Weighing Units and Weights in the Context of Trade Between Upper Mesopotamia and Anatolia (Nineteenth and Eighteenth Centuries BCE)

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Chapter 12
Weighing Units and Weights in the Context of Trade Between Upper Mesopotamia and Anatolia (Nineteenth and Eighteenth Centuries BCE)

Cécile Michel*

Abstract - The archives of the Assyrian merchants, found at Kaneš in Central Anatolia, highlight the use of a weight system, well adapted to quantify the metals they traded from East to West and back. An atypical progressive metrological list of weights shows the importance of fractions in Old Assyrian numeracy and computing practices. Accounts documents reveal two different cultures for the use of weighing units according to the commodities quantified and where they were quantified. In Upper Mesopotamia, tin and silver were measured in *gu*, *mana* and *gin*, while in Anatolia, locally traded copper was often counted only in the *mana* unit.
In addition, merchants had to deal with different weight standards: The Anatolian *mana* weighed ten per cent less than the Mesopotamian *mana*. Texts also mention the verification of weights and reveal methods for correcting discrepancies. A hundred and sixty stone weights found at Kaneš may be compared with the data provided by the metrological list. These weights, which show significant variations, witness the existence of many individual weight standards, and confirm the recurrent necessity to correct discrepancies.

At the very beginning of the second millennium BCE,[1] inhabitants of the Aššur (Qala'at Sherquat) city-state, in Iraq on the Tigris, engaged in large-scale trade with Anatolia. This period, which covers the first three centuries of the second millennium BCE is generally called 'Old Assyrian'. Assyrians exported tin and textiles to Central Anatolia, and brought back gold and silver.[2] They established trading settlements on the Anatolian Plateau, far from their homeland. Their archives, mainly dated to the nineteenth century, have been found at three sites, with the vast majority coming from excavations in the lower town at Kaneš (modern Kültepe), near Kayseri, in Turkey.
Kaneš has, up to now, provided 22 500 cuneiform tablets written in the Old Assyrian dialect. Only 40 such tablets have been found scattered within the round citadel, in and outside of the palace. Thus we do not have official archives of the Anatolian kingdom if they ever existed. In the lower city, north-east of the mount, 22 460 tablets have been excavated, with approximately 22 000 dating to the nineteenth century (phase II) and 460 to the eighteenth century (phase Ib). Note that for Aššur, the home city of the Assyrian merchants, the Old Assyrian level has not been excavated; only 25 tablets from this period have been unearthed, probably because they had been discarded in later levels. The majority of these are school texts.[3]
The Old Assyrian tablets document the regular trade established by Assyrian merchants between Aššur and Kaneš. In Aššur, they bought tin originating from the Far East; textiles, made locally or imported from Southern Mesopotamia; and donkeys. The merchandise was taken to Anatolia on donkey caravans.[4] Aššur itself did not produce much, except textiles and donkey harnesses, but was an important centre in an international trading network. In Anatolia, the Assyrians sold their merchandise for cash or on credit, at times increasing their profits via the local trade of copper and wool.[5]

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[1] All the dates mentioned in this chapter, except bibliographical references and archaeological discoveries, are to be understood as BCE.

[2] For a general overview of the Old Assyrian trade in Anatolia, see Michel (2001, 2008a) and Veenhof (2010a).

[3] For a general bibliography of the Old Assyrian period and a catalogue of the Old Assyrian sources, see Michel (2003, 2006a, 2011a).

[4] Larsen (1967), Michel (2001: 171-301).

[5] Dercksen (1999); Veenhof (1999).

When coming back from Kaneš, the Assyrians brought gold and silver with them. The gold was usually hoarded in Aššur or used to buy tin. The silver was refined and assayed in both Kaneš and Aššur, and was the favoured means of payment. Part of it was immediately reinvested in new caravans. In Anatolia, tin was sold at twice its price in Aššur, and each piece of textile at three times its price.[6] This significant profit was reduced by the many taxes the merchants had to pay in Aššur, en route, and in Kaneš.
During their trading activities and financial operations,[7] Assyrian merchants had to carry out various computations. They needed to know the different measurement systems and to be able to calculate prices by converting an amount of a product into silver or copper according to a tariff decided in advance.[8] They used an additive decimal system to count objects, and among the different metrological systems they used, the weight system dominated because of the nature of the goods traded, predominantly metals.[9] Tin, gold, silver and iron were measured according to the Mesopotamian sexagesimal weight system in *gu*, *mana*, *gin* and *še*; one *gin* weighed a little more than eight grams (Table 12.1).[10]

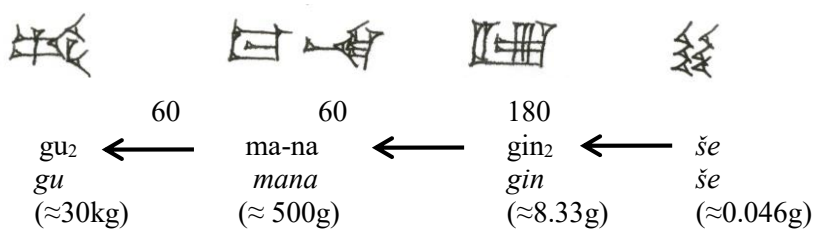

Table 12.1 The Mesopotamian weight system used in the Old Assyrian sources

Merchants' archives constitute an excellent source for analysing quantification and computation practices. The metrological list of weights found at Kaneš, the only extant example of this type of list, may be analysed in parallel to similar, contemporaneous Old Babylonian lists; it highlights how quantities were shaped in the Old Assyrian corpus. Recording the various operations made with weights enables the identification of weight standards and their verification, as well as discrepancies and corrections.[11] Texts dealing with manipulations of weights reveal the existence of the Anatolian *mana,* which was lighter than the Mesopotamian *mana*, and the use of a simplified weight system to quantify copper on the Anatolian Plateau.[12] A large collection of stone weights discovered at Kaneš may be compared with the data provided by the archives and the metrological list, and an attempt to correlate some of these weights with textual measures will be made.

12.1. A Progressive Metrological List of Weights

In Ancient Mesopotamia, scribes learned how to read, write, count and calculate with the help of various school texts.[13] The towns of Aššur and Kaneš have produced about twenty Old Assyrian school tablets.[14] Those dealing with computation are mainly round tablets bearing small conversion exercises of one product into another, usually silver.[15] Excavations in Kaneš have also provided the aforementioned metrological list.
According to Proust (2007: 269, Fig. 2), who has studied material from Old Babylonian Nippur, about 40 per cent of the mathematical tablets produced in a school context consisted of metrological lists and tables.[16] The metrological lists relate to the learning of quantities and the various systems of measuring

[6] Veenhof (1988).
[7] Larsen (1977), Michel (2001: 303-357).
[8] Michel (2008b).
[9] Michel (2006b).
[10] The translations usually found in the English literature for these measurement units are: gu_2 'talent'; *ma-na* 'mina'; gin_2 'shekel'; še 'grain'.
[11] Veenhof (1972: 54-68); Dercksen (1996: 80-85).
[12] Dercksen (1996: 86-89); Michel (1998: 258-261).
[13] Veldhuis (1996; 2011); Proust (2007); Robson (2008).
[14] Michel (2008b). Bibliography relative to these school texts: Michel (2003: 139-140; 2006a: 445; 2011a: 432).
[15] Michel (2006b).
[16] Note that about 10 to 20 per cent of the Mesopotamian school texts are usually mathematical texts (Veldhuis 1997).

units in which they could be expressed. They consist of enumerations of measurement values, in the form of simple progressive lists, containing one or more of the different measuring systems (capacities, weights, surfaces and lengths). These lists allow us to understand the various measurement units and their corresponding numerical values,[17] as well as the relations existing between the different measurement units. Metrological tables present the same enumerations as the lists, but in the form of tables giving the equivalent number of each measurement value in the sexagesimal place-value notation.[18]

12.1.1 An Old Assyrian Metrological List

Two fragments of this metrological list, Kt t/k 76+79, dated to the eighteenth century were found in a house in Kaneš.[19] This corresponds to the second phase (Ib) of the Old Assyrian settlement in Kültepe lower town. The large tablet (18 × 16.5 × 2 cm), partly destroyed, is quadrilateral and thick. It presents four columns on each side, covered with coarse signs. The lines are not regular and there is no alignment between the various columns. This tablet was presumably written by a student. On the obverse, the scribe registered a progressive list of measurement values, expressed in weights, from 1 *gin* to 60 or 100 *gu*, and on the reverse, a lexical list, with logograms and Akkadian words, recording metals, stones and plants.

A list of metals and metal objects makes up only nine lines (v 1-9) and lists gold, iron, tin, copper and bronze (silver is curiously lacking) and the names for various vessels and cauldrons in bronze and copper.[20] The list of stones is much longer, at least forty lines (from v 10 to possibly part of column vii). It starts with semi-precious stones, like lapis lazuli, carnelian and rock crystal (?), and progresses to more common ones, such as grindstones.[21] The last two columns, which are much too fragmentary to be transliterated, enumerate a number of plants (Figs 12.1 and 12.2).

Fig. 12.1 Photo of the obverse of Kt t/k 76+79 (©Kültepe Archaeological Mission)
Fig. 12.2 Copy of Kt t/k 76+79 by Hecker 1993, pl. 47

[17] In the weight system, for example, the numerical signs used before gu_2that is, aš, differ from those used before še, gin_2 and mana, that is, diš. The phenomenon being systematic in the use of weight system in this corpus, we shall not indicate the type of numerical sign used in parenthesis unless otherwise specified. Thus, instead of 1(aš) gu_2 3(diš) *ma-na*, we will write 1 gu_2 3 *ma-na*.

[18] Proust (2008, 2010).

[19] The two fragments of this text, discovered in 1968, were edited by Hecker (1993: pl. 47), and a photo of col. i and ii (Kt t/k 79 obverse) is published by Özgüç (1986: pl. 47, 2). For a first attempt of a reconstruction, see Michel (1998: 254). I am grateful to F. Kulakoğlu, Director of Kültepe-Kaneš excavations, who very kindly provided me with good photos of these two fragments.

[20] Lines v 4-9 are cited by Dercksen (1996: 79).

[21] Michel (2017).

The metrological list inscribed on the obverse of this school text, even if broken, may be reconstructed as follows (Table 12.2):

i	ii	iii	iv
[1 gin$_2$ kù-babbar*]	[1 ma-na 8 gin$_2$]	[3 ma-na 3 še]	[2 gu$_2$]
[2 gin$_2$]	[1 ma-na 9 gin$_2$]	[4 ma-na 4 še]	[3 gu$_2$]
[3 gin$_2$]	[1 ma-na 10 gin$_2$]	[5 ma-na 5 še]	[4 gu$_2$]
[4 gin$_2$]	[1 ma-na 11 gin$_2$]	[6 ma-na 6 še]	[5 gu$_2$]
[5 gin$_2$]	[1 ma-na 12 gin$_2$]	[7 ma-na 7 še]	[6 gu$_2$]
[6 gin$_2$]	[1 ma-na 13 gin$_2$]	[8 ma-na 8 še]	[7 gu$_2$]
[7 gin$_2$]	[1 ma-na 14 gin$_2$]	[9 ma-na 9 še]	[8 gu$_2$]
[8] gin$_2$	1 ma-na 1⌜5⌝ [gin$_2$]	[10 ma-na 10 še]	[9 gu$_2$]
⌜9⌝ gin$_2$	1 ma-na 16 [gin$_2$]	[11 ma-na 11 še]	[10 gu$_2$]
10 gin$_2$	1 ma-na 17 [gin$_2$]	[12 ma-na 12 še]	[11 gu$_2$]
11 gin$_2$7 1/2 še	1 ma-n[a 18 gin$_2$]	[13 ma-na 13 še]	[12 gu$_2$]
12 gin$_2$15 še	1 ma-na 19 [g]in$_2$	[14 ma-na 14 še]	13 gu$_2$
13 1/8 gin$_2$	1 1/3 ma-na l[á] 1 gin$_2$	[15] ma-na [15 še]	14 gu$_2$
14 1/6 gin$_2$	1 1/3 ma-[na]	16 ma-na 16 še	15 gu$_2$
15 1/4 gin$_2$	1 1/2 ma-[na]	17 ma-na 17 še	16 gu$_2$
16 1/3 gin$_2$	1 2/3 ma-[na]	[18] ma-na 18 še	17 gu$_2$
17 1/2 gin$_2$	1 5/[6 ma-na]	[1]9 ma-na 19 še	18 gu$_2$
18 2/3 gin$_2$	[1 5/6 ma-na 1 gin$_2$]	20 la$_2$ 1 ma-na	19 gu$_2$
19 5/6 gin$_2$	[1 5/6 ma-na 2 gin$_2$]	20 ma-na	[20 l]a$_2$ [1] gu$_2$
1/3 ma-n[a]	[1 5/6 ma-na 3 gin$_2$]	30 ma-na	2[0] gu$_2$
1/2 m[a-na]	[1 5/6 ma-na 4 gin$_2$]	[4]0 ma-na	[30 g]u$_2$
2/3 ma-[na]	[1 5/6 ma-na 5 gin$_2$]	[50] ma-na	[40 g]u$_2$
5/[6] ma-[na]	[1 5/6 ma-na 6 gin$_2$]	55 ma-na	[50 g]u$_2$
[1 ma-na]	[1 5/6 ma-na 7 gin$_2$]	1 gu$_2$	[60 g]u$_2$
[1 ma-na 1 gin$_2$]	[1 5/6 ma-na 8 gin$_2$]	[1] gu$_2$ 10⌝ m[a-na]	[*1 me-at gu$_2$*]
[1 ma-na 2 gin$_2$]	[1 5/6 ma-na 9 gin$_2$]	[1 gu$_2$ 20 ma-na]	
[1 ma-na 3 gin$_2$]	[2 ma-na]	[1 gu$_2$ 30 ma-na]	
[1 ma-na 4 gin$_2$]	[2 ma-na 1 še]	[1 gu$_2$ 40 ma-na]	
[1 ma-na 5 gin$_2$]	[2 ma-na 2 še]	[1 gu$_2$ 50 ma-na]	
[1 ma-na 6 gin$_2$]			
[1 ma-na 7 gin$_2$]			

Table 12.2 Transliteration of the Old Assyrian metrological list
* kù-babbar = silver

The top and the bottom of the tablet are destroyed. Suggested restorations of measurement values are proposed between brackets at the beginning and at the end of each column.
The list of weights starts with 1 *gin* (of silver) and increases by units of 1 *gin* until 19 *gin*. But, from 11 *gin* onwards, the scribe added a progression in *še* which starts with 7 1/2 *še*, followed by 15 *še* (twice 7 1/2), then fractions of *gin*. The three first fractions are specific to the Old Assyrian signs list and do not exist elsewhere in the cuneiform corpus. The first sign is a *hapax legomenon*, the last two are to be read 1/6 and 1/4.[22] Then follow the existing cuneiform signs of fractions corresponding to 1/3, 1/2, 2/3 and 5/6. These fractions of *gin* are equivalent to the following amounts of *še* (*gin*): 30 (1/6), 45 (1/4), 60 (1/3), 90 (1/2), 120 (2/3), 150 (5/6). Thus, the first still unknown sign should correspond to a fraction of *gin* which is equivalent to an amount of *še* comprising between 15 and 30 *še*. The addition of the two previous weights, 7 1/2 *še* + 15 *še* equals to 22 1/2 *še*, a quantity that is quite common in the texts and always written in *še*; it corresponds to 1/8 *gin*. Thus, the unknown fraction sign must be read 1/8 (Fig. 12.3).[23]

[22] Michel (1992).
[23] Michel (1998).

Fig. 12.3 Sign created for 1/8

After 19 5/6 *gin*, the scribe continues with an arithmetic progression of *mana*, starting with 1/3 *mana* (= 20 *gin*), using the classic sequence of fractions: 1/3, 1/2, 2/3, 5/6 (thus from 10 to 10 *gin* up to 1 *mana*). The end of column i and the beginning of column ii are destroyed, but may be easily restored: the sequence of weights follows a progression of units of 1 *gin* (as in column i).
In column ii, line 12, 1 *mana* 19 *gin* is expressed in two different ways, by the additive notation 1 *mana* + 19 *gin* and the subtractive: 1 1/3 *ma-na* la_2 (minus) 1 gin_2. Then, the development again progresses by 10 *gin* using the four existing fractions of *mana* (which correspond to sixths): 1/3, 1/2, 2/3, 5/6.
The reconstitution of the end of column ii is not certain, but a development of weights in *mana* is obvious at the beginning of the third column, thus, a progression of *gin* is probably added to 1 5/6 *mana* in order to reach 2 *mana*. Further, to the progression of *mana* units, it seems quite obvious that the scribe added a progression of *še* units as shown by the end of the sequence in column iii, lines 14-17 up to 19 *mana* 19 *še*. Then, for the second time, the scribe uses a subtractive notation 20 la_2 (minus) 1 *ma-na* to express this time 19 *mana*. But curiously enough, since the development of *mana* was made in parallel to a progression of *še*, this amount is smaller than the previous weight by 19 *še*: this is unique in such a metrological list.
From 20 *mana* there is an arithmetic progression by ten *mana* – except for 55 *mana* – up to 1 and 2 *gu*, and by units of 1 *gu* up to 19 *gu*. Here, for the third time, an equivalent of this last weight is also given in a subtractive notation: 20 la_2 (minus) 1 gu_2. The list ends with weights of *gu* developed by 10 units up to 60 (presumably written with six wedges). The last line, which is broken, may perhaps contain:

1 *me-at* gu_2: 1 hundred *gu*.

Whether we consider *gin* or *mana*, all the fraction sequences in this list correspond to a more or less regular progression of the inferior unit. The use of fractions becomes less frequent while the measurement units increase: the scribe does not use fractions of *gu* but multiples of *mana*. However, the progression of weights has no methodical character: for example, as indicated in italics in the following table (Table 12.3), quantities in *še* are added to progressive integers of *gin* and *mana*. Similarly, the subtractive notations indicated in bold in Table 12.3, mark breaks in the progression.

gin	*gin* (+ *še*)	*mana*	1 *mana* + *gin*	*mana*	1 5/6 *mana* + *gin*	*mana*+*še*	*mana*	*gu*
1	*11(+7 ½)*	1/3	1 + 1	1 1/3	1 5/6 + 1	*1 + 1*	**20 – 1**	1
	12(+ 15)	1/2		1 1/2			20	↓
↓	*13 1/8*	2/3	↓	1 2/3	↓	↓ + ↓	30	**19 =**
	14 1/6	5/6		1 5/6			40	**20 – 1**
10	*15 1/4*	1	**1 + 19**		1 5/6 + 9	*19+19*	50	20
	16 1/3		**=**		2 mana		55	30
	17 1/2		**1 1/3 – 1**					40
	18 2/3							50
	19 5/6							60 or (1×)60 (100)

Table 12.3 A synthetic and modern presentation of this Old Assyrian metrological list (*In italics*: Simultaneous progression of two units. **In bold**: use of subtractive notation)

Are the irregularities found in this list specific to this particular text, or can we find parallels in the contemporaneous Old Babylonian corpus?

12.1.2 Comparison with Contemporaneous Old Babylonian Lists and Tables of Weights

Metrological lists and tables are attested throughout the Ancient Near East, from Kaneš in Anatolia to Susa in Elam; for the great majority, they date to the Old Babylonian period, which is more or less contemporaneous with the Old Assyrian period.[24] Christine Proust (2010) estimates that, of a total of a little less than six hundred metrological lists and tables examined so far, 80 per cent were found in the Old Babylonian Nippur, south of Mesopotamia. The Old Babylonian metrological lists and tables more or less follow the same progression, with a few local variations.

In order to compare the Old Assyrian weight metrological list to Old Babylonian ones, we choose five samples originating from various places. The first is made of the combination of several manuscripts from Nippur as reconstructed by Christine Proust.[25] The second and third documents are preserved at Yale and their provenience remains unknown; one is a list,[26] the second is a table inscribed on a prism.[27] The fourth sample is a list from Kiš,[28] and the last, a list from Mari written on a cylinder (Table 12.4).[29]

	Nippur Proust 2007: 312-313 (Composite text) (tables and lists)	Yale MLC 1854 Neugebauer 1935 (MKT 1): 92-94 (list)	Prism YBC 2392 Chambon & Robson 2011: 136-143 (table)	OB Kiš Robson 2004: no. 19 (list)	Mari, cylinder Chambon 2002: 497-499 (list)	Kültepe list Kt t/k 76+79
Measures in še	1/2 še kb* 1 še 1 1/2 še 2 še 2 1/2 še 3 še 4 še ↓ 29 še igi-6-gal$_2$ gin$_2$ igi-6-gal$_2$ gin$_2$ 10 še igi-4-gal$_2$ gin$_2$ igi-4-gal$_2$ gin$_2$ 5 še 1/3 gin$_2$ 1/2 gin$_2$ 1/2 gin$_2$ 10 še 1/2 gin$_2$ 15 še 1/2 gin$_2$ 25 še 2/3 gin$_2$ 2/3 gin$_2$ 10 še 2/3 gin$_2$ 15 še 2/3 gin$_2$ 25 še 5/6 gin$_2$ 5/6 gin$_2$ 10 še 5/6 gin$_2$ 15 še 5/6 gin$_2$ 25 še	1/2 še kb (idem) igi-6-gal$_2$ gin$_2$ igi-6-gal$_2$ gin$_2$ 5 še igi-6-gal$_2$ gin$_2$ 10 še igi-4-gal$_2$ gin$_2$ igi-4-gal$_2$ gin$_2$ 5 še igi-4-gal$_2$ gin$_2$ 10 še 1/3 gin$_2$ 1/3 gin$_2$ 5 še 1/3 gin$_2$ 10 še 1/2 gin$_2$ 1/2 gin$_2$ 5 še 1/2 gin$_2$ 10 še 2/3 gin$_2$ 2/3 gin$_2$ 6? še 2/3 gin$_2$ 15 še 2/3 gin$_2$ 20 še 5/6 gin$_2$ 5/6 gin$_2$ 1 še 5/6 gin$_2$ 2 še ↓ 5/6 gin$_2$ 10 še ↓ 5/6 gin$_2$ 15 še ↓ 5/6 gin$_2$ 25 še ↓ 5/6 gin$_2$ 29 še	1/2 še kb (idem) igi-6-gal$_2$ gin$_2$ igi-6-gal$_2$ gin$_2$ 5 še igi-6-gal$_2$ gin$_2$ 10 še igi-4-gal$_2$ gin$_2$ igi-4-gal$_2$ gin$_2$ 5 še igi-4-gal$_2$ gin$_2$ 10 še 1/3 gin$_2$ 1/2 gin$_2$ 2/3 gin$_2$ 5/6 gin$_2$	1/2 še kb [kb is repeated each line] (idem) igi-6-gal$_2$ gin$_2$ kb igi-6-gal$_2$ gin$_2$ 5 še kb igi-6-gal$_2$ gin$_2$ 10 še kb igi-4-gal$_2$ gin$_2$ kb igi-4-gal$_2$ gin$_2$ 5 še kb igi-4-gal$_2$ gin$_2$ 10 še kb 1/3 gin$_2$ kb 1/3 gin$_2$ 5 še kb 1/3 gin$_2$ 10 še kb 1/3 gin$_2$ 15 še kb 1/3 gin$_2$ 20 še kb 1/2 gin$_2$ kb 1/2 gin$_2$ 5 še kb 1/2 gin$_2$ 10 še kb 1/2 gin$_2$ 15 še kb 1/2 gin$_2$ 20 še kb 2/3 gin$_2$ kb 2/3 gin$_2$ 5 še kb 2/3 gin$_2$ 10 še kb 2/3 gin$_2$ 15 še kb 2/3 gin$_2$ 20 še kb 5/6 gin$_2$ kb 5/6 gin$_2$ 5 še kb 5/6 gin$_2$ 10 še kb ↓ 5/6 gin$_2$ 15 še kb 5/6 gin$_2$ 20 še kb	1/2 še kb [kb is repeated each line] (idem) ↓ 22 1/2 še kb ↓ 29 še kb igi-6-gal$_2$ gin$_2$ kb igi-6-gal$_2$ gin$_2$ 10 še kb igi-4-gal$_2$ gin$_2$ kb igi-4-gal$_2$ gin$_2$ 5 še kb 1/3 gin$_2$ kb 1/3 gin$_2$ 15 še kb 1/2 gin$_2$ kb 1/2 gin$_2$ 15 še kb 2/3 gin$_2$ kb 2/3 gin$_2$ 10'še kb 2/3 gin$_2$ 15 še kb 5/6 gin$_2$ kb 5/6 gin$_2$ 1 še kb 5/6 gin$_2$ 2 še kb ↓ […]	[no še quantities]

[24] Neugebauer (1935: 88-94); Nemet-Nejat (1993: 17-19); Proust (2007: 97-117, 311-315).

[25] Proust 2007: 311-315 (composite text). Each text gives a sequence of measurement values; the following texts are used in this reconstitution (note that igi-4-gal$_2$ means 1/4): Ni 3742 (1/2 še to 20 še), Ni 3515 (21 še to igi-4-gal$_2$ gin$_2$), Ni 5196 (1/3 gin$_2$ to 5/6 gin$_2$ 25 še), Ni 3909 (1 gin$_2$ to 15 gin$_2$), Ni 3885 (16 gin$_2$ to 5/6 *ma-na*), Ni 3515 (5/6 *ma-na* to 2 *ma-na*), Ni 1082 (10 *ma-na* to 14 *ma-na*), Ni 5196 (14 *ma-na* to 19 *ma-na*), Ni 3909 (30 *ma-na* to 1 gu$_2$), Ni 5108 (3 gu$_2$ to 16 gu$_2$). See also Proust (2009).

[26] Neugebauer (1935: 92-94).

[27] Chambon and Robson (2011:136-143).

[28] Robson (2004: no. 19).

[29] Chambon (2002: 497-499).

	29 ma-na 30 ma-na 40 ma-na 50 ma-na		19 ma-na 20 ma-na 30 ma-na 40 ma-na 50 ma-na			**19 ma-na 19 še** **20 la₂ 1 ma-na** 20 ma-na 30 ma-na 40 ma-na 50 ma-na 55 ma-na
Measures in *gu*	1 gu₂ kb 1 gu₂ 10 ma-na 1 gu₂ 20 ma-na 1 gu₂ 30 ma-na 1 gu₂ 40 ma-na 1 gu₂ 50 ma-na 2 gu₂ 3 gu₂ ↓ 19 gu₂ 20 gu₂ 30 gu₂ 40 gu₂ 50 gu₂ 1x60 gu₂ (and goes on till 216 000 (šargal) gu₂)	1 gu₂ (idem) 1x60 gu₂ kb	1 gu₂ (idem) 1x60 gu₂ kb	1 gu₂ kb (idem)	[…]	1 gu₂ [1] gu₂ 10° m[a-na] [1 gu₂ 20 ma-na] [1 gu₂ 30 ma-na] [1 gu₂ 40 ma-na] [1 gu₂ 50 ma-na] [2 gu₂] [3 gu₂] [4 gu₂] [5 gu₂] [6 gu₂] [7 gu₂] [8 gu₂] [9 gu₂] [10 gu₂] [11 gu₂] [12 gu₂] 13 gu₂ 14 gu₂ 15 gu₂ 16 gu₂ 17 gu₂ 18 gu₂ **19 gu₂** **[20 l]a₂ [1] gu₂** 2[0] gu₂ [30 g]u₂ [40 g]u₂ [50 g]u₂ [60 g]u₂ *[1 me-at gu₂°]*

*kb = ku₃-babbar = silver ↓ = continuous count

Measures in *gin*	1 gin₂ 1 1/3 gin₂ 1 1/2 gin₂ 1 2/3 gin₂ 1 5/6 gin₂ 2 gin₂ 3 gin₂ ↓ 19 gin₂ 1/3 ma-na 1/2 ma-na 2/3 ma-na 5/6 ma-na	(idem)	1 gin₂ 1 igi-6-gal₂ gin₂ 1 igi-4-gal₂ gin₂ 1 1/3 gin₂ 1 1/2 gin₂ (idem)	1 šu-ši [x x] kb 1 gin₂ kb 1 1/3 gin₂ kb 1 1/2 gin₂ kb (idem)	[…]	[1 gin₂ kb°] [2 gin₂] [3 gin₂] ↓ 11 gin₂ 7 1/2 še 12 gin₂ 15 še 13 1/8 gin₂ 14 1/6 gin₂ 15 1/4 gin₂ 16 1/3 gin₂ 17 1/2 gin₂ 18 2/3 gin₂ 19 5/6 gin₂ 1/3 ma-n[a] 1/2 m[a-na] 2/3 ma-[na] 5/[6] ma-[na]
Measures in *mana*	1 ma-na 1 1/3 ma-na 1 1/2 ma-na 1 2/3 ma-na 1 5/6 ma-na 2 ma-na 3 ma-na ↓	(idem)	(idem) 2 ma-na 3 ma-na ↓	(idem)	[…]	[1 ma-na] [1 ma-na 1 gin₂] [1 ma-na 2 gin₂] [1 ma-na 3 gin₂] ↓ **1 ma-na 19 gin₂** **1 1/3 ma-na la₂ 1 gin₂** 1 1/3 ma-na 1 1/2 ma-na 1 2/3 ma-na 1 5/6 ma-na [1 5/6 ma-na 1 gin₂] [1 5/6 ma-na 2 gin₂] [1 5/6 ma-na 3 gin₂] [1 5/6 ma-na 4 gin₂] [1 5/6 ma-na 5 gin₂] [1 5/6 ma-na 6 gin₂] [1 5/6 ma-na 7 gin₂] [1 5/6 ma-na 8 gin₂] [1 5/6 ma-na 9 gin₂] [2 ma-na] [2 ma-na 1 še] [2 ma-na 2 še] [3 ma-na 3 še] ↓

Table 12.4 Comparative table of Old Babylonian and Old Assyrian metrological lists and tables for weights

The table presenting these different documents shows that the Old Assyrian metrological list of weights differs from all the texts dated to the Old Babylonian period that seem to have had the same function.

These usually start with the quantity 1/2 *še* and present a long development in *še* units, while the Kaneš list begins with 1 *gin*. In the Kaneš list, the progression both in *še* and fractions of *gin* is added to the arithmetic progression of *gin* (beginning from 11 *gin*) as if they were disconnected. Rather than *še* units, the smaller amounts added increase from 7 1/2 *še* up to 1/6 *gin* (7 1/2 – 15 – 22 1/2 – 30), and from 15 up to 1/3 *gin* and from 30 up to 5/6 *gin*. A second progression of *še* units increases in parallel to a development of *mana* units (in italics on Table 12.2).
The Old Babylonian documents, after a progression of units of *še* up to 29, show an arithmetic development by 5 or 10 *še* after each fraction of *gin*; the most regular example being the list of Kiš (5 – 10 – 15 – 20 *še*). It is interesting to note that the Mari cylinder adds the quantity 22 1/2 *še* between 22 and 23 *še*, a quantity attested by the fractional notation 1/8 *gin* in the Kaneš list. The Old Babylonian lists and tables use the classic Mesopotamian expressions for 1/6 and 1/4: igi-6-gal$_2$ and igi-4-gal$_2$, while the Kaneš lists bears the specific Old Assyrian signs for these two fractions which are, in both cases, used only for *gin* and not for higher weight units.
The development of *mana* units is quite similar in all the documents, except that some Old Babylonian tablets progress in units up to 30 *mana* while others, as well as the Kaneš list, stop at 20 *mana*, and then progress by 10 *mana* up to 1 *gu*.
The Kaneš sample repeats three times the previous quantity using successively the additive then the subtractive notation 19 *gin* (1/3 la$_2$ 1 gin$_2$), 19 *mana* (20 la$_2$ 1 *ma-na*) and 19 *gu* (20 la$_2$ 1 gu$_2$). Most of the texts end with 1(geš$_2$) gu$_2$ = 60 gu$_2$.[30]
We can summarize the remarkable characteristics of the Kaneš list as follows:

- No quantity inferior to 1 *gin* (in contrast to some Old Babylonian samples which start with 1/2 *še*)
- Two different arithmetic progressions of *še*, one with *gin* and the other one with *mana*. The first increases by 7 1/2 *še* – not attested in the Old Babylonian texts –, and uses symbols for fractions of *gin*; the sign 1/8 is a *hapax legomenum*.
- Use of subtractive notations creating steps in the progression of the list.

None of these features are found in the Old Babylonian lists and tables. Thus, the Kaneš metrological list of weights bears witness to a culture of quantification different from the similar, contemporaneous culture evidenced by documents produced by the Old Babylonian schools of Southern Mesopotamia or Mari, which are quite homogeneous. When writing the list, the Kaneš scribe's intention was not only to memorize the weight system that was most widely used by the merchants, but also to practice the different notations of integers and fractions. This is confirmed by the use, three times, of subtractive notation (with 'la$_2$') which, in one case, gives a quantity smaller than the previous one. This metrological list is the only text of this category found at Kaneš, and the site has not provided any numerical tables.[31]
Nippur schools produced metrological lists and tables in about equal quantities. Christine Proust noted that metrological lists were often written on the other side of lexical lists – which is the case for the Old Assyrian sample – while metrological tables were more linked to numerical tables, indicating a higher level in mathematical education.[32] Thus, metrological lists and tables did not have the same function. For their daily accounts, the Assyrian merchants only needed to know the notation of the weight measures and the relationships between the different weight units.

12.1.3 How Quantities Were Shaped: Fractions Linked to Weight Units

The Old Assyrian metrological list of weights analysed above shows that the Assyrian merchants used, with sexagesimal weight measurement units, measurement values expressed by a combination of signs for numbers from 1 to 9 (diš, aš) and tens (u) in an additive decimal notation; they gave a special importance to fractions in the notation of quantities.
These fractions are mainly found in connection with *gin* and *mana* units, but 1/2 is also associated with *še*. By contrast, fractions are never linked to the larger unit of weight, the *gu*.

[30] It is not impossible that the Kaneš sample included a line for 100 *gu* written literally 1 *me-at* gu$_2$.
[31] Another fragment of a school text from Kaneš, k/- 129, bought on the antiquities market in 1959 by Ankara Museum, contains a list of multiplication formulae written linearly and without the results (a-ra$_2$-1-kam, a-ra$_2$-2-kam, etc.). This is part of a lexical list bearing names of stones, animals, aromatic plants and multiplication formulae (Hecker 1993: 290-291; photo of the obverse: pl. 48-2).
[32] Proust (2008: 145-153).

Beside the use of the Mesopotamian signs for 1/3, 1/2, 2/3 and 5/6 for *gin* and *mana* – and ignoring the classic expression igi-n-gal$_2$ for the writing of inverses – the Assyrians invented signs for 1/8, 1/6 and 1/4 which are only found with the *gin* unit in the list.[33] The subtractive notation 1/3 *mana* minus 1 *gin* for 19 *gin* allows the fraction 1/3 (for 19 and 20 *gin*) to be used twice (Table 12.5).

Fractions of še				1/2			
Fractions of gin$_2$							
	1/8	1/6	1/4	1/3	1/2	2/3	5/6
							
Fractions of ma-na				1/3	1/2	2/3	5/6

Table 12.5 Fractions linked to weight measurement units

All these fractions – except 1/8 – are attested many times in the merchant accounts.[34]
The quantities of *še* occurring in the Old Assyrian texts are the followings: 5 *še* (rare),[35] 7 1/2 *še*, 10 *še*, 15 *še*, 20 *še* (very rare),[36] 22 1/2 *še*.[37] This last weight is common, which means that the sign for 1/8 (*gin*) attested in the metrological list seems to have been created on purpose by its scribe.
Then quantities are expressed in fractions of *gin*, as for example 1/6 *gin* (=30 *še*), 1/4 *gin* (=45 *še*), etc. Signs for 1/6 and 1/4 are associated exclusively with the *gin* unit. But they are also very occasionally found to quantify *realia*, such as textiles: 1/6 tug$_2$ (1/6 of a textile)[38] or 1/4 tug$_2$ (1/4 of a textile).[39]
Subtractive notation allows 3/4 *gin* (1 la$_2$ 1/4 gin$_2$) to be expressed for which there was no specific sign.[40] But, curiously enough, it is also used sometimes to write fractions for which there was a specific sign, for example 2/3 *gin* (1 la$_2$ 1/3 gin$_2$) or 5/6 *gin* (1 la$_2$ 1/6 gin$_2$).[41] On the other hand, the fractions 1/3 *gin* and 1/6 *gin* are never written by way of a subtractive notation. Only inverses are subtracted from a quantity, and this quantity being either an integer (from 1 to 20) or a fraction of the upper unit, or of the unit itself: 1/3 *mana* minus (la$_2$) 1/6 *gin*.[42]
According to their archives, merchants preferred to use fractions of the superior unit rather than integers of the inferior unit, for example, they used 1/3 of *mana* more than 20 *gin*. This certainly had an impact on their computing practices, and it is also possible that the use of fractions of the superior unit reflects specific weighing practices.

12.2. Weighing and Weight Standards

The principal goods traded by Assyrian merchants: metals (gold, silver, tin, copper), textiles, wool, precious stones (lapis lazuli, carnelian), and donkeys, were quantified by weight or by number. Weighing was done with the help of a twin-pan balance. Weighing scales have been found in pairs in merchant

[33] Michel (2006b).
[34] Michel (1992). Thus, they lacked the fraction 1/5 which could have been useful in some computations.
[35] JCS 14, 9:4; TPAK 1, 204 1; KTS 1, 52b:1.
[36] JCS 14, 9:9.
[37] Note that we find one example of 27 1/2 še ku$_3$-babbar '27 1/2 *še* of silver' in AKT 3, 29:9 (neither copy nor photo of the tablet is available). This could correspond to 22 1/2 + 5 *še*, both quantities attested in the Old Assyrian documentation.
[38] AnOr 6, 15:14'; ICK 1, 124:9, 8'; TC 2, 52:16; VS 26, 150:10.
[39] BIN 4, 61: 6, 10.
[40] For example, TC 1, 102:9, 1 la$_2$ 1/4 gin$_2$ ku$_3$-babbar, '1 minus 1/4 *gin* silver'". This notation is relatively frequent.
[41] 2/3 as 1 la$_2$ 1/3 gin$_2$ (Kt a/k 537:9); 5/6 as 1 la$_2$ 1/6 gin$_2$ (AKT 5, 52:14; CCT 1, 30a:11; OIP 27, 21:5; TC 1, 84:38).
[42] 1/3 *ma-na* la$_2$ 1/6 gin$_2$ (AKT 3, 22:4; TC 1, 80:10; *Anatolica* 12, 154:10); 1/3 *ma-na* la$_2$ 1/4 gin$_2$ (Kt 87/k 36:13); 1/2 *ma-na* la$_2$ 1/3 gin$_2$ (VS 26 151:20); 1/2 *ma-na* la$_2$ 1/4 gin$_2$ (Adana 237E, tablet 1: 1); 1 1/2 *ma-na* la$_2$ 1/4 gin$_2$ (*Anatolica* 12, 154:19).

graves at Kültepe dating from the nineteenth and eighteenth centuries. They are made in copper, are round and convex, and pierced by four holes. Their relatively small size – diameter between 5.7 and 8.3 cm – implies that, if they correspond to real scales, they were used only to weigh small quantities.[43] Their discovery in merchant graves naturally bears witness to the importance of weighing for this profession (Fig. 12.4).

Fig. 12.4 Scale pans from Kulakoğlu & Kangal 2010, nos. 404-405 (©Kültepe Archaeological Mission)

A weighing scale is visible on a cylinder-seal imprint on a loan contract envelope found in the lower city of Kaneš. Behind a woman holding a spindle, the visible part of the scale is the beam from which the scale pans hung (Fig. 12.5).[44]

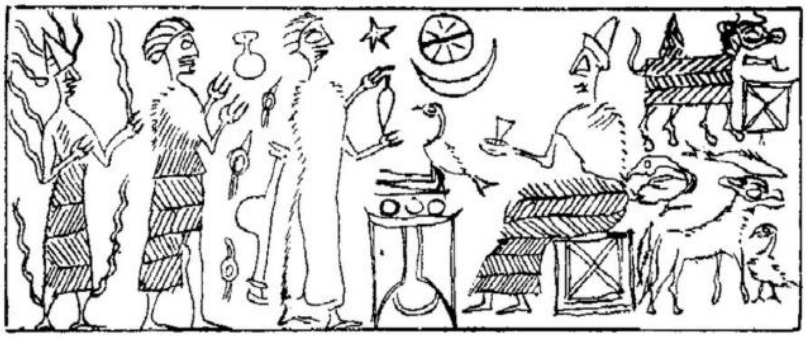

Fig. 12.5 Seal imprint Ka 82, seal A on the envelope KTS 1, 45a

The words na_4 in Sumerian and *abnum* in Akkadian, which mean 'stone', often refer to weights, implying that weights were regularly made of stone. The Old Assyrian tablets document weight standards, manipulations with weights and weight discrepancies, while archaeology has provided dozens of weights of various shapes.

12.2.1 Weight Standards

Texts refer to weight standards used in the weighing process; their owner, either a town or an individual, may be mentioned as well as their weight. Weights could belong to individuals, to town authorities and other institutions:

> '2 *gu* 1/3 *mana* of good quality copper according to the stone-weight of [the town of] Tuhpia and 50 *mana* of copper in pieces according to our weights[45]

or

[43] Kulakoğlu and Kangal 2010, No. 404 (Kt 96/k 108) and 405 (Kt 01/k 11), and personal communication by F. Kulakoğlu.
[44] For a recent description of this seal, see Michel (2014). For the weighing practices at Mari at the same period, see Joannès (1989).
45 Kt 93/k 278:1-6, 2 gu_2 13 1/3 *ma-na,* urudu sig_5: *i-na a-ba-an, Tu_3-uh_3-pi_2-a, u_3* 50 *ma-na* urudu, $i_2^!$(KAM)-*kum, i-na ab_2-na-ti_2-ni.*

7 *mana* of copper according to our weights.[46]

The various weight standards attested in the Old Assyrian texts are the following:

- 10 *gin* and 1/2 *mana*: '(the weight of) the silver has been verified by means of my 1/2-*mana* and 10-*gin* weights'[47]
- 1/2 *mana*: 'a 1/2-*mana* weight'[48]
- 1 *mana*: 'His own 1-*mana* weight';[49] 'By the 1-*mana* weight of the trade bureau';[50] 'By the 1-*mana* weight of Šū-Ištar';[51] 'By my own 1-*mana* weight'.[52]
- 10 *mana*: 'By your own ten-*mana* weight'.[53]
- To these, we may add those attested in the texts quoted below (Table 12.6): 1/4 *gin* – 2/3 *gin* – 1/2 *gin* – 1 *gin* – 1/3 *mana*.

12.2.2 The Verification of Weight Standards, Discrepancies and Corrections

As there were many weight standards, it was important to verify them. Both official and private weights were regularly verified and could then be said 'certified' (*takittum*):

From it (previous amount), we gave Uṣur-ša-Ištar 16 *mana* of silver (weighed) by the 1-*mana* weight of the trade colony, certified (weight).[54]
He transferred 14 *gu* 30 *mana* of (copper or wool?) to me (weighed) by your weights, certified (weights). (Fig. 12.6)[55]
8 *mana* of silver (weighed) by my 1-*mana* weight, certified (weight).[56]

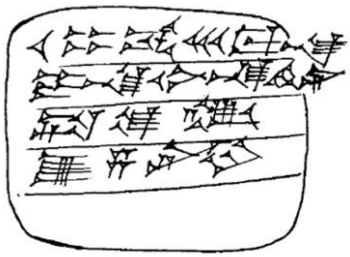

Fig. 12.6 Copy of VS 26, 134 by K. R. Veenhof

When checked, many weights were found to be too light: 'Your 1-*mana* weight is deficient'.[57] A correction had to be carried out by the addition of a small weight to the weights on the set of scales:[58]

6 *gu* of good quality copper, 10-*gin* brought back to (each) 10-*mana* weight, (its) silver (weight) established, and furthermore 14 *gu* of copper in pieces, 10-*gin* brought back to (each) 10-*mana* weight, (its) silver (weight) established.

46 Kt 93/k 734: 3-4, 7 *ma-na* urudu *i-na*, *ab*$_2$*-na-ti*$_2$*-ni*. See also '26 *mana* of copper according to our weights' in KUG 7:14-15, 26 *ma-na* urudu, *i-na ab*$_2$*-ni-ni.*

47 BIN 6, 237:3-5, *i-na* 1/2 *ma-na-i*$^?$-[*a*], *u*$_3$ 10 gin$_2$*-i-a* : ku$_3$-[babbar], *u*$_2$*-du-u*$_2$.

48 TC 3, 113:9, *ab*$_2$*-nu-um* 1/2 *ma-na-um.* See also BIN 6, 237:3-5 (previous note); AKT 4, 26:4-5 (below).

49 ATHE 35:35, 1 *ma-na-u*$_2$*-šu*.

50 TC 3, 171:13, *i*-1 *ma-na-im ša ka*$_3$*-ri-im*.

51 BIN 6, 242:2-3, *i-na*, 1 *ma-na-im ša Šu-Ištar*.

52 HUCA 39, 8-10 (L29-557) :19, *i-na ma-na-i-a*.

53 BIN 6, 205:9-11: *i-na*, *e-šar-tim ma-na-im*, *ku-wa-tim-ma*.

54 TC 3, 171:12-16, ša$_3$-ba 16 *ma-na* ku$_3$-babbar, *i*-1 *ma-na-im ša ka*$_3$*-ri-im*, *ta-ki-tam*$_2$ *a-na*, *U*$_2$*-ṣur-ša-Ištar*, *ni-di*$_2$*-in.*

55 VS 26, 134:1-4 (entire text), 14 gu$_2$ *30 ma-na*, *i-na ab*$_2$*-na-ti*$_2$*-ni*, *ta-ki-tam*$_2$, *u*$_2$*-sa*$_3$*-ni-qam*$_2$.

56 Prag I 608:1-3, 8 *ma-na* « gin$_2$ » ku$_3$-babbar, *i-na* 1 *ma-na-i-a*, *ta-ki-tam*$_2$. Kt 94/k 1176 (courtesy M. T. Larsen):16 (*takittam*).

57 ATHE 35:34-35, 1 *ma-na-ka*$_3$, *ma-ṭi*$_2$*-i.* The expression *bitqat abnim* denoted a 'deficient weight' (EL 278:6). See Dercksen (1996: 82-86).

58 Kt c/k 535:3-8, 6 gu$_2$ urudu sig$_5$ 10 gin$_2^{tum}$, *a-ṣe*$_2$*-er* 10 *ma-na-e*, *ta-u*$_2$*-ur-ma* ku$_3$-babbar *u*$_2$*-du*, *a-ha-ma* 14 gu$_2$ urudu *ši*$_2$*-kam*, [1 gi]n$_2^{tum}$ *ta-u*$_2$*-ur*, [kù-babbar] *u*$_2$*-du*, text cited by Dercksen (1996: 82-83).

In this example, the 10-*mana* weight being used is lighter by 10-*gin*, a discrepancy of 1.66 per cent. The following text shows a smaller discrepancy of 0.83 per cent, since the 1-*mana* trade colony weight is lighter by 1/2-*gin* (Fig. 12.7):[59]

Fig. 12.7 Photo of Kt 93/k 462 by C. Michel

15 *mana* of refined silver, 1/2-*gin* brought back to (each) 1-*mana* weight of the trade colony, (its) silver (weight) established, Aššur-taklāku has loaned to the trade colony.

Text	Total amount	Weight used	Weight owner	Weight added	Per cent discrepancy
CCT 1, 2	40 *mana*	1 *mana*	trade office	1 1/4 *gin*	2.1
UF 7, 327:6-8	2 *mana*	1 *mana*		1 1/4 *gin*	2.1
Kt c/k 254:19-23	5 *gu*	10 *mana*		10 *gin*	1.66
Kt c/k 535:3-8	6 *gu* and 14 *gu*	10 *mana*		10 *gin*	1.66
Kt c/k 671:36-37	5 gu	10 *mana*		10 *gin*	
BIN 6, 242:2-5	10 *mana*	1 *mana*	Šū-Ištar	1 *gin*	1.66
Kt 87/k 293:6, 23-24	1 *mana* 5 *gin*	1 *mana*		1 *gin*	1.66
Kt 94/k 708:1-6	1/3 *mana*	1/3 *mana*	'my weight'	1/4 *gin*	1.25
Kt a/k 459:5-9	9 *mana* 11 *gin*	1 *mana*	Adad-ṣulūlī	2/3 *gin*	
Kt 93/k 531:35,41-43	13 *mana*	1 *mana*		2/3 *gin*	1.1
AKT 4, 26:4-5	2 *mana*	1 *mana*	trade colony	1/2 *gin*	0.83
BIN 6, 238:1-4	1 1/3 *mana*	(1) *mana*	trade colony	1/2 *gin*	0.83
Kt c/k 1500:36, 48-49	3 *mana*	(1) *mana*		1/2 *gin*	0.83
Kt 93/k 462	15 *mana*	1 *mana*	trade colony	1/2 *gin*	0.83
TC 3, 213:32-34	4 *mana*	1 *mana*	trade colony	1/2 *gin*	0.83
VS 26, 119:34-36	1 *mana*	1 *mana*		1/2 *gin*	0.83

Table 12.6 Weight discrepancies attested by Old Assyrian texts

[59] Kt 93/k 462:7-13 (unpublished), 15 *ma-na* ku$_3$-babbar *ṣa-ru-pa$_2$-am*, *a-ṣe$_2$-er* 1 *ma-na-im*, *ša ka$_3$-ri-im* 1/2 gin$_2$-ta, *ta-ur-ma* ku$_3$-babbar, *u$_2$-du-u$_2$ i-ṣe$_2$-er*, *ka$_3$-ri-im*, *A-šur$_3$-tak$_2$-la$_2$-ku*, *i-šu.*

The discrepancies found in the Old Assyrian texts range from 0.83 per cent to 2.1 per cent for a 1-*mana* weight standard (Table 12.6). One may observe that a 10-*mana* weight is used to weigh quantities expressed in *gu*, while a 1-*mana* weight is placed on the scale to weigh quantities expressed in *mana* (even 40 *mana*).

12.3. Two Cultures of Quantification

As they were trading in a different country, some 1 000 km away from their home, the Assyrian merchants had to deal with a different culture of quantification in Anatolia, even though the country was using the Mesopotamian weight system.

12.3.1 The Mesopotamian and the Anatolian Mana

The Anatolian standard *mana*, called *aban mātim* 'weight of the country', was a little lighter than the Mesopotamian *mana*. A letter dated to the eighteenth century gives a metrological correlation between both standards as follows (Fig. 12.8) :[60]

Fig. 12.8 Photo of Kt u/k 3 in Özgüç 1986, pl. 60.1 (©Kültepe Archaeological Mission)

1	*a-na Šu-Ištar qi$_2$-bi$_2$-ma um-ma A-šur$_3$*-gal-*ma*	Say to Šū-Ištar: thus (says) Aššur-rabi.
	i-na 16 tug$_2$ *ša ik-ri-bi-ka$_3$*	Out of the 16 textiles of your votive offerings,
	a-na 2 tug$_2$ 2 *me-at* urudu *a-ba-an ma-tim*	for 2 textiles: 2 hundred (*mana*) of copper according to the **weight of the country**
	Tu$_3$-ra-me-el : *i-di$_2$-na-am a-na* 2 tug$_2$	Turam-El gave me. For 2 textiles:
5	1 me-at 80 *ma-na* urudu *a-ba-an ma-tim*	1 hundred 80 *mana* of copper according to **the weight of the country**
	Šu-Hu-bur i-di$_2$-na-am a-na 2[1] tug$_2$	Šū-Hubur gave me. For 2 textiles:
	1 *me-at* 80 *ma-na* urudu *a-ba-an ma-tim*	1 hundred 80 *mana* of copper according to **the weight of the country**
	A-šur$_3$-ba-ni i-di$_2$-na-am 2 *me-at* 80 *ma-na*	Aššur-bāni gave me. 2 hundred 80 *mana*
	urudu *a-ba-an ma-tim ša* 3[?] tug$_2$ *A-la-hu-um*	of copper according to **the weight of the country** for 3 textiles Alāhum
10	*i-di$_2$-na-am ši$_2$-ti$_2$ ṣu$_2$-ba-ti$_2$* 3 tug$_2$ *ma-aṭ-u$_2$-ti$_2$-šu-nu*	gave me. The remainder of the textiles, their 3 textiles of bad quality,
	e-zi-ba-ma 16 gin$_2$-ta *ta-ad-nu*	he left with me, and at 16 *gin* a piece they were sold.
	1 tug$_2$ *ša qa$_2$-tim ša i-a-ti$_2$ i-di$_2$-na-ni a-na*	1 textile of current quality which he gave me, for 10
	10 gin$_2$ku$_3$-babbar *ta-di$_2$-in a-na* 2 tug$_2$ 2/3 *ma-na* /ku$_3$-babbar	*gin* of silver was sold. For 2 textiles, 2/3 *mana* of silver
	Lu-lu i-di$_2$-na-am šu-nigin$_2$ urudu *ša i-ta-di$_2$-nu*	Lulu gave me. The total amount of copper they gave
15	8 *me-at* 40 *ma-na a-ba-an ma-tim a-na*	(successively)
	ab$_2$-na-ti$_2$-ni i-tu$_3$-ur-ma 7 *me-at* 60 *ma-/na*	

[60] Kt u/k 3:1-16; text published in photo by Özgüç (1986: pl. 60.1); edited by Dercksen (1996: 87). We know that there were different weight standards linked to the various kingdoms of Upper Mesopotamia, Syria and the Levant; see Ascalone and Peyronel (2006), Chambon (2011: 82-99), and below Sect. 12.3.3.

8 hundred 40 *mana* of copper according to **the weight of the country** in **our own weights** turned to 7 hundred 60 *mana*.

	Textiles	**Price in copper (*mana*)**	**Price in silver**
Total amount of textiles	16		
Textiles sold	2	200	
	2	180	
	2	180	
	3	280	
	3		3 × 16 *gin*
	1		10 *gin*
	2		2/3 *mana*
total amount		840 (*aban mātim*) = 760 (*abnātīni*)	1 1/2 *mana* 8 *gin*

Table 12.7 Data given by the text Kt u/k 3

According to this text, 840 *mana* weighed with the 'weight of the country' corresponded to 760 Mesopotamian *mana* (Table 12.7). Thus, the Mesopotamian *mana* was about 10 per cent heavier than the Anatolian *mana*. All the people involved in this letter were Assyrians which explains why they needed to convert the amount of copper obtained into their own standard.
The Anatolian *mana* is often referred to in the texts by both Anatolians and Assyrians. For example, the following letter was sent by an Assyrian to an Assyrian and mentions the use of the weight of the country:[61]

> The remainder of your *sû*-stones, 6 pieces weighing 8 *gu* minus 10 *mana*, has been sold for 4 hundred 40 *mana* [of copper in pieces] according to the weight of the country.

When the two standards were used in a text written by an Assyrian merchant, only the 'weight of the country' was specified; the Mesopotamian weight standard was then implicit as in the following text:[62]

> Your 20 textiles of current quality have been taken to the palace; (at a price of) 40 *mana* of copper each (piece), according to the 'weight of the country': you are registered in the trade bureau (for) 4 hundred 87 *mana* of copper for two-thirds of your textiles, you can take it when the copper becomes available. For the (last) third of your textiles, at 9 *gin* (of silver) each, you can take within 10 days 1 *mana* 1/6 *gin* of silver.

The price in copper of two-thirds of the textiles (13 1/3 textiles) is equivalent to 533 1/3 *mana* of copper according to the 'weight of the country'. The amount of copper given in the text, 487 *mana*, is about nine per cent less, and would thus correspond to the Mesopotamian *mana*. The price in silver of one-third of the textiles (6 2/3 textiles) should be 1 *mana*, but the scribe computed a little more: 1 *mana* 1/6 *gin*.[63]
The Anatolian *mana* was mostly used to weigh copper. However, it is attested once to weigh silver,[64] and once to weigh tin, in the following small text:[65]

---

[61] KTS 1, 7a:19-22, *ši*$_2$-*ti*$_2$ *su*$_2$-*a*-*ti*$_2$-*ka*$_3$, 6 *su*$_2$-*a*-*tim* 8 gu$_2$ la$_2$ 10 *ma*-*na*, *a*-*na* 4 *me*-*at* 40 *ma*-*na*, *a*-*ba*-*an ma*-*tim ta*-*ad*-*na.* To the texts cited by Veenhof (1972: 54-57) and Dercksen (1996: 86-89) mentioning the 'Anatolian *mana*', one may now add AKT 5, 45:15'; AKT 5, 50:10; Prag I 520:18; Sadberg 16:4; VS 26 72:12-15. Note that the text AKT 6, 251:11-12 mentions the 'weight of the [local] palace' (*a*-*ba*-*an*, e$_2$-gal^{lim}) which might be another way to express the Anatolian weight.

[62] CCT 2, 24:23-27, 20 tug$_2^{tu}$-*ka*$_3$ *ša qa*$_2$-/*tim*, *i*-*na* e$_2$-gal^{lim} *i*-*le*-*qe*$_2$-*u*$_2^!$, 4[0] *ma*-*na*-ta urudu *i*-*na a*-*ba*-*an*, *ma*-*tim ša še*$_2$-*ni*-*pe*$_3$-*e ša* tug$_2^{ti}$$_2$-*ka*$_3$, 4 *me*-*at* 87 ma-na urudu, e$_2$ *ka*$_3$-*ri*-*im* la$_2$-*ap*$_2$-*ta*^{ti}$_2$, *i*-*wa*-*ṣa* urudu *ta*-*la*$_2$-*qe*$_2$ *ša šal*$_2$-*ša*-*at*, tug$_2^{ti}$$_2$-*ka*$_3$ 9 gin$_2$-ta 1 *ma*-*na* 1/6 /gin$_2$, ku$_3$-babbar *a*-*di*$_2$ 10 *u*$_4$-*me* : *ta*-*la*$_2$-*qe*$_2$.

[63] Dercksen (1996: 86, 88).

[64] 'Send me with the first caravan 10 *gin* of silver under your seal for the 8 1/3 *gin* of silver according to the weight of the country', VS 26, 72:12-15, *a*-*na* 8$^!$ 1/3 gin$_2$ ku$_3$-babbar /*i*-*na a*-*ba*-*an ma*-/*tim*, 10 gin$_2$ ku$_3$-babbar *ku*-*nu*-*ka*$_3$-*ka*$_3$, *iš*-*ti*$_2$ *a*-*li*-*ki*-*im*, *pa*$_2$-*ni*-*e*-*ma še*$_2$-*bi*$_4$-*la*$_2$-*nim*; text cited by Dercksen (1996: 88). The ratio between the two standard *mana* would be here 16.67 per cent.

[65] Kt 94/k 240 (complete text), 10 *ma*-*na*, an-na *i*-*na*, *a*-*ba*-*an ma*-*tim*, *a*-*na I*-*šu*-*hi*-*im*, *a*-*di*$_2$-*in.*

I gave 10 *mana* of tin according to the weight of the country to Išuhum.

12.3.2 Weighing Tin in Mesopotamia, Copper in Anatolia

Among the commodities traded by the Assyrian merchants in Anatolia, tin, gold, silver, and iron were measured according to the Mesopotamian sexagesimal weight system in *še*, *gin*, *mana* and *gu*, as in the following example:[66]

In all: 4 hundred 10 *gu* 11 *mana* of tin, (is) the value (in tin) of Imdīlum's caravan

The principal units of this weight system were the *mana* and the *gin*; this can be implied from the frequent use of fractions for these two units. Such a focus led perhaps, in Anatolia, to the parallel development of a specific way of quantifying copper in *mana*.[67]

The Assyrians traded copper only within Anatolia, where it was abundant and therefore cheap.[68] The metal circulated in the form of ingots, which could be counted with integers or weighed; large volumes of copper were exchanged, often many *gu* (300 kg): '73 *gu* 10 *mana* of copper in pieces (2.195 tonnes)'[69] or '98 *gu* 50 *mana* of copper in pieces (2.965 tonnes).'[70]

Copper could also be quantified in hundreds of *mana*, in a system ignoring the other units in the Mesopotamian weight system, and perhaps influenced by the local decimal system.[71] Thus, in the text documenting the difference from the Anatolian *mana* quoted above (Kt u/k 3), the scribe wrote:

8 hundred 40 *mana* of copper according to the weight of the country (Anatolian weight)
7 hundred 60 *mana* of copper according to our weight (Mesopotamian weight)

instead of using the higher *gu* unit. A conversion into *gu* would correspond respectively to:

14 *gu* of copper according to the weight of the country
12 *gu* and 40 *mana* of copper according to our weight.

Quantities of copper expressed in a decimal system using the *mana* as unit could reach hundreds, if not thousands of *mana*. This way of writing was frequently applied to copper in pieces and bad quality copper:

2 hundred 60 *mana* of bad (copper).[72]
4 hundred 30 *mana* of copper.[73]

This system was used by both Anatolians and Assyrians. A loan contract involving only Assyrians concerns '2 hundred 43 *mana* of copper and 2/3 *mana* of refined silver'.[74]

The unit '*mana*' was often implied as if copper was quantified as discrete objects:[75]

2 hundred (*mana*) of copper in pieces (irregular shaped bits of copper).[76]
4 thousand (*mana*) of copper in pieces.[77]
10 thousand (*mana*) of copper.[78]

In the same text, the scribe could use both quantifying methods, with and without the *gu*:

---

[66] VS 26 155:39-41, šunigin$_2$ 4 *me-at* 10 gu$_2$, 11 [*ma*]-*na*, an-na *a-wi-it* ellat^{at} *Im-di$_2$-lim.*
[67] Texts from the Middle Euphrates and the Upper Habur show a count in *gin* and not in *mana*.
[68] For the copper trade in Anatolia, see Dercksen (1996).
[69] BIN 4, 199:10-11, 73 gu$_2$ 10 *ma-na* urudu *ši$_2$-ki-im.*
[70] Prag I 471:1-2, 98 gu$_2$ 50 *ma-na* urudu *ši$_2$-kam.*
[71] See Michel (1998: 258-261).
[72] KUG 7:27-28, 2 *me-at* 60 *ma-na*, *la-mu-num.*
[73] Kt 93/k 735:5, 4 *me-at* 30 *ma-na* urudu (letter between two Assyrians).
[74] Kt 93/k 170 :6-9, 2 *me-at* 43 *ma-na*, urudu *u$_3$*, 2/3 *ma-na* ku$_3$-babbar, *ṣa-ru-pa$_2$-am.*
[75] See for example: '2 hundred 8 bronze nails', Kt 93/k 508:3, 2 *me-at* 8 *si$_2$-pa$_2$-ra-tim*.
[76] Kt 93/k 771:1, 2 *me-at* URUDU *ši$_2$-kam.*
[77] BIN 4, 160:1, 4 *li-me* urudu *ši$_2$-kum.*
[78] CCT 2, 13:5, 10 *li-me* urudu. This amount of copper corresponds to 5 tonnes.

Herewith, 7 1/2 *gu* of good quality <copper> and a hundred [*mana*] of copper in pieces.[79]

Note that inside Anatolia, there were specific weights (*abnum*) to quantify wool, which corresponded to unknown units:

65 stones of wool.[80]

This weight could be implied in the following examples:

1 hundred 50 units of wool.[81]
As price of 3 hundred units of wool, I received 1 hundred 37 *mana* of copper as his share.[82]

The use of two different methods to express weights of copper, based on a mixture of the decimal and sexagesimal systems or only on a decimal base reflects two cultures of quantification, Mesopotamian and Anatolian; the latter borrowed the system of the former but adapted it. As they settled in forty or so towns on the Anatolian Plateau, the Assyrian merchants introduced their writing and their metrology, but might have been influenced by a local decimal tradition that they partially adopted.
Should we then consider that the quantification of copper using only the *mana* always referred to the Anatolian *mana* standard? A text proves that the use of the Anatolian weight did not necessarily imply a count in hundreds of *mana*:[83]

2 *gu* 10 *mana* copper in pieces according to the weight of the country.

Such different traditions for quantifying metal weights are also attested by texts from Upper Mesopotamia and Middle Euphrates.[84] A small Mari administrative tablet (eighteenth century) gives the conversion of an amount of copper offered by the king of Yamhad (an area of Aleppo) to Mari, on the Middle Euphrates, as follows:[85]

1 ten thousand 6 thousand 7 hundred 40 *gin* of mountain copper, it is computed as 4 *gu* 39 *mana* of mountain copper.

Thus:

10000 + 6000 + 700 + 40 (16740) *gin* of mountain copper, it is computed as 4 *gu* 39 *mana* of mountain copper.

A tablet from Qal'at al-Hadi, which may correspond to the ancient city of Šurnat, south-east of Šubat-Enlil (Tell Leilān),[86] proposes such a conversion, but applied to silver: '58 *mana* of silver, it is computed as 3 thousand 5 hundreds *gin* of silver.'[87]
Both samples highlight the use of the *gin* instead of the use of *mana* in Old Assyrian texts.

3.3 The Anatolian Gin and Other Regional Standards

If the Anatolian *mana* was ten per cent lighter than the Mesopotamian *mana*, it is tempting to assume that the Anatolian *gin* was also ten per cent lighter than the Mesopotamian *gin*. In almost all of the occurrences, the expression *aban mātim* is applied to *mana* weights. But there is at least one text where

[79] Kt 93/k 507:17-18, ša$_3$-ba 7 1/2 gu$_2$ <urudu>, sig$_5$ *u$_2$ me-at* urudu *ši$_2$-/kam*. See also in Kt u/k 4 (quoted by Dercksen 1996, n. 229):13, 18, 20, '1 hundred 5 *gu* of copper' (*me-at* 5 gu$_2$ urudu), '4 thusand (mana) of copper' (4 *li-mi$_3$-im* urudu), '5 thousand 5 hundred (*mana*) of copper in pieces' (5 *li-mi$_3$-im* 5 *me-at* urudu *ši$_3$-kam*).
[80] TC 3, 183:1-2, 65 *ab$_2$-ni*, *ša-ap$_2$-tum*.
[81] Kt 93/k 675:1, 1 *me-at* 50 sig$_2^{hi-a}$.
[82] Kt a/k 230:8-10 (Dercksen 1996: 232), *ši$_2$-im* 3 *me-at* sig$_2^{hi-a}$ 1 *me-at* 37 *ma-na* urudu *qa$_2$-su$_2$ al-qe$_2$*.
[83] AKT 5, 45:15', 2 gu$_2$ 10 *ma-na* urudu *ši$_2$-kam i-na a-ba-an /m*[*a-tim*].
[84] Durand (1987a: 605).
[85] M. 11745 = ARMT 25, 20:1-3, 1 gal 6 *li-mi* 7 me 40 gin$_2$ urudu kur, *up-pu-uš$_2$-ma*, 4 gu$_2$ 39 *ma-na* urudu kur.
[86] Eidem (2011: 48).
[87] 58 *ma-na* ku$_3$-babbar, *up-pu-uš$_2$-ma*, 3 *li-mi* 5 me gin$_2$ ku$_3$-babbar, text edited by D. J. Hawkins in Meijer (1986: 44-45).

it concerns a quantity given in *gin*. In this letter addressed by two merchants to two others bearing Assyrian names, we read the following:[88]

> For 8[?] 1/3 *gin* silver according to the weight of the country: 10 *gin* of silver under your seal.

If we assume that the corresponding 10 *gin* are weighed with a Mesopotamian standard, this would mean that the Anatolian *gin* was more than fifteen per cent heavier than the Mesopotamian *gin*. E. Ascalone and L. Peyronel have carried out a detailed study of the weight artefacts found in the Near East and dated to the third and second millennia BCE.[89] According to their study (Ascalone and Peyronel 2006: 409-422), the equivalencies between the Mesopotamian and Anatolian weight systems are (Table 12.8):

	Mesopotamian		Anatolian	
mana	498 g	1	470 g	1
		↓		↓
gin	8.3 g	60	11.75 g	40

Table 12.8 Equivalencies between the Mesopotamian and Anatolian weight systems

Thus, the Anatolian *gin* is heavier than the Mesopotamian *gin* and there are **forty** *gin* in an Anatolian *mana* and not **sixty** as in the Mesopotamian metrological weight system.
According to these authors, other standards in use in other areas are also represented among the Kültepe artefacts:[90]

- The Levantine *gin* which would weight 9.4 g (a *mana* of 50 *gin*)
- The Syrian / Karkemiš *gin* which would weight 7.8 g (a *mana* of 60 *gin*)
- The Aegean *gin* which would weight 6.6 g.

3.4 A Collection of Weights from Kültepe

We shall now address the culture of quantification from the viewpoint of the material culture. Excavations in Kültepe started in 1948 under the direction of T. Özgüç, and are still going on today, under the direction of F. Kulakoğlu (since 2006). Up to now, more than a hundred and sixty weights had been found in the lower city, dating from the first three centuries of the second millennium BCE. About ninety have been recorded in publications, eighty are still unpublished. These weights are predominantly made in hematite, but there are also a few weights in rock crystal and lead. They are often ovoid, in the shape of a seed; a barrel, with long-cylindrical body and flattened ends; triangular or cylindrical prisms; or zoomorphic (ducks, frogs or bovine heads, Fig. 12.9).[91]

Fig. 12.9
Samples of stone weights found at Kültepe, Kulakoğlu and Kangal 2010: 319-320 (nos. 377-385, 388-389) (©Kültepe Archaeological Mission)

[88] VS 26, 72: 12-13, *a-na* 8[!] 1/3 gin_2 ku_3-babbar *i-na a-ba-an ma-tim*, 10 gin_2 ku_3-babbar *ku-nu-ka*$_3$-*ka*$_3$.
[89] Ascalone and Peyronel 2006: 41-422 (Kültepe), 423-430 (Aššur).
[90] Ascalone and Peyronel (2006: 494-514).
[91] Özgüç (1986: 78-81, appendix 5); Dercksen (1996: 80-86); Kulakoğlu and Kangal (2010: 319-322).

Among all these many weights, only two could form a pair corresponding to the Mesopotamian *mana* and to the Anatolian *mana*; both date to level II (nineteenth century) of the lower city (Fig. 12.10).

Fig. 12.10 The presumed Assyrian and Anatolian *mana* (©Kültepe Archaeological Mission).
On the left: Kt 02/k 140 (level II); h: 5.5 cm, l: 10.4 cm, 493.95 g.
On the right: Kt f/k 103 (level II); h: 5.9 cm, w: 7.97 cm, 444.26 g

What is thought to be the Mesopotamian *mana* weighs 493.95 g (Kt 02/k 140) and the Anatolian *mana* 444.26 g (Kt f/k 103);[92] thus the Anatolian *mana* weighs 10.06 per cent less than the Mesopotamian *mana*. While we do not know anything about the context of discovery of the Mesopotamian *mana* unearthed in 2002, it is important to note that the so-called Anatolian *mana* was found in 1954 in a house together with an archive belonging to an Anatolian merchant.[93]
These weights are given with a possible margin of uncertainty: it is possible, for example, that they have been slightly damaged and should weight a little more. Such a possibility has to be taken into account when trying to identify the measurement values of the stone weights found at Kültepe: thus, negative and positive discrepancies may both be possible.
If the assumption concerning the identification of the Mesopotamian and Anatolian *mana* is correct, then the 'pair' of ducks, Kt y/k 93and Kt 74/k 8, found respectively in 1971 and 1974 in the lower city level Ib – but possibly excavated in the same house – could perhaps be identified as follows (Fig. 12.11):

Kt 74/k 8 (8.25 g): 1 Mesopotamian *gin* (which, based on a Mesopotamian *mana* = 493.95 g, should weight 8.23 g)
Kt y/k 93 (1.9 g): 1/4 (?) Mesopotamian *gin* (which, based on the Mesopotamian *mana*, should weight 2 g).

Fig. 12.11 Two weights in the shape of ducks (©Kültepe Archaeological Mission).
Kt 74/k 8 (level Ib): 8.25 g, and Kt y/k 93 (level Ib): 1.9 g

Duck-shaped weights are attested in texts.[94] Beside the two heavy bronze duck weights mentioned in the inscription of King Erišum and cited below, an unpublished letter specifies the weight of a duck-shaped weight: 'Concerning the duck [weight] you wrote to me about, I gave him all the copper, and I obtained the duck [weight], its weight is 13 2/3 *mana*.'[95]

[92] Note that Ascalone and Peyronel (2006: Tables 8.22, KT 76) give the wrong weight of 475 g for Kt f/k 103.
[93] Michel (2003: 76-77); Michel (2011b: 100, 108).
[94] There are some references to bronze duck-shaped figures whose use is not clear: Kt h/k 87: 3 (2 duck-shaped figures with lamp wicks); Kt c/k 1517:1 with other bronze unknown objects.
[95] Kt h/k 228:4-8, *a-šu-mi*$_3$ *us*$_2$*-hi-a-am*, *ša ta-aš*$_2$*-pu-ra-ni ig-ri-*[*šu*], *ma-al-a-nu-um* urudu *a-di*$_2$*-šu-*[*ma*], *us*$_2$*-hi-a-am u*$_2$*-še*$_2$*-ṣi*$_2$*-am*, *šu-qu*$_2$*-ul-tu*$_3$*-šu* 13 2/3 *ma-na.*

If this copper object in the shape of a duck really is a weight, then this text attests the existence of weights other than those included in the Old Babylonian lexical lists (see below).
The smallest stone weight attested at Kültepe weighs 0.63 g (Kt p/k 144) and could correspond to a Mesopotamian weight of 15 *še* (which, based on the Mesopotamian *mana* of 494 g, should weight 0.68 g).
Old Babylonian lexical lists provide a list of stone weights (ur_5-ra, Sect. 4) which may give an idea of the smallest weight in use in that period. One of the most complete lists, found at Nippur, mentions the following stone weights corresponding to *še* units (Table 12.9): 5 *še* – 10 *še* – 15 *še* – 20 *še* – 22 1/2 *še* – 1/6 *gin* – 1/4 *gin* – 1/3 *gin* – 1/2 *gin* – 2/3 *gin* – [5/6] *gin*.[96]
Fifty-four Kültepe stone weights are lighter than 8 g ranging from 0.63 g to 7.95 g. The weights of these stones vary considerably and there is not always clear correspondence between attested weights in the texts and these stones, if we rely on the identification of the weight of the *mana* proposed above. However, it is possible to make tentative identifications with the following weights for both Mesopotamian and Anatolian standards:

- Mesopotamian: 15 *še* – 22 1/2 *še* – 25 *še* –1/6 *gin* – (1/6 *gin* + 7 1/2 *še*) – 1/4 *gin* – 1/3 *gin* – (1/4+1/6 *gin*) – (1/3 *gin* + 22 1/2 *še*) – 1/2 *gin* – (1/2 *gin* + 22 1/2 *še*) – 5/6 *gin*
- Anatolian: 10 *še* – 22 1/2 *še* – 1/6 *gin* – 1/4 *gin* – (1/6 *gin* + 22 1/2 *še*) – 1/3 *gin* –1/2 *gin* – (1/4+1/3 *gin*) – 2/3 *gin*, and in the following weights: 3/4 *gin* – 5/6 *gin*

We can also presumably find some Syrian, Levantine and even Aegean weights

- Syrian: 15 *še* – 1/6 *gin* – 1/4 *gin* – 1/3 *gin* – 1/2 *gin* – 5/6 *gin* – 1 *gin*
- Levantine: 15 *še* – 22 1/2 *še* – 1/6 *gin* – 1/4 *gin* – 1/3 *gin* – 1/2 *gin* – 2/3 *gin*
- Aegean: 1/2 *gin* – 1 *gin*

If the identifications for Mesopotamian and Anatolian weights are correct, several weights show discrepancies with the supposed correct weights, and might have been inaccurate when small quantities of gold and silver were weighed.
Twenty-one weights, thus more than ten per cent of the total number of weights, correspond more or less to the Mesopotamian *gin* with discrepancies ranging from –2 per cent to +2 per cent. By contrast, the Anatolian *gin* does not seem to be represented in the collection of weights, and only fractions of the Anatolian *gin* have been found. Twenty-one weights are between 1 and 2 Mesopotamian *gin* (exclusive). There are three weights which could correspond to the Mesopotamian 2 *gin* (Kt 85/k 193, Kt 10/t, 23, Kt n/t 255), and there is one weight that can be identified with the Anatolian 2 *gin* (Kt 10/t 57).
Forty-one weights are between 2 and 12 Mesopotamian *gin* (exclusive). For the Mesopotamian standards, there are weights corresponding to:

3 *gin* – 4 *gin* – 5 *gin* – 6 *gin* – 7 1/2 *gin* – 10 *gin*.

For the Anatolian standards, there are stone weights for:

1 1/2 *gin* – 2 *gin* – 2 1/6 *gin* – 2 1/4 *gin* – 3 *gin* – 4 *gin* – 5 1/2 *gin* – 6 *gin*, and in the following weights: 8 *gin* – 10 *gin*.

There are only fourteen weights between 12 Mesopotamian *gin* and 1 Mesopotamian *mana* (exclusive): 15 *gin* – 1/3 *mana* – 1/2 *mana* – 5/6 *mana*, and very few weights over a *mana*: only five weights ranging from 575 g to 5 250 g. The correspondences of these could be the following:

- 575(+) g → 1 Mesopotamian *mana* + 10 *gin*
- 1 012(+) g → 2 Mesopotamian *mana*
- 2 600 g → 6 Anatolian *mana*
- 4 250 g → 9 1/2 Anatolian *mana*
- 5 250 g → 12 Anatolian *mana*.

[96] OIP 11, 179. For heavier weights corresponding to *mana*, the list mentions the following weights: 1 – 2 – 3 – 5 – 10 – 15 – 20 – 30 – 40 – 50.

Weight (g)	Date (level) and material	Inventory number	Weight ref. KT*	Mesopotamian weight	Anatolian weight	Other possibilities
0.63	?	Kt p/k 144		15 *še*	10 *še*	15 *še* (Syrian)
0.65	Ib haematite	Kt f/k 144	2	15 *še*		15 *še* (Syrian)
0.8	? haematite	Kt 08/k 118				15 *še* (Levantine)?
1.1	Ia haematite	Kt 85/k 194	3	22 1/2 *še*		22 1/2 *še* (Levantine)
1.1+	II haematite	Kt 84/k 97	4	22 1/2 *še*		22 1/2 *še* (Levantine)
1.15	Ib haematite	Kt y/k 95	5	25 *še* ?		
1.3+	? haematite	Kt 82/k 138	6	1/6 *gin*	22 1/2 *še*	1/6 *gin* (Syrian)
1.4	? haematite	Kt 10/t 25		1/6 *gin*	22 1/2 *še*	
1.6	Ia haematite	Kt 85/k 81	7			1/6 *gin* (Levantine)
1.7	Ib haematite	Kt 02/k		(1/6 *gin* + 7 1/2 *še*)		
1.8+	? haematite	Kt y/k 33	9		1/6 *gin*	
1.8+	Ia haematite	Kt 84/k 21	8		1/6 *gin*	
1.9	Ib haem duck	Kt y/k 93	10	1/4 *gin*?		1/4 *gin* (Syrian)
2.2	Ib haematite	Kt 76/k 183	11			1/4 *gin* (Levantine)
2.5	Ib rock cristal duck	Kt 90/k384		1/3 *gin*?		1/3 *gin* (Syrian)
2.68	Ib haematite	Kt i/k 287	12	1/3 *gin*		
2.7		Kt 93/k 37		1/3 *gin*		
2.8	II haematite	Kt 84/k 150	14		1/4 *gin*	
2.8	II haematite	Kt 84/k 96	13		1/4 *gin*	
2.85	Ia haematite	Kt y/k 94	15		1/4 *gin*	
3		Kt 98/k 28				1/3 *gin* (Levantine)
3.05	II haematite	Kt m/k 226	16			1/3 *gin* (Levantine)
3.22+	Ib haematite	Kt ṣ/k 55	17		(1/6 *gin* + 22 1/2 *še*)	1/2 *gin* (Aegean)
3.25	Ib haematite	Kt 02/k 65			(1/6 *gin* + 22 1/2 *še*)	1/2 *gin* (Aegean)
3.3	II haematite	Kt 82/t 22	18	(1/4+1/6 *gin*)		1/2 *gin* (Aegean)
3.5		Kt 95/k 5		(1/4+1/6 *gin*)		
3.6	Ib haematite	Kt 02/k 210			1/3 *gin*	
3.6	? haematite	Kt 08/k 119			1/3 *gin*	
3.7	Ib haematite	Kt 74/k 3	19	(1/3 *gin* + 22 1/2 *še*)	1/3 *gin*	
3.8	? haematite	Kt 13/t 56		(1/3 *gin* + 22 1/2 *še*)	1/3 *gin*	1/2 *gin* (Syrian)
3.8+	II haematite	Kt f/k 205	20	(1/3 *gin* + 22 1/2 *še*)		1/2 *gin* (Syrian)
3.9		Kt 89/k 33				1/2 *gin* (Syrian)
3.95	II haematite	Kt o/k 155	21			1/2 *gin* (Syrian)
4		Kt 96/k 128		1/2 *gin*		
4.2		Kt 87/k 181		1/2 *gin*		
4.2		Kt 94/k 1589		1/2 *gin*		
4.2		Kt 94/k 29		1/2 *gin*		
4.3		Kt 75/k 21	22			
4.5		Kt 76/k 184				1/2 *gin* (Levantine)?
5+	Ia haematite	Kt 95/k 50	5+		1/2 *gin*	
5.12	Ib haematite	Kt 76/k 182	23	(1/2 *gin* + 22 1/2 *še*)		2/3 *gin* (Syrian)
5.63	Ib haematite	Kt 76/k 179	24		1/2 *gin*	
5.8	Ib haematite	Kt 01/k 172				
5.8	? haematite	Kt 08/k 117				
6.3	II haematite	Kt 85/k 14	25			2/3 *gin* (Levantine)
6.3		Kt 88/k 812				2/3 *gin* (Levantine)
6.3+	Ib haematite	Kt i/k 58	26			2/3 *gin* (Levantine)
6.35	? haematite	Kt 123	27			1 *gin* (Aegean)
6.5	Ib haematite	Kt 03/130				5/6 *gin* (Syrian)
6.7		Kt 89/k 27		5/6 *gin*		
6.75	Ib haematite	Kt p/t 10	28	5/6 *gin*		
6.88		Kt z/t 1		5/6 *gin*		
7.8	II haematite	Kt 82/k 266	29		2/3 *gin*	1 *gin* (Syrian)
7.9	? haematite	Kt 13/k 107	**1 incision**			1 *gin* (Syrian)
7.95		Kt n/t 257				1 *gin* (Syrian)
8	Ib haematite	Kt 82/k 1	30	1 *gin*		
8		Kt 86/k 25		1 *gin*		
8		Kt 86/k 83		1 *gin*		
8		Kt 98/k 53		1 *gin*		
8.01	II haematite	Kt ṣ/k 54	31	1 *gin*		
8.05+	Ib haematite	Kt g/k 114	33	1 *gin*		
8.06	II haematite	Kt e/k 280	32	1 *gin*		
8.1	Ib haem grave	Kt 81/k 41	36	1 *gin*		
8.1	Ib haematite	Kt 84/k 117	37	1 *gin*		
8.1	Ib haem grave	Kt f/k 400	34	1 *gin*		
8.1	Ib haematite	Kt n/k 256	35	1 *gin*		
8.15	II haematite	Kt 03/k 211		1 *gin*		
8.17	Ib haematite	Kt a/k 690	38	1 *gin*		
8.2	Ib haem grave	Kt 83/k 109	39	1 *gin*		
8.2	Ib	Kt 94/k 12		1 *gin*		
8.2	Ia	Kt 91/k 269		1 *gin*		
8.2+	Ia haematite	Kt 84/k 77	40	1 *gin*		
8.25	Ib haem duck	Kt 74/k 8	41	1 *gin*		
8.25	Ib haematite	Kt 01/k 93		1 *gin*		
8.3		Kt 89/k 26		1 *gin*	3/4 *gin*	
8.32		Kt g/k 34	44	1 *gin*	3/4 *gin*	
8.4	? haematite	Kt 10/k 18				
8.4+	Ib haem grave	Kt 84/k 80	42	1 *gin* 5 *še*		
8.45+	Ib haematite	Kt 74/k 50	43	1 *gin* 5 *še*		
8.5		Kt 95/k 107			2/3 *gin* 20 *še*	
8.56	Ib haematite	Kt g/k 44		1 *gin* 7 1/2 *še*		
8.6	II haematite	Kt t/k 77	45	1 *gin* 7 1/2 *še*		
8.85	Ib haematite	Kt 76/k 178b	46	1 *gin* 15 *še*		
9	Ib	Kt 95/k 72		1 *gin* 15 *še*	5/6 *gin*	
9	Ib	Kt 99/k 72		1 *gin* 15 *še*	5/6 *gin*	
9	Ib	Kt 97/k 507		1 *gin* 15 *še*	5/6 *gin*	
9	II	Kt 84/k 114		1 *gin* 15 *še*	5/6 *gin*	
9	Ib haematite	Kt 85/k 79	47	1 *gin* 15 *še*	5/6 *gin*	
9.5	II	Kt 97/k 510		1 1/6 *gin*		1 *gin* (Levantine)?
10	Ib haem. frog	Kt 00/k 41				
10.2	Ib rock cristal	Kt r/k 125	48	1 1/4 *gin*		
12.5	Ia haematite	Kt i/k 60	49	1 1/2 *gin*	1 1/6 *gin*	
13.2+	Ib haematite	Kt 76/k 177	50			1 2/3 *gin* (Syrian)
13.65	Ib haematite	Kt 02/k 14		1 2/3 *gin*	1 1/4 *gin*	

14.1	? haematite	Kt 13/t 33				1 1/2 *gin* (Levantine)
14.5	Ib rock cristal	Kt r/k 124	51		1 1/3 *gin*	
15.87	?	Kt n/t 254				2 *gin* (Syrian)
16.1	Ia haematite	Kt 85/k 193	52	2 *gin*?		
16.4	? haematite	Kt 10/t 23		2 *gin*		
16.59	Ia haematite	Kt n/t 255		2 *gin*		
16.6	Ia haematite	Kt n/k 205	53		1 1/2 *gin*	
16.6	Ib/II haematite	Kt 85/k 80	54		1 1/2 *gin*	
16.8	II	Kt 89/k 54				
18.5	Ia	Kt 95/k 49		2 1/4 *gin*	1 2/3 *gin*	2 *gin* (Levantine)
20.2	II	Kt 94/k 1602		2 1/2 *gin*		
21.6	? haematite	Kt 10/t 57			2 *gin*	
22.7(+)	Ib lead	Kt u/k 98		2 5/6 *gin*		
24.2	? haematite	Kt 13/t 77			2 1/6 *gin*	
24.35+	Ib haematite	Kt e/k 50	55			
24.5	Ib stone	Kt v/k 74	56	3 *gin*		
24.5+	II haematite	Kt ş/k 53	57	3 *gin*		
24.6	Ib haematite	Kt 02/k 40		3 *gin*		
24.6	? haematite	Kt 08/k 115		3 *gin*		
24.62	Ib	Kt 74/t 21	58	3 *gin*		
24.8	? haematite	Kt 08/k 114		3 *gin*	2 1/4 *gin*	
25	II	Kt 95/k 233			2 1/4 *gin*	
25(+)	Ib lead	Kt u/k 97			2 1/4 *gin*	
32.5(+)	Ib lead	Kt u/k 96		4 *gin*	3 *gin*	
41	II stone	Kt 81/k 56	60	5 *gin*		
41	? stone	Kt y/k 37	59	5 *gin*		
41.60	? haematite	Kt 10/t 22		5 *gin*		
42	Ia stone	Kt b/k 472	61	5 *gin*		
44	Ia	Kt 95/k 47			4 *gin*	
44.5	Ib	Kt 95/k 174			4 *gin*	
45	Ib haematite	Kt 76/k 178a	62		4 *gin*	
50.75(+)	II lead	Kt j/k 152		6 *gin*		
59	II	Kt 94/k 1601				
59.9	? haematite	Kt 13/t 157				
59.95(+)	Ib lead	Kt j/k 153				
62.7	II haematite	Kt f/k 131	63	7 1/2 *gin*	5 1/2 *gin*	8 *gin* (Syrian)
68	Ib haematite	Kt b/k 317	64		6 *gin*	10 *gin* (Aegean)
80	Ib	Kt 99/k 24		10 *gin*		
80	?	Kt e/k 30		10 *gin*		
80(+)	Ib lead	Kt u/k 95		10 *gin*		
81	Grave stone	Kt b/k 323	65	10 *gin*		
82.5	Ib haematite	Kt p/k 172	66	10 *gin*		
83.86	II	Kt d/k 111		10 *gin*		
88	Ia	Kt 95/k 48			8 *gin*	
88.5	? haematite	Kt 13/t 52			8 *gin*	
89	Grave haemat.	Kt b/k 322	67		8 *gin*	
95+	? haematite	Kt Kt. 122	68			10 *gin* (Levantine)
98.4	Ib haematite	Kt 77/k 131	69	12 *gin*		
109+	II haematite	Kt 75/k 20	70		10 *gin*	
124.37	Ib haematite	Kt i/k 58		15 *gin*		
160.4	? stone	Kt 93/k 97				1/3 *mana* (Levantine)?
165	Ib haematite	Kt p/k 165	71	1/3 *mana*	15 *gin*	
172.78	?	Kt i/k 59				
173	Ia stone	Kt 79/k 29	72			
178,5	II haematite	Kt i/k 185	73			
180+	II haematite	Kt i/k 47	74			
238.94	?	Kt Kt 30a				1/2 *mana* (Levantine)?
248	Ib haematite	Kt l/k 184	75	1/2 *mana*		
418.19	?	Kt 01/k 1		5/6 *mana*		
430	II	Kt 87/k 75				
430+	II haematite	Kt 75/k 21				
444.26	**II stone**	**Kt f/k 103**	**76**		**1 *mana***	
493.95	**II haematite**	**Kt 02/k 140**		**1 *mana***		
575(+)	Ib lead	Kt e/k 142		1 *mana* 10 *gin*		
1012(+)	II lead	Kt e/k 137		2 *mana*		
2600	II granite	Kt 87/k 233			6 *mana*	
4250	II stone	Kt n/k 244	77		9 1/2 *mana*	
5250	Ib animal	Kt u/k 108	78		12 *mana*	

KT

number given to Kültepe weights by Ascalone and Peyronel 2006: 410-413; they listed 78 weights attested in T. Özgüç's publications. Some of them have been weighed again, which explains possible variations.

Fig. 12.9 List of weights found at Kültepe and their possible correspondence in the Assyrian or Anatolian system

The 10-*mana* weight attested by the texts has not yet been found during the excavations. The fact that the three heaviest weights correspond to the Anatolian standard fits perfectly well with the need to weigh copper in large quantities in Anatolia.
No weight is attested for the upper unit, the *gu*, apart from inscriptions of King Erišum:[97]

I constructed two beer vats, twins ... I placed two duck [weights] of 1 *gu* each inside them.

[97] Grayson 1987: 20, text A.0.33.1 :12-14, 2 *hu-bu-re-en tu*$_3$*-i-me-e*[*n*], [x (x)] *e-pu-uš* 2 *u*$_2$*-us*$_2$*-e-en ša* 1 gu$_2$-ta, *i-n*[*a*] *qar-be-šu-nu a-di*$_2$.

Now, if we consider the amounts of *še* (added to *gin*) in the list of weights from Kültepe – which correspond to quantities attested in the accounts – we have the following sequence:

> 7 1/2 *še* – 15 *še* – 1/8 *gin* (22 1/2 *še*) – 1/6 *gin* (30 *še*) – 1/4 *gin* (45 *še*) – 1/3 *gin* (60 *še*) – 1/2 *gin* (90 *še*) – 2/3 *gin* (120 *še*) – 5/6 *gin* (150 *še*)

Except 7 1/2 *še*, which weighs about 0.35 g, all of these quantities would be attested by weights found during the lower town excavations (computed by the Mesopotamian standard except 2/3 *gin*, or computed by the Anatolian standard except 15 *še*).
The lexical thematic list of weights quoted above ends with the following sequence of weights: 22 1/2 *še* – 20 *še* – 15 *še* – 10 *še* – 5 *še*, a sequence which is somewhat different.
About a third of the weights were found in graves located under the houses of the lower city, which means that merchants were regularly buried with sets of weights. An analysis of the material grave by grave could perhaps allow a reconstruction of some sets of weights. For example, four weights excavated in 1995 could possibly belong to the same grave dated to the beginning of the seventeenth century (level Ia). The weight stones recorded could amount, according to the Anatolian standard, respectively to:

Kt 95/k 107	8.5 g	2/3 *gin* 20 *še* (?)
Kt 95/k 49	18.5 g	1 2/3 *gin*
Kt 95/k 47	44 g	4 *gin*
Kt 95/k 48	88 g	8 *gin*

The study of this collection of weights together with the exact archaeological context could give much more information about weighing practices.

Conclusion

Old Assyrian weights and weighing practices prove to be a fruitful topic to highlight the peculiarities of the merchants' culture of quantification. The metrological list of weights from Kaneš shows many different features compared to similar Old Babylonian texts, stressing the use of fractions of the higher units and subtractive notations; these could be indications about the way the merchants computed and weighed as they carried out their trade.
Accounts documents reveal two different cultures for the use of weighing units according to the commodities quantified and the country. In Upper Mesopotamia, tin and silver were measured with the help of the four Mesopotamian weight units: *gu*, *mana*, *gin* and *še*, while in Anatolia, quantities of locally traded copper could be counted with the *mana* unit alone, switching to a decimal system. Thus, large quantities of metal were occasionally expressed in hundreds, even thousands, of *mana*.
During their trading activities in Anatolia, the Assyrian merchants had to deal with different weight standards: The Anatolian *mana* weighed ten per cent less than the Mesopotamian *mana*. The multiplication of weight standards, linked to the existence of many official and private collections of weights, following both the Mesopotamian and Anatolian standards, but also those from elsewhere (Syrian, Levantine, and the Aegean), explains the variety in the hundred and sixty stone weights excavated at Kültepe; these can be linked to the weight values expressed in the merchants' accounts and in the metrological list. The measurement values obtained for some stone weights do not correspond to attested weights in Old Babylonian lexical lists.
The large number of weight standards also confirms the recurrent necessity, attested by the written documentation, to regularly verify the weights and to correct discrepancies. Each owner of a set of weights would have had to know how to correct their incorrect weights, and we can imagine that merchants engaged in double weighing.

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