The Old Assyrian Trade Network from an Archaeological Perspective.

J. Kool.
Figure 1. Weighing at the time of Ashurnasirpal II (Gadd 1936, plate 6).
Istanbul: Nederlands Historisch- Archaeologisch Instituut, 205.
The Old Assyrian Trade Network from an Archaeological Perspective.

J. Kool.
## CONTENTS

Introduction .......................................................................................................................... 7

Scientific questions and structure of the paper. ................................................................. 7

Texts and material used for my investigations. ................................................................. 9

I. The Old Assyrian Trade .................................................................................................. 11

Geographical and chronological perspective. ................................................................. 11

Background and short description of the Old Assyrian Trade (based on texts)............. 15

II. Scientific and archaeological evidence of trade. A theoretical approach. ............... 23

i. Scientific and archaeological evidence. Qualification of creditability............... 23

ii. What is trade? ............................................................................................................. 26

iii. How to find material/archaeological remains of trade? .................................... 27

III. Archaeological evidence based on stone weights ......................................................... 30

i. Methodology of the investigation. ............................................................................. 30

ii. Some history. ............................................................................................................. 31

iii. The Rahmstorf test. Are these stones real stone weights? .................................. 35

iv. The underlying weighing system. Standard weights, multiples or fractions thereof. The metrological-historical investigation .............................................. 42

v. Were these weights used for commercial trade? ...................................................... 52

vi. Did these stones refer to weight standards of various cities, indicating long distance trade? .......................................................... 55

vii. Final conclusions of the investigation of the Karum Kanesh stone weights ................................................................. 57

IV. Archaeological evidence based on clay tablets ........................................................... 58

i. The methodology of the investigation. ................................................................. 60

ii. The authenticity and dating of the tablets ............................................................ 60

iii. The site and context. ............................................................................................... 62

iv. The purpose of the texts. ......................................................................................... 65

v. The translation and interpretation by the translator ............................................. 66

vi. Final conclusions of the investigation of the clay tablets .................................... 66

Conclusions ......................................................................................................................... 67

Summary .......................................................................................................................... 71

Samenvatting ....................................................................................................................... 73

Bibliography .................................................................................................................... 75
List of Figures: ........................................................................................................................................80
Tables ..................................................................................................................................................82
Annexes................................................................................................................................................83

A. List of Karum Kanesh stone weights. .........................................................................................83
B. Analysis of weights found in Boğazköy III (Ḫattuša). .........................................................84
C. Scheme of weight standards used in the Anatolian Bronze and Iron Age. .................87
Introduction

Scientific questions and structure of the paper.

Trade is an old phenomenon and (long distance) trading was already common more than 4000 years ago in Mesopotamia.
It would be great if we could use the modern Google Earth program to go back in time and see for ourselves what it looked like. I would zoom in on Mesopotamia of the Middle Bronze Age (from 2000 BC to 1600 BC), “MBA”.
I imagine that cities would be recognizable as large clusters of houses, buildings and structures. Probably you could see the lines in the earth representing the many routes that connected these cities with each other.
If lucky, when zooming in any further, you could perhaps see sand or dust clouds along these lines marking caravans crossing deserts. Caravans with donkeys for the rough and mountainous areas.

I have a special interest in the so-called Old Assyrian Trade route (“OAT”), the MBA trade route between Assur, in the North of present Iraq on one side of the trail and Karum Kanesh, the present Kültepe in Cappadocia in central Anatolia on the other.
The Old Assyrian Trade has been dated on the basis of the clay tablets texts and lasted from circa 1920 BC to at least 1740 BC (see page 59). It is unique, because we have more information about this long distance trade than any of the numerous other local or long distance trade routes in the Near East during the Bronze Age.
In Karum Kanesh some 20,000 cuneiform texts on clay tablets have been found (Veenhof 1972, 456- 64). The approximately 3000 published texts - mainly commercial contracts - give a fair and detailed insight in long distance trade that has taken place some 4000 years ago. And there is more to come if other tablets have been published in future.
In short the AOT is one of the best documented phenomena of the ancient economic history.

With such an amount of clay tablet texts it is rather obvious, that we base our evidence of the OAT mainly on these texts. But can we trust these texts and rely on the information they give us?

