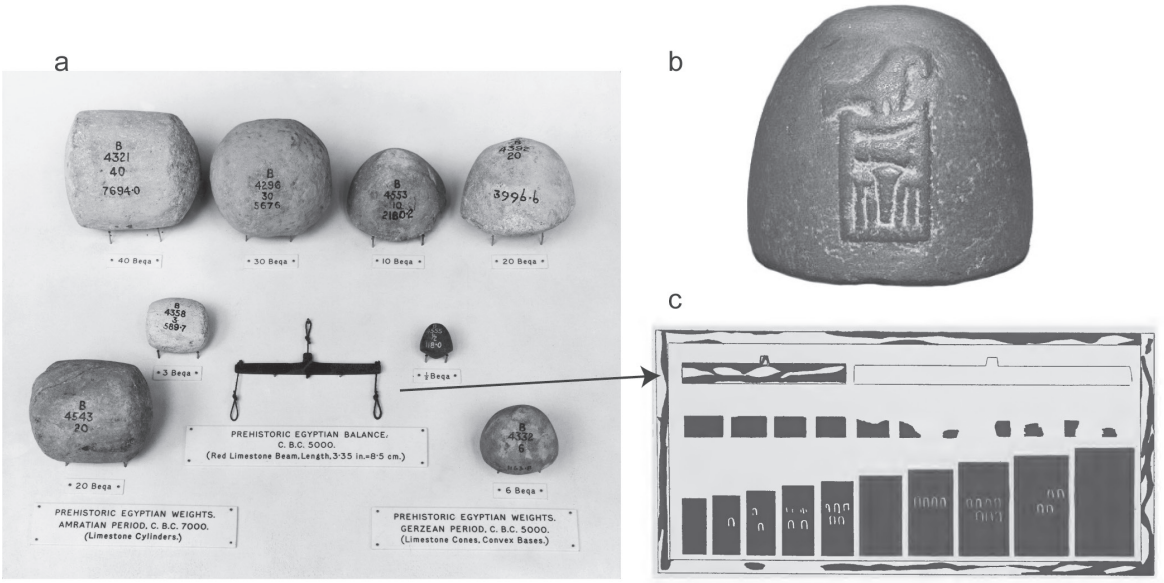


Fig. 1: *a Possible weights from Naqada tombs excavated by Petrie and an unprovenanced stone balance beam most likely dating to the earlier and mid 3rd millennium BC (courtesy of Science Museum London).*
b Possible weight inscribed with the name of King Narmer, 1770 g, SMÄK ÄS 5847 (after Büttner *2018: fig. 6).*
c Depiction of balance beams and weights in the tomb of Hesy-Ra (after Quibell *1913: fig. 5).*

pothesis that this fundamental change in Egypt can be linked to the rule of the so-called Hyksos kings. They gained control of the North of Egypt between c. 1640 and 1530 BCE as a result of the presence of a huge community of foreigners that migrated to the Eastern Delta already in the Late Middle Kingdom as traders and expedition leaders.[14]

2 Evidence from Tell el-Dabʿa/Avaris

Excavations in Tell el-Dabʿa/Avaris, the ancient capital of the Hyksos kings, located in the Eastern Delta of Egypt (Fig. 4), produced approximately 50 weights made of iron-rich sedimentary rocks, most likely hematite. Few examples occur already in the Middle Kingdom, but most of them can be dated to the Second Intermediate Period and the Early New Kingdom.[15]

One assemblage is derived from a richly furnished tomb in area A/I dating to the later Hyksos period (stratum D/3, Middle Bronze Age (MBA) IIB-C), according to the enclosed grave goods.[16]

Area A/I is the first area ever excavated in 1966–67 under the direction of Manfred Bietak and is located in the west of the still preserved part of the ancient tell (Fig. 5).[17] Its uppermost layers date to the Ptolemaic and Late Period,[18] and some remains of New Kingdom activity prove continued use of the site.[19]

14 Bietak 1997: 103.

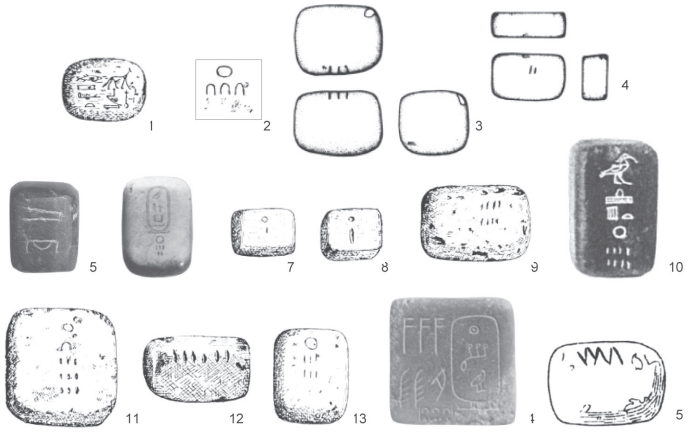
15 The publication of the remaining weights by the authors is in preparation.

16 For the stratigraphy of Tell el-Dabʿa see Bietak 2010: 140, fig. 1.

17 Bietak 1968: 81–102.

18 Lehmann 2012–13.

19 Bietak 1968: 103.



a 1-2, 7: Koptos
3-5: Elephantine
8: Defenneh
11-12: Memphis
13: Gurob
6, 10, 14: no provenance

Fig. 2a: Canonical Egyptian weights of the Old Kingdom (after Rahmstorf *2012: pl. 120).*

b 1-15: Uronarti
16-18: Shalfak
19-21: Elephantine
22-27: no provenance
28-20: Koptos

Fig. 2b: Canonical Egyptian weights of the Middle Kingdom (after Rahmstorf *2012: pl. 121).*

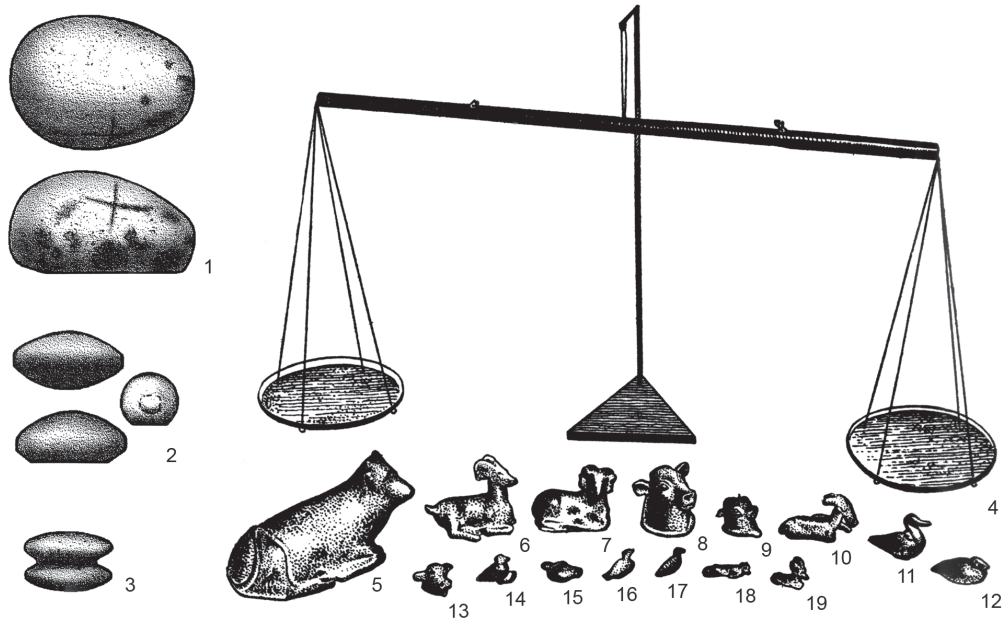


Fig. 3: Canonical Egyptian weights of the New Kingdom (after Rahmstorf *2012: pl. 122).*

Four grid squares were excavated to the depth of the layers of the Second Intermediate Period, revealing buildings and a small alley with tombs of children and adults located below the floors (Fig. 6).[20]

The disturbed Tomb 1 in square A/I-g/3.4 underneath a floor paved with mudbricks is a vaulted chamber tomb that was not entirely excavated due to the height of the surrounding sections. The tomb contained the remains of at least five scattered skeletons (Fig. 7). Several bronze items (daggers, axes, knives, toggle pins), scarabs and pottery vessels survived, which can only partially be assigned to certain individuals.[21]

This tomb is of special interest because it contains not only these still rich grave goods, but, also two sets of weights. One set was found in front of the no longer preserved torso of Burial 4. Unfortunately, no detailed photographs were taken or are still existing, but their exact location is marked on the field drawing (Fig. 7). It is reasonable to assume that they were once stored inside an organic container that had decayed within the soil.

The weights of the presumed second set were found scattered all over the tomb. One cylindrical weight was lying close to Burial 2 (Fig. 8) and probably belonged to this individual.

The first set comprises 11 objects (Fig. 9).[22] Three weights are apparently unworked pebbles, one is made of steatite, the others consist of iron-rich sedimentary rock – here taken to be hematite. Three of them are sphendonoid (Fig. 9: 462 a, b, k), two others, now broken, once had the same shape (Fig. 9: 462 c, f). The worn fractures sug-

20 See Prell/Rahmstorf 2019 for a presentation of all the tombs found in area A/I.

21 See Prell/Rahmstorf 2019 for a presentation of the complete inventory.

22 The authors are grateful to R. Hölzl and M. Hüttner from the "Kunsthistorisches Museum" in Vienna who provided access to the objects stored there.

Fig. 4: Location of Tell el-Dabʿa in Egypt's Eastern Delta (after Bietak *2018: 225, fig. 2).*

gest that they were recycled and kept in use. One weight is cylindrical (Fig. 9: 462 d), the shape of the other objects (Fig. 9: 462 e, g–i, l) seems to be random. One of the sphendonoid weights (Fig. 9: 462 k) bears four markings on the base, most likely indicating a certain weight unit.

The second group consists of seven objects – all made from hematite (Fig. 10). Two are again sphendonoid (Fig. 10: 379 a, b), another is cylindrical (Fig. 10: 379 c). The others (Fig. 10: 379 d–g) seem to have again an arbitrary natural shape. The random shapes demonstrate that even simple pebbles may have functioned as weights (see below for similar circumstances concerning weights found in a Late Bronze Age tomb in Akko).

Interestingly, whilst the tomb was plundered, relatively precious grave goods like daggers and axes, were left behind. The lower extremities of three of the five individuals interred here were found *in situ*, but all the torsos had been disturbed. This fact suggests that the grave robbers intended to remove precious metal objects worn on the torso and the head as has been confirmed by other burials in Tell el-Dabʿa.[23] The presence of weights suggests that the person using them was a merchant, equipped with his goods and

23 Philip 2006: 86–88, 109–114, 116–119.

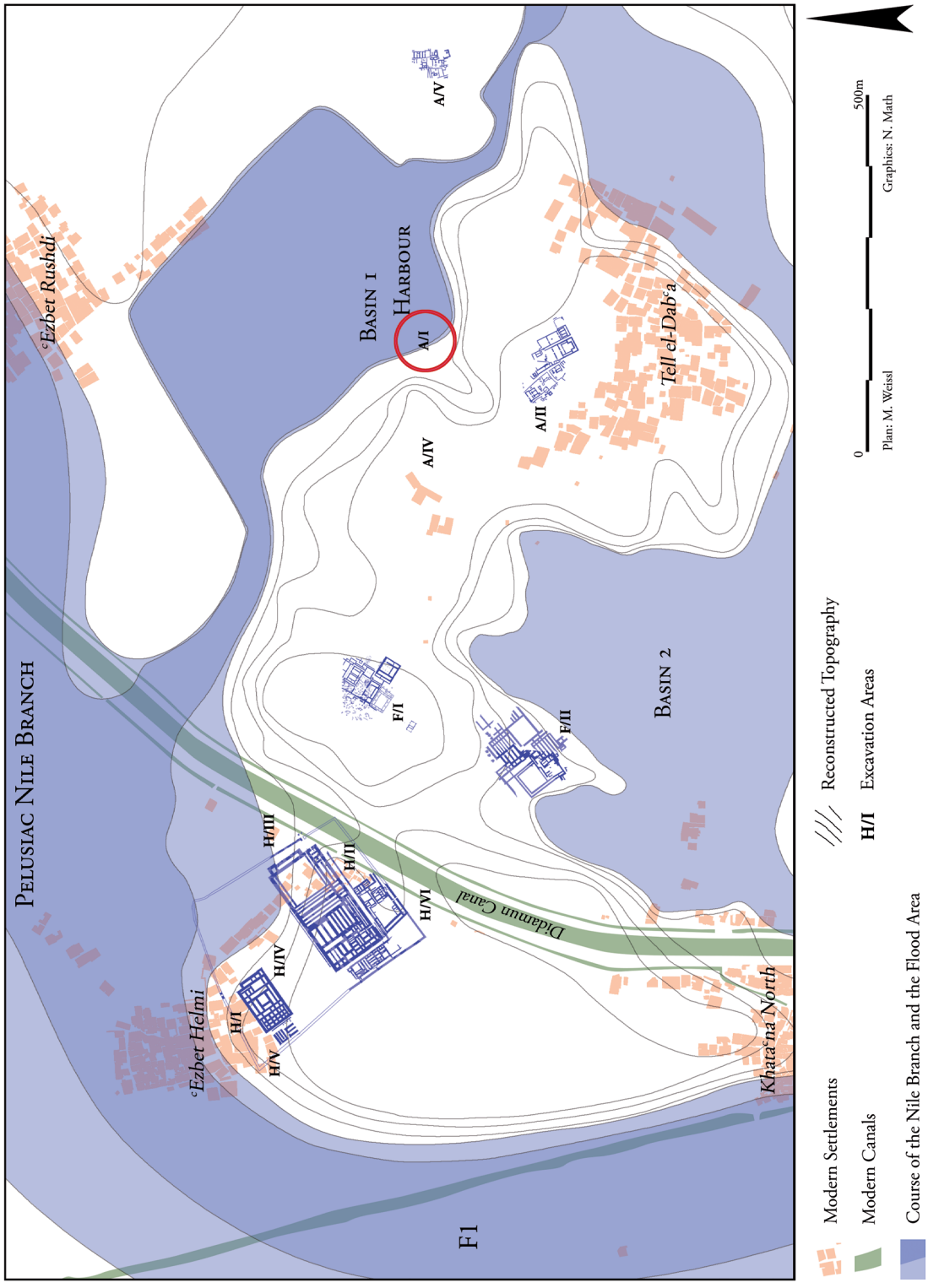


Fig. 5: Location of area A/I north of the modern village Tell el-Dabʿa with reconstruction of the ancient landscape (after Bietak *2018: 224, fig. 1).*

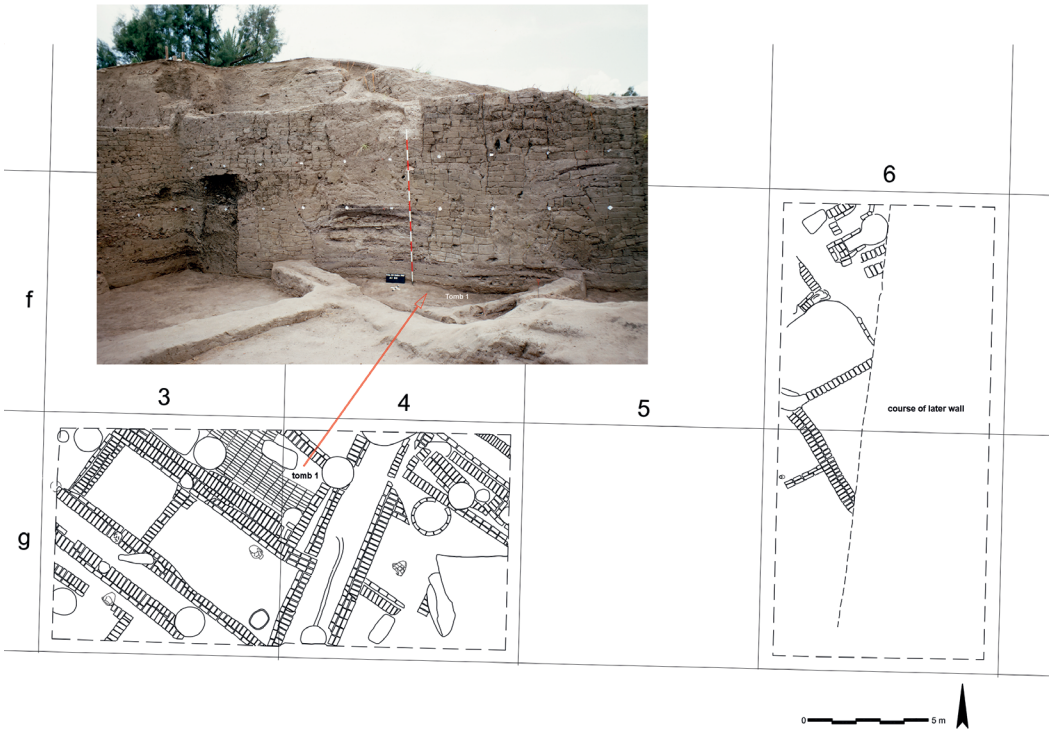


Fig. 6: The Second Intermediate Period layers as excavated in area A/I and the northern section of square A/I-g/3.4 with the location of tomb 1 indicated (plan: P. Aprent, photo: M. Bietak).

tools for the afterlife.[24] Unfortunately no remains of a scale could be identified among the grave inventory.[25] This is not uncommon: at Ur, for example, scales are present only in four of the 26 Early and Middle Bronze Age graves with weights.[26]

3 Weighing Equipment as Grave Inventory beyond Egypt

So far, no evidence for undoubted weights from graves from other Old or Middle Kingdom sites in Egypt is known to us. We would like to present here a short overview of weights in burials from Syro-Mesopotamia and the Levant but also the Aegean, Anatolia and the Gulf region during the Early and Middle Bronze Age. Generally, weights are rarely used as grave goods in the Early Bronze Age (Fig. 11). Seven examples are known from Early Dynastic tombs in Ur and

24 For the use of a balance scale and weights within the Hittite death rituals, see Otten 1958: 131–132. Weighing the heart of the deceased against the feather of Maat is a common theme in Egyptian funerary beliefs, but one cannot assume a coherent meaning for the Bronze Age contexts presented here.

25 Fragments of a metal sheet with bent egdes that might have represented a scale pan find a better preserved comparison in F/I-p/18, tomb 14 (Stratum d/1), see Schiestl 2008: 120, 453, pl. XXII.c. As this object is clearly only pierced on one side with two perforations next to each other, it cannot be addressed as scale pan, but maybe a belt plaque, see Prell 2019: 316–317; Bietak 1968: 102.

26 Hafford 2012: 48.

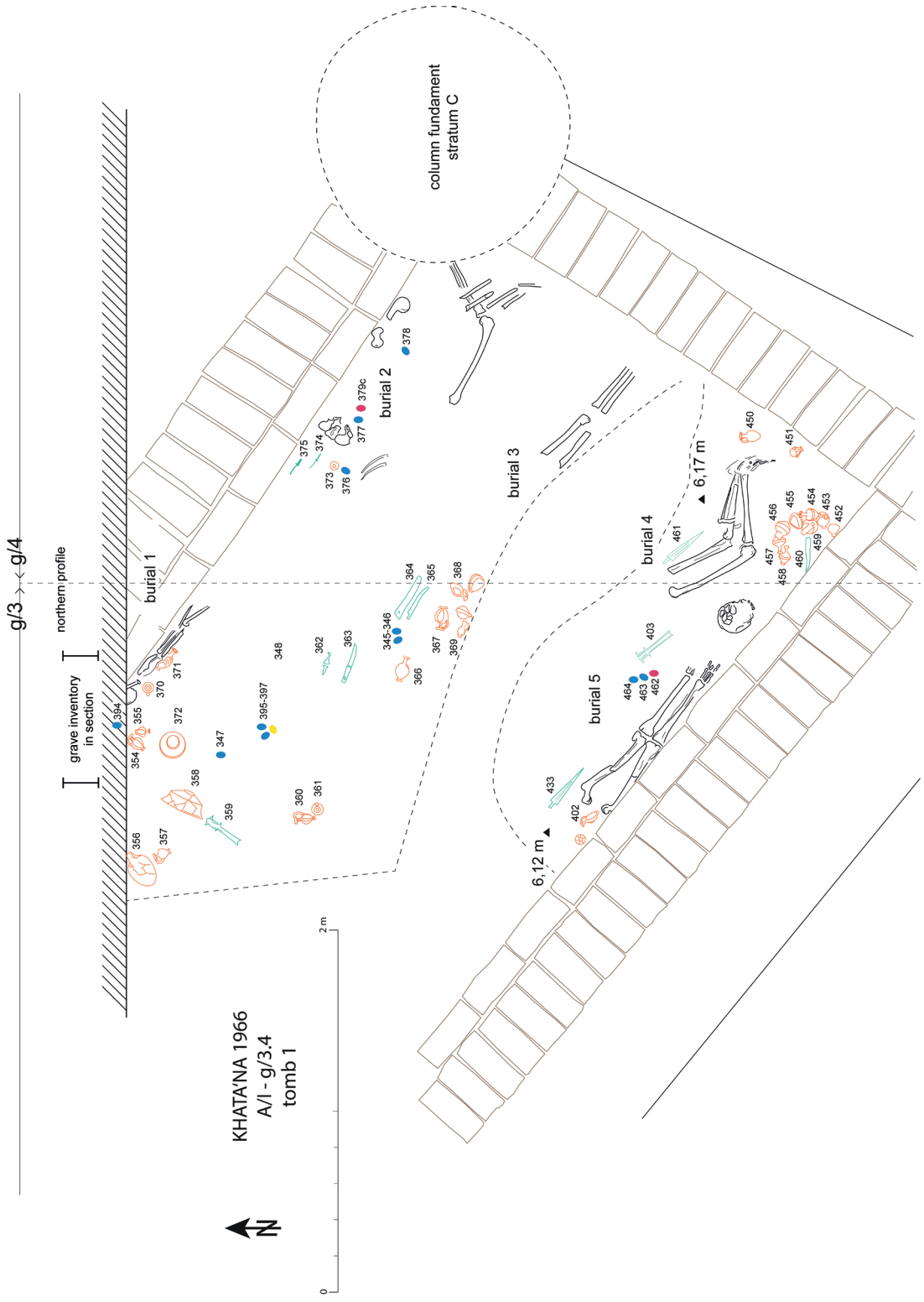


Fig. 7: A/I-g/3.4, tomb 1, burials 1–5 with grave inventory (green: metal, orange: pottery, blue: scarabs, red: weights, yellow: frog amulet, plan: P. Aprent).

five more from graves dating to the Akkadian Period.[27] A set of two scale-pans is documented in PG 1054.[28] Seven weights and a set of scale-pans were discovered in tomb IV at Tello/Girsu (Early Dynastic III).[29] Weights possibly dating to the late 3rd millennium are documented in two tombs in Susa and were accompanied by scale-pans.[30] Other weights are known from an intramural, most likely Akkadian, burial at Nippur[31], as well as from tomb 8 in Tell ed-Der.[32] Interestingly, some early spool-shaped objects, most likely representing weights in this region, have also been found in Aegean tombs (for example: Steno/Lefkas,[33] Aghios Kosmas in Attica,[34] Chalandriani/Syros,[35] Kapros/Amorgos[36] and Archanes/Crete).[37]

Weights as grave goods became more common in the Middle Bronze Age (Fig. 11), but not in large numbers. We list here some but very probably not all known specimens. In the Isin Larsa/Old Babylonian Period from Ur 14 intramural tombs with weights are known.[38] Two of them (LG/23 and LG/45) also contained the remains of scales.[39] A further two weights and a set of scale-pans were found in tomb LG/170.[40] In Tell ed-Der, weights came to light in tomb 62.[41] The deceased in the Old Babylonian tomb 45 in Uruk was provided with a set of seven weights.[42] A lion weight is known from a grave in Susa, dating to the beginning of the 2nd millennium BCE.[43] A jar found in Larsa filled with scrap metal, seals and numerous weights[44] is addressed as a tomb.[45] In Kültepe-Kanesh in south-central Anatolia weights were included as grave goods in several burials dating c. to the 19th century BCE. Some of the graves also contained the remains of bronze scale-pans.[46]

The context of tomb 1974 in Tell el-Ajjul in the southern Levant remains unclear. It can be dated only to the Middle to Late Bronze Age,[47] therefore the precise date of the included weight remains uncertain. One late Middle Helladic grave at Lerna in the Argolid in Greece also yielded a spool-shaped weight.[48]

27 Ialongo/Vacca/Peyronel 2018: 22; Hafford 2012: 48–49, table 9. See as well Woolley 1934: 473 (PG 1413).

28 Müller-Karpe 1993: 13; Woolley 1934: 105, fig. 17, 107.

29 De Genouillac 1936: 31, 95, 122, pl. 88.1.

30 Tallon 1987: 194, nos. 684–685.

31 A simple earth burial with few funerary gifts in area TB XI, tomb no. 3B 68, see McCown/Haines 1967: 144.

32 Boehmer/Pedde/Salje 1995, 19. Ratnagar 2003: 88 also mentions weights in a tomb in Hili (Abu Dhabi) and Shahdad (Iran), but gives no references and in the publications of this tomb/the cemetery no weights could be identified by the present authors. A lot of 13 weights found at Mari in an area that contained tombs and sometimes mentioned as coming from a funerary context (e.g. Chambon 2006: 188) actually could not be attributed to a certain tomb, see Margueron 2019.

33 Dörpfeld 1927: 297–298.

34 Mylonas 1959: 87, 99, fig. 166.8–11.

35 Tsountas 1899: 100, 111, 122, pl. X.35–36.

36 Rambach 2000: 13 f., pl. 3.4, pl. 155.9.

37 Sakellarakis/Sapouna-Sakellarakis 1997: 64–65, 582, fig. 594. See as well Rahmstorf 2003.

38 Ialongo/Vacca/Peyronel 2018: 22; Hafford 2012: 48–49, table 9.

39 Peyronel 2000; Ascalone/Peyronel 1999: 368, fn. 40.

40 Peyronel 2011: 124; Woolley/Mallowan 1976: 210.

41 De Meyer 1978: pls. 16, 17.4–5.

42 Boehmer/Pedde/Salje 1995: 19, 21.

43 Belaiew 1934: 135, fig. 1 A16, no. 177.

44 Arnaud/Calvet/Huot 1979.

45 Boehmer/Pedde/Salje 1995: 19, fn. 8 with reference to the article of Arnaud/Calvet/Huot 1976.

46 Kulakoğlu 2017: table 21.3.

47 Petrie/Mackay/Murray 1952: pls. XXII.3, XXIII.5. Date according to Laidlaw/Ucko/Sparks 2009: 89, no. 77.

48 Rahmstorf 2003: 297; Banks 1967: 193, 195, no. 366.

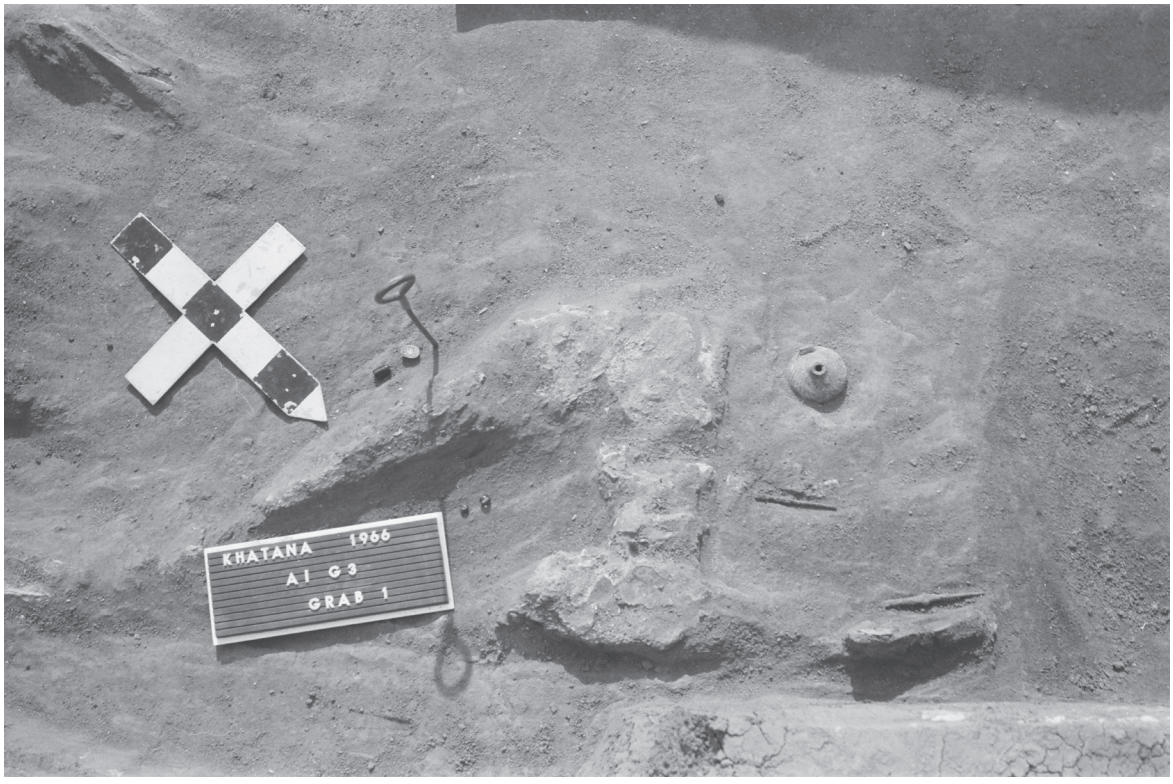


Fig. 8: Detail of A/I-g/3.4, tomb 1, burial 2 including weight inv.-no. 379c (photo: M. Bietak).

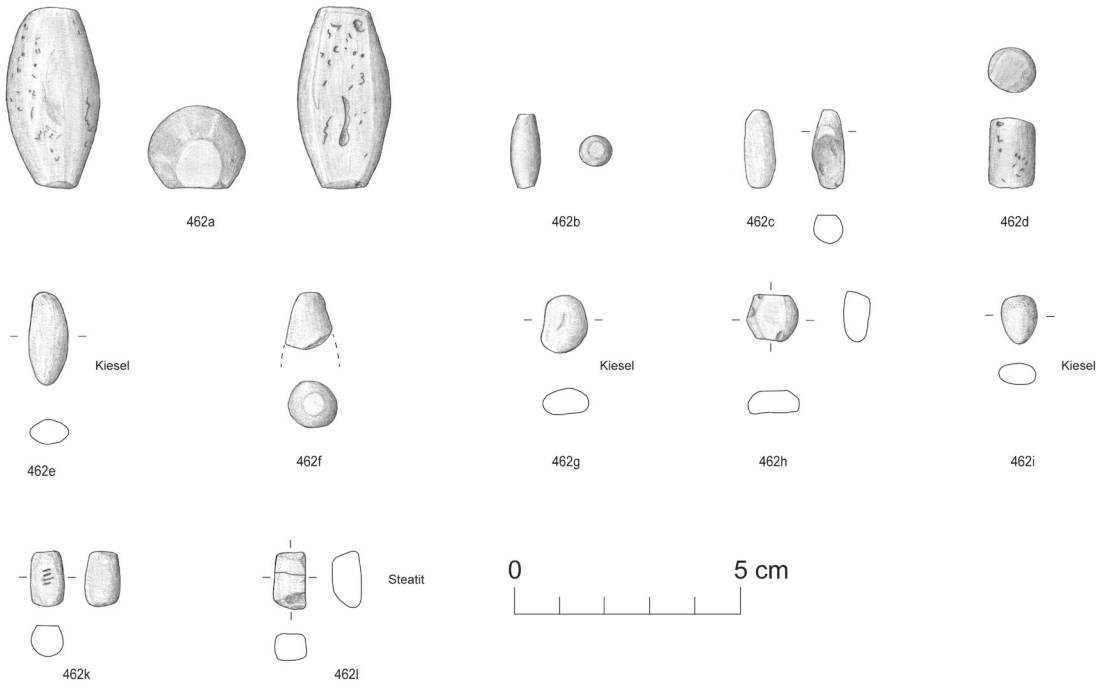


Fig. 9: Set of weights (inv.-no. 462a-l) found with A/I-g/3.4, tomb 1, burial 4 (drawing: S. Prell).

A couple of sites from the latest Early and the beginning of the Middle Bronze Age in the Gulf region also comprise burials with weighing equipment. We know of eight hematite weights found together with the remains of a metal scale in a late Early Dilmun Period burial mound S 352 at Saar in Bahrein.[49] In addition, four sphendonoid weights and two duck-shaped weights were excavated in Saar, Tumulus 4[50] and a set of four sphendonoid weights in an unspecified grave at all-Hajjar, Site 2 in Bahrain.[51] Further weights from funerary contexts have been discovered on the Omani Peninsula. The cubical weight from Tomb 6 in Shimal seems to correspond to the Harappan weight unit,[52] thus underlining trade relations between the Gulf region and the Indus Valley Civilisation during the late third and early second millennium BCE. A second spherical weight with a flat base was found in tomb 99 at Shimal. Its shape and weight (25.71 g, slightly chipped = c. two Harappan units of 13.7 g) also point to the Indus region.[53] Sphendonoid and cubical weights known from the Arabian Peninsula illustrate the role of the region as an intermediator between the West and the East.[54]

In the Late Bronze Age, providing the deceased with weighing equipment became slightly more common, but still not frequent.[55] Some weights from tombs in Akko, although dating to the developed Late Bronze Age, need mentioning because they display certain similarities with the presented data from late Middle Bronze Age Tell el-Dabʿa finds. During a rescue excavation near the "Persian Garden", several burials were discovered, five of which were undisturbed.[56] They

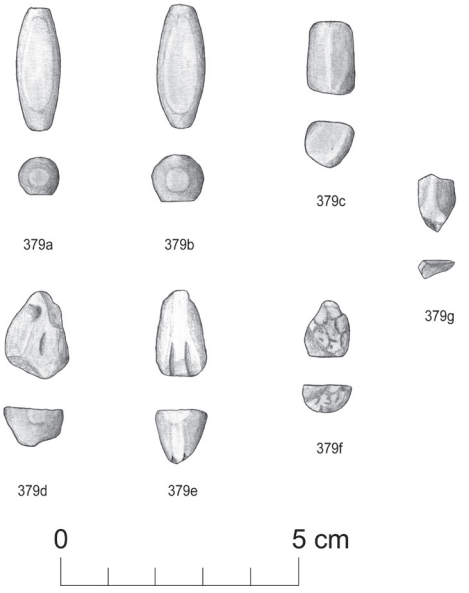


Fig. 10: Weights (inv.-no. 379a-g) found scattered all over the tomb (drawing: S. Prell)

49 Peyronel 2000: 185, fn. 29; Ascalone/Peyronel 1999: 368–369. Their weights correspond to 1/8, 1/2, 2/3, 1, 2, 3, 5, and 10 *shekels*, see Mortensen 1994: 396. For a photo of seven of the weights, see Vine 1993: 47, fig. on the upper right; according to the captions they follow the Mesopotamian *shekel* (c. 8.3 g).

50 Lombard 1999: 99, nos. 100–105.

51 Ascalone/Peyronel 1999: 369 (26.3 g, slightly chipped); Lombard/Kervran 1989: 35, no. 56.

52 Ascalone/Peyronel 1999: 370.

53 Cleuziou/Vogt 1985: 272.

54 See as well Peyronel 2000: 185, fn. 29.

55 See Steinmann 2012: 282, fn. 78 for a list of Aegean tombs containing parts of scales and sometimes as well lead weights; see as well Alberti 2006; 2003 and Bergonzi 1996. For Late Helladic graves containing spool-shaped weights, see Rahmstorf 2003: 297. A Late Cypriote grave in Hala Sultan Tekke provided a set of nine weights, see Fischer/Bürge 2018: 58, fig. 25. For a Late Bronze Age tomb containing two sets of scale-pans in Megiddo (T 912 B), see Guy 1938: pl. 125.6–9; Susa: Belaiew 1934: 136, fig. II.C–6; Tell Jerishe: Ory 1944: 55–57, pl. 13.4.

56 Ben-Arieh/Edelstein 1977: 2.

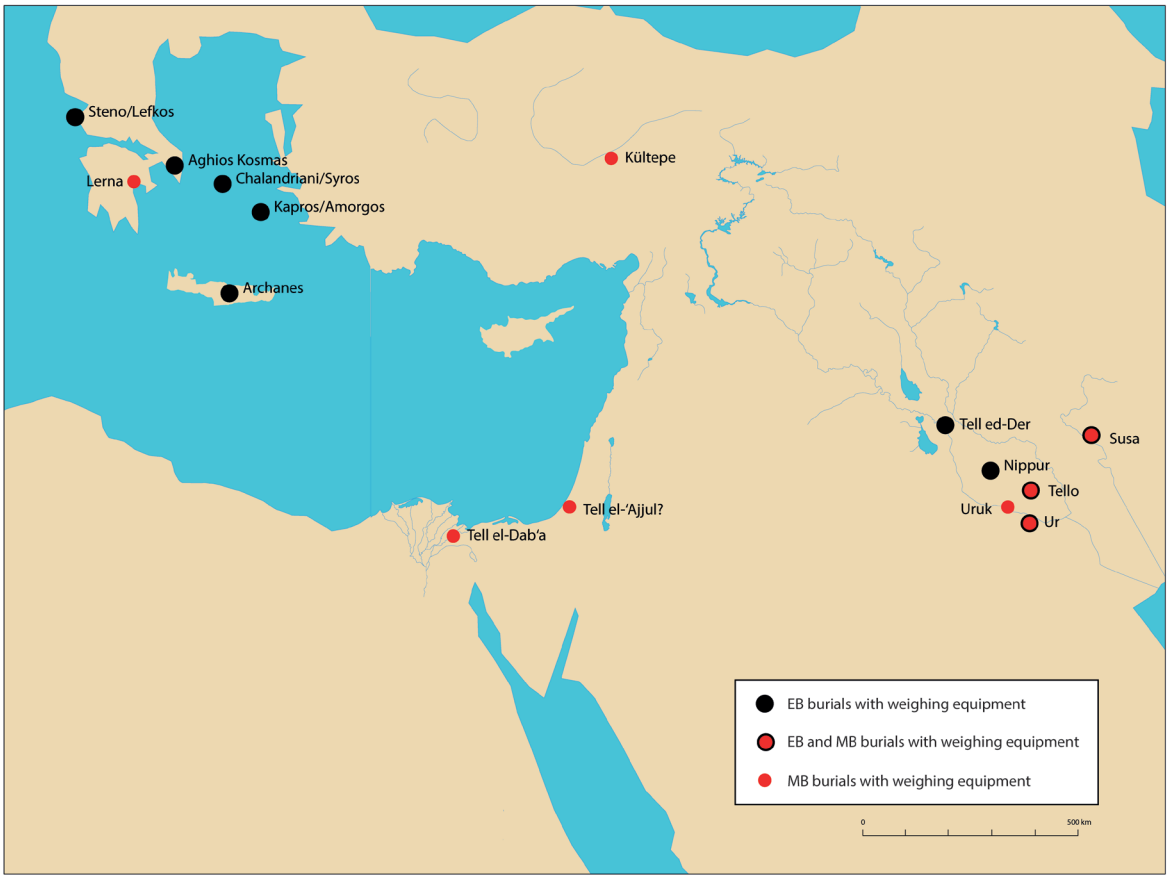


Fig. 11: Tombs including weighing equipment in the Early and Middle Bronze Age (plot: S. Prell).

consisted of simple earth pits and in three tombs (A2, B3, and C1) weights were found amongst the relatively rich grave goods including weapons. Weights were often found concentrated near the feet, the hip or the head of the deceased. This suggests that sets were once stored in a bag of organic material. Hematite weights and animal-shaped metal weights were also recovered. Interestingly, some simple stones, partly worked to achieve a certain weight, were included in those sets[57]– comparable to the simple pebbles and broken but re-shaped weights from tomb 1 in A/I-g/3.4 in Tell el-Dab'a. Weighing equipment was also occasionally still part of the grave goods assemblage in the Iron Age.[58]

57 Eran/Edelstein 1977: 52.

58 E.g. a scale-pan in tomb GVIII 111 in Hama, see Riis 1948: 136, fig. 181; scale pans were also included in the Neo-Assyrian tomb 1B209 in Nippur, see Hauptmann/Pernicka 2004: 31, pl. 40.681–682 or in two Neo-Babylonian tombs in Uruk, see van Ess/Pedde 1992: 55, pls. 54–55. In addition, a scale-pan is also known from an Iron Age tomb (T 39) in Megiddo, see Harrison 2004: 91, pl. 33.4.

4 Conclusions

Weights and balances have been used from the Aegean in the west to the Indus region in the east, since at least the earlier third millennium BCE. Four main types have been developed independently in the various regions: spools, sphendonoids, parallel-epipeds and cubes (Fig. 12).[59] The overlap in the distribution of the different shapes and their metrological systems are indicative of exchange.[60] For our discussion it is important to note that sphendonoid/ellipsoid shape (green symbol) and the materials hematite and other dark stone were used for weights from western Anatolia into Syro-Mesopotamia (with a few examples in the mature Harappan culture[61]) from the Early Bronze Age. Among other weight units the so-called 'Syrian, Levantine or Ugarit *shekel*' of c. 9.1–9.4 g was in use in Syria (e. g. Ebla[62]) and the Aegean since the Early Bronze Age.[63] In Egypt the parallel-epipeds were the dominant type during the Old and Middle Kingdom.[64] Their metrological system was vastly different to the ones in Anatolia and Syro-Mesopotamia where statistical tests (Cosine Quantogram Analysis) of 103 Middle Bronze Age weights from Ebla demonstrates the continuous use of weight units known since the third millennium BCE.[65] Most prominent were the Mesopotamian *shekel* 8.3–8.4 g (especially well documented at Kültepe/Karum Kanesh[66]) and the *shekel* of 9.1–9.4 g.

With the Late Bronze Age the characteristics of weights (shape, material, metrology) in Anatolia, Syria/Levant, and then also on Cyprus, remained similar. The most dominant unit was still the *shekel* of 9.1–9.4 g and ten times this unit (c. 91–94 g) as documented by the set of 150 weights found in the shipwreck of Uluburun.[67] By then, Egypt participated in the international exchange in the East Mediterranean in a much more intensive way than previously and adopted the typical shapes, the characteristic dark stone material and the specific metrology of the other Eastern Mediterranean countries. The weights from Tell el-Dab'a demonstrate this rather clearly: the unit of c. 9.1–9.4 g and also the Mesopotamian *shekel* (c. 8.3–8.4 g) were used.[68] For example, the four parallel grooves on inv.-no. 462k (Fig. 9, Tab. 1), which weighs 2.05 g, seem to refer to the Mesopotamian *shekel* of c. 8.3–8.4 g. This unification with other regions of the eastern Mediterranean facilitated trade in general and is indicative of the stronger engagement of Egypt during the New Kingdom in the exchange in the Eastern Mediterranean and beyond.

Considering the evidence presented, the most likely hypothesis is that the changes in the weighing equipment and the related weighing system were established in Egypt by the Hyksos, who originally hailed from the middle and northern part of the eastern Mediterranean. Our case study contributes to the understanding of the time of the Hyksos as a period in which suppos-

59 Rahmstorf 2007 for an overview of forms and regions.

60 Rahmstorf 2007: 30–38.

61 Rahmstorf 2020.

62 On the weights from Ebla see as well Ascalone/Peyronel 2006.

63 Rahmstorf 2007: 21–22.

64 Cour-Marty 1990: 54–55, fig. 26.

65 See for the method: Petruso 1992: 71–75; Pakkanen 2012; Ialongo/Vacca/Peyronel 2018: 24.

66 For the simultaneous use of different weight systems in Kültepe see Dercksen 2016.

67 Pulak 2000.

68 See Rahmstorf 2007: 11–12 for the difficulty in assigning a specific weight unit with certainty.

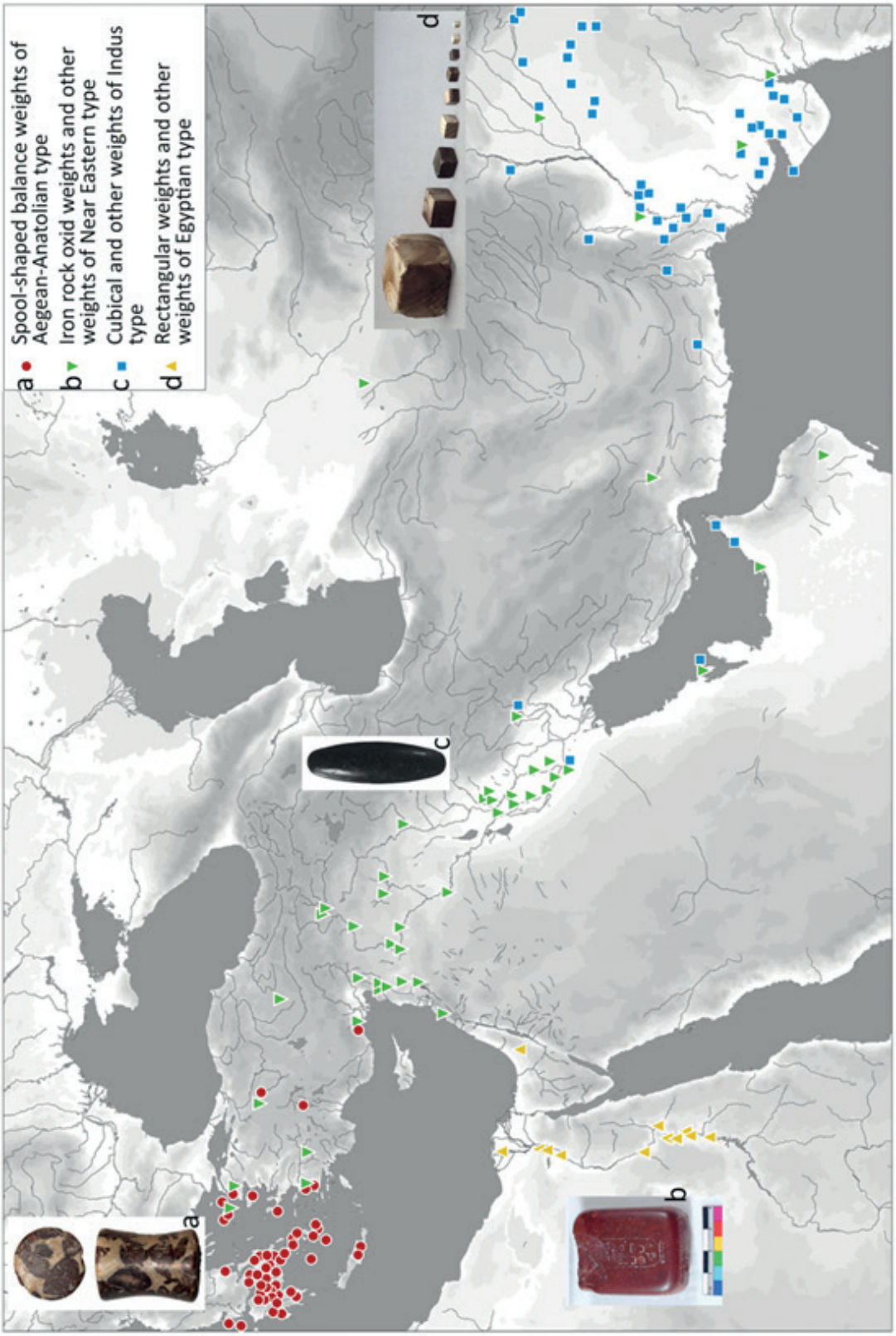


Fig. 12: Distribution of sites with weights in the third millennium BCE and the main (canonical) weight types (after Ramstorf *2016: 30, fig. 3)*

edly many militaristic and technological innovations reached Egypt from the east, as it has been assumed by numerous scholars.[69] Such lists of innovations often comprise the horse, the chariot or the composite bow, but in fact definite evidence that the Hyksos were indeed responsible for the introduction of all these novelties is not always conclusive. For example, no artefacts related to chariots or composite bows were ever discovered in Tell el-Dabʿa, a fact which may be explained by the soil conditions in the Egyptian Delta which do not allow the preservation of organic material. Yet, we have proof that the earliest horse remains[70] and the earliest known scimitar so far[71] – a very common weapon in Egypt during the New Kingdom – derive from the site. Technological achievements, like the fast turning potters' wheel[72] or metallurgical innovations are however difficult to pinpoint as innovations brought to Egypt by the Hyksos.[73] Nevertheless, it is certain that the Hyksos' rule over the country had a considerable impact on Egypt and generally resulted in the introduction of innovations. It should be noted that these consisted not only of militaristic and technological appliances, but also of tools for trade as the weights from Tell el-Dabʿa presented here seem to suggest.

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69 See Säve-Söderbergh 1951; Schulman 1980; Shaw 2001: 59–71 or Booth 2005: 36–46, just to name a few.

70 Bietak/Forstner-Müller 2009: 88, fig. 8 for a complete skeleton that can be dated to the 15th Dynasty. Earlier horse bones can be attributed to a late 13th Dynasty context, see Boessneck/von den Driesch 1992: 22, 25.

71 Forstner-Müller 2008: 51.

72 There are indications though that the fast turning wheel was brought to Egypt in the Second Intermediate Period, see Aston 2004: 51.

73 For a complete overview of the subject, the cultural interference and the impact of the Hyksos rule on Egypt, covering religious, technological and militaristic as well as political and social aspects, see Mourad, forthcoming.

Table 1: Potential ratios of the weights found in tomb 1 area A/I-g/3.4

inv.-no.	weight in gram	potential ratio	result
462a	44.90	5	8.98
462b	2.65	1/3	7.95
462c	1.65	1/6	9.36
462d	4.94	½	9.88
462e	1.45	1/6	8.7
462f	2.97	1/3	8.91
462g	1.25	1/8	10
462h	1.76	1/5?; 1/6?	8.8; 10.56
462i	0.70	1/12	8.4
462k	2.05	1/4	8.2
462l	1.11	1/8	8.88
379a	8.83	1	8.83
379b	5.06	2/3?; ½?	7.59?; 10.12?
379c	3.75	½?; 1/3?	7.5?; 11.25?
379d	4.6	1/2	9.2
379e	5.19	1/2	10.38
379f	1.42	1/6	8.52
379g	0.85	1/10	8.5

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