One weak element of historical evidence is that writers of texts often give their own subjective view of past situations or developments. Consequently, texts alone cannot be fully trusted as a reliable source of information of the past. “If we rely too much on official accounts of history, we may accept a biased or idealized perspective, but material remains are compelling evidence” (Evans 2004, 52).

It is recommended to look for additional archaeological evidence based on material finds in order to mitigate the subjectivity of the written sources.

Aims of the research

The purpose of this paper is to find answers to the following two questions.

I. Can we find additional archaeological evidence that Karum Kanesh was a centre of long distance trade between various trading centers, especially between Assur and Karum Kanesh?

To demonstrate trade I analyzed 75 stone weights found in situ in Karum Kanesh, described in Özgüç’s publication (Özgüç 1986, 77-9).

II. Are the clay tablets found in Karum Kanesh authentic, their legal and contractual texts un-biased and as such reliable (historical) sources of information?

Most archaeologists see in a clay tablet only a historical object just because of the text written on it.

In my opinion clay tablets are material and archaeological artifacts. The narrative texts may give historical evidence, but the material objects themselves can be looked at, analyzed and interpreted. And consequently they can be a source of
archaeological evidence.
In my investigations I have looked at the material objects and the type of the texts.

Structure of the paper.

In this paper I will start with background information about long distance trade in the MBA in general and the OAT in particular (Chapter I). In Chapter II - “Scientific and archaeological evidence of trade. A theoretical approach.” - I have added theoretical content to this bachelor paper. Chapter III is devoted to the (metrological-historical) analysis of stone weights and in Chapter IV the investigation of clay tablets (texts) has been described. The conclusions and summary (as well as a summery in Dutch language) can be found in on pages 65-72.

In order to give more perspective to my investigation of the collection of Karum Kanesh stone weights (MBA), I have also analyzed a few stone weights found in another karum, Karum Iḫattuša. The conclusions can be found in Annex B.

Texts and material used for my investigations.

There are numerous publications about the OAT and I am grateful to Mr. D. Meijer, Mr. B. Düring, both of the faculty of Archaeology and Mr. J.G. Dercksen (lecturer Assyriology, Faculty Humanities) all from Leiden University, who have been so kind to give me reading clues.

The 75 stone weights found in Karum Kanesh have been summarized by Özgüç in a detailed information scheme (Özgüç 1986, 79). This sheet mentions for each stone the excavation number, the present location (museum), the length, the thickness, the weight in milligrams, the layer where the weight was found and the material the weights are made of (see Figure 9). Mehmed Ali Düveni made a photograph of 46 of the 75 stones (Figure 5).
The reports of Özgüç do not give further and more detailed information about the contexts and precise locations where the weights have been found.

I would have preferred to see and hold the material evidence myself. However these objects, as they are part of museum collections in Turkey and elsewhere, were not available to me.

In order to get an impression of old Bronze Age stone weights, I visited the British Museum and the Petrie Museum in London. The forms, sizes and material of these stones are very similar to the stones found by Özgüç.

For my investigation of the clay tablets I made use of the report of Özgüç’s publication (Özgüç 1986, 2-21). See Chapter IV and especially part iii, The site and context.
I. The Old Assyrian Trade

Geographical and chronological perspective.

There are indications that trade is a very old activity of mankind that already existed long before the MBA. Probably people traded actively in most parts of the world. We have some evidence of organized trade between Egypt and the lower Mesopotamia since the 4th millennium BC (Moorey 1987, 36). Veenhof is convinced of the existence of trade in Mesopotamia since the 4th millennium BC. According to him: “trade and traders must have existed in Mesopotamia of old, because its early civilization could not have developed and flourished without essential materials such as metals, stones and timber, which the alluvial floodplain of Tigris and Euphrates lacked” (Veenhof 1997, 336). Mesopotamia had means to pay for these “imports” because they were relatively wealthy. Their own overproduction of food and wool allowed them to ‘export’ surplus food and textiles. We have convincing information about the existence of trade in Mesopotamia through mid third millennium BC texts that mention two types of traders in a list of professions and refer to trade and trade goods (Veenhof 1997, 337).

In another area, Ebla in Syria, third millennium BC palace archives have been found that documented production and trade in textiles (Larsen 1987, 53). The Middle Bronze Age (MBA) period is much better documented with regards to long distance trade. There is quite some information available about the many trade routes in the Near East and around the Eastern Mediterranean Sea. The rather old scheme that Larsen made of MBA trading routes (see below) gives a summarized impression of regional trade routes.
Figure 2. Scheme of long distance trade in the MBA (Larsen 1987, figure 5.2).

We can see trade connections between Anatolia, Assur, Syria/Levant, Mari, North and South Babylonia, Susa and Dilmun (Oman). The scheme is not complete and later Larsen and others added more trade routes. We have indications of trade routes between Assur, Susa, Iran and Afghanistan, between Cyprus and the Levant/Syria (see Larsen 1987, 50-1), between India and Mesopotamia, between Greece/Troy and Mesopotamia (Rahmstorf 2006, 50), between Egypt and Palestine and between Crete and Greece (Warburton 2000, 77). Based on texts found in Mari we could assume that Hazor (North of Galilee) and Lais (Tel Dan) have been busy trading posts in the Levant (Ilan 1998, 306-8).

The above scheme of Larsen gives a summary of trade connections in the MBA. In order to show that trading took place during a much longer period, I have made a time-related scheme with the most important trading cities during the Early Bronze Age “EB IV”, Middle Bronze Age “MBA” and the Late Bronze Age “LBA”.
During the first two centuries of the second millennium a “collapse” took place in Syria, Palestine, Cyprus, Egypt, Anatolia and the Aegean, but not all cities were affected. Ebla showed considerable growth during the same period (Akkermans and Schwartz 2003, 294).

Most scientists believe that the collapse was caused by climate changes and a quick desiccation of the land. But it also possible that the urbanization in the third millennium triggered more food production, causing intensification of land use and erosion of the soil. In the beginning of the Middle Bronze Age most local and regional cities resurrected or were reoccupied and the economic activities and the long distance trade increased again. All in all we have no solid explanation for the start nor for the end of the collapse in the beginning of the second millennium BC (Akkermans and Schwartz 2003, 282-26).

Figure 3 Chronological and geographical scheme of cities which were active in trade. Made by author 2012.
It is tempting to assume that the synchronism of the beginning of the Middle Bronze Age, the end of the “collapse” and the strong development of long distance trade in the whole region is more than a coincidence.

We know almost nothing about other less important (parallel or local) trade routes. Imagine the many local traders or smugglers being active in trade of wood, foodstuff, tools, garments, weapons, jewels, animals, wool, people, pottery etc. The Assyrian traders of the MBA had a large number of trade routes with many smaller trading places “en route”. We know that some twenty Assyrian trade colonies were established in Anatolia in the beginning of the 2\textsuperscript{nd} millennium BC to boost trade, all - according to Veenhof (1972, 456) - under the administrative and governmental control of Karum Kanesh.

If we rely on the frequency that its name was mentioned in contracts and consider the size of the archeological site (“In Anatolia there is no ruin of the size of the Karum of Kanesh”, Özdüç 1986, XX) we can establish that the Karum in Kanesh was the largest karum in the area. Of these some twenty trade colonies only Karum Kanesh, Alişar and Boğazköy have been identified.

I like to mention the Old Assyrian copper trade system in Anatolia (Dercksen, 1996). Strictly speaking it was not part of the long distance OAT route between Karum Kanesh and Assur; this copper trade was mainly a regional Anatolian business. Probably the Assyrian merchants played an important role in the Anatolian copper trade.

Texts (contracts, letters, inter-state agreements etc.) mention notorious long distance trade routes because they were important. Of the small (less official) business- or trade routes almost no traces or references in texts have been found.
Background and short description of the Old Assyrian Trade (based on texts).

The period of trading
Texts on clay tablets document that the OAT between Assur en Karum Kanesh lasted from circa 1920 BC to (at least) 1835 BC (Veenhof 1997, 337). After a collapse (see below) it has resurrected and the OAT continued from 1840 till its final decline after 1740 BC. See Chapter IV, ii about the dating of the clay tablets.

We do not have relevant texts in Karum Kanesh from before 1920 BC and it is assumed that the trade started around 2000 BC. However texts found in Ebla (Larsen 1977, 120) tell about trade between Assur and Anatolia in approximately 2300 BC.

In 1835 BC Karum Kanesh was almost completely destroyed and burned to the ground, probably by the king of Zalpa (Özgüç 1986, XX). They found no evidence of trade and habitation after this year and we must assume that the trade stopped and that the village was more or less deserted. The trade started again around 1840 BC.

The end of the OAT (around 1740 BC) coincided with the collapse of powerful states, local wars in Northern Mesopotamia and growing military power of populations such as Hurrians and Hittites (Matthews 2005, 453). The dating of the final end of the AOT is being contested; Özgüç believes that layer lb in Karum Kanesh, representing the last habitation of Karum Kanesh, ended around 1740 BC (Özgüç 1986, XXI).
The route(s)
When I use the words OAT route I do not refer to a single route between Assur and Karum Kanesh. See Figure 4.
Texts about the OAT mention a large number of cities, villages, karums, small trading places and toll stations. These places were not located on one straight line between Assur and Karum Kanesh and it makes sense to assume that there were a number of routes. At one end of the route was Assur, the Assyrian capital during the period of the OAT.
Assur, named after the main god of the Assyrians, was located in what is presently North of Iraq near the shore of the Tigris River. At the other end was Karum Kanesh, the present Kültepe, located 20 km North East of the city Kayseri in the region of Cappadocia, Anatolia.
Between these two locations - some 1000 km apart from each other (in direct line) - was a route that crossed steppes and high mountains. It was not an easy track and in winter much of the route, especially the stretch through high mountains, was impossible to pass. The distance, the difficult environment and the weather conditions allowed the Assyrian traders only two return trips per year.

We have to take notice of the amount of attention and care Assur and the involved kingdoms gave to create, hold, administer and safeguard the OAT route for such a long period. Assyrian kings had regular correspondence with the local kingdoms along the route(s) about the amount of toll they could ask from the passing caravans, their priority purchasing rights and the security they should provide. Apparently the trade was so important and profitable that it was worthwhile to take all the trouble, time and high expenses (Özgüç 1986, XX).

The trip.

I try to imagine how such a long distance trip took place. First the master or merchant purchased goods to sell on the “other” market. If he did not wish to make the trip himself he hired a caravan leader to travel for him instead. The leader of the caravan had to make sure that they had sufficient water and fodder for the donkey’s and food and drink for the people. He had to find a safe and pleasant place to stay at night. If there was no “caravanserai” in the neighborhood they had to sleep in tents and guard the donkeys. We know from Veenhof (Veenhof 1972, 460) that the local kingdoms they passed offered some protection (against a substantial toll price or “datum”), but thieves and robbers lurked in the mountains to attack you when you were off-guard to rob the goods and precious metals and to kill the people.

We have no indication that caravans had their own security guards/soldiers, but we assume that members of the group carried arms.
The caravan leader had even more responsibilities. He decided which route to follow, paid for the purchases during the trip, kept a detailed administration and had an active correspondence with his master(s) in Assur or Karum Kanesh.

A caravan or convoy (that is a group of caravans travelling together) would either follow the ‘southern route’, crossing the Euphrates at Birecik to reach Kayseri via Maraş, or choose the ‘northern route’ which proceeded along the banks of the Tigris as far as Diyarbakır and from there via Malatya to Karum Kanesh (Palfi 2008, 3).

Once the caravan arrived at the final destination, the caravan leader had to execute the (written) orders of his master. He had to sell the goods he had transported for silver or gold. Sometimes he had to purchase goods to bring home.

The Karum of Kanesh.
Kültepe (the ancient Kanesh) was an important city in Anatolia during the Bronze Age. The king lived in the centre of the city in a palace surrounded by the houses of the local population.

Near the south gate outside of the city wall was the location of the colony of Assyrian traders (the Karum). “Karum” is an Assyrian word for harbor or market. Representatives (most likely family) of merchants from Assur lived in this part of the city (semi-) permanently. Apparently they had adopted quite a lot of the Anatolian culture and they lived in Anatolian type of houses. The Commercial Office of the colony took care of the administration and represented the interests of the Karum Kanesh traders against the palace and other merchants. This office, mentioned in the texts, has not been identified yet in the remaining ruins (Dercksen 2004, 103).

No typical Assyrian remains have been found in Kültepe outside the Karum, which means that we have to assume that Assyrians lived exclusively of predominantly in the Karum.
The goods.
We can read in the texts about the export from Assur to Karum Kanesh of “annakum”, which has been identified by most scholars as tin, and high quality (fashionable) woolen material (Veenhof 1997, 339-40). As has been shown earlier in Figure 2, Assur was not the primary source of the goods it exported; they came from Babylonia (textiles) or Iran/Afghanistan (tin).

Not all the imported goods remained in Karum Kanesh; a large portion was being re-exported to other places in Anatolia, like Boğazköy and other karums such as Alişar and Acemhöyük. We also know that some tin was re-exported (see below) to Cyprus and Crete. (Melillaart, 1974, 252).

Karum Kanesh exported gold and silver to Assur. Other goods were seldom mentioned.

My conclusion is that in essence the trade focused on the trade in tin, an ingredient for making bronze, and very much in demand since tin-bronze replaced arsenic-bronze during the Early Bronze Age. Tin-bronze making is a rather efficient procedure (you need only 5% tin content); much healthier than arsenic-bronze production and the result is a hard, durable metal ideal for the production of weapons and tools.

Bronze.
As mentioned above bronze was an important material in the Bronze Age. Anatolia had copper sources in their neighbourhood but probably hardly any tin and, although new investigations indicate some tin mining in Anatolia and the Carpates in the Early Bronze Age (Hanilci et al. 2010, 57), we get the impression that Karum Kanesh and most parts of Anatolia were depending on the OAT for that non-local metal.

Düring gives a caveat, because this impression could be biased. Apart from the Karum Kanesh texts we have very few other sources of information (Düring 2010, 275) and it is quite possible that small scale local mining took place in Anatolia
allowing local populations to produce bronze in small quantities (cottage production).

It is widely assumed, that Assur imported tin through its (exclusive) trade lines with Persia, Uzbekistan and/or Afghanistan, where tin was being mined, and that Assur dominated the tin trade in the region including Anatolia (Larsen 1987, 50).

Payments.
For these exports the Assyrians were being paid in gold and silver. In those days these precious materials were used as “near money” and the markets were liquid and rather transparent. For the transportation of silver and gold the traders needed only a few donkeys. Consequently most of the donkeys that arrived in Karum Kanesh were being sold in the local market.
Silver was used for payment and investment. The so-called silver banks were well established and offered a “fair” interest for silver deposited there and substantially higher interests for loans to traders (Veenhof 1999, 55-83; Dercksen 1999b, 85-99).

The economic model of the OAT.
Ian Morris and JG Manning (2005, 1-58) investigated the economic and financial systems used by ancient societies and developed some models. In their opinion historians and archaeologists are still inclined to see economic developments as regional matters. Historians have the attitude to focus on the differences between regional economic systems centered around Greece, Rome, Egypt and Mesopotamia. Morris and Manning favour a different approach and believe that economic developments were not restricted to specific regions and had influence widely beyond the regional borders.
Mario Liverani (2005, 48-57) investigated the economic models of the Near East societies in the Bronze Age. He highlighted three themes: the ownership of land, the private or public/ state/temple centred character of the trade and the structure
of the craftsmanship. But he did not formulate a universal “all purpose”
theoretical economic model that can be applied to the OAT.
I feel intrigued to start a special investigation to the economic characteristics of
the OAT. However, an investigation to find broadly accepted economic models
based on a comparative study of societies is beyond the scope of this essay.

The traders.
The contract partners mentioned in the Karum Kanesh texts were probably all
private persons. A limited number of Assyrian families were active in the OAT
trade for decades and we can read that in many cases fathers or other senior
members of the family stayed in Assur while their sons/cousins lived in Karum
Kanesh. Palfi investigated the family names mentioned in the contracts (2008, 5-9)
and could trace most names to a small number of probably influential Assyrian
families.
Although it is possible that some acted as agents in behalf of the state (king or
temple) we have not found any such contract in Karum Kanesh. All contracts
found refer to traders trading for their own account.

The influence of the Assur state.
The fact that traders were primarily private persons does not mean that the
states/kingdoms had no role to play. The OAT was too important for all
participants to leave the states completely out of it. Kings in Assur, in Karum
Kanesh and along the roads were allowed to demand toll (“datum”) from the
caravans (in return for protection). The king of Assur did all he could to make
sure that the Assyrian traders were the only traders in tin between Assur and
Karum Kanesh. Just like King Sargon of Akkad - who reigned from 2334 to 2279
BC - in the story about his military campaign to defend “the rights of the
Mesopotamian traders in their colony of Buruskkhanda” (Vanstiphout 1998 in
Bobokhyan 2009, 41).
The whole phenomenon resembles the Dutch VOC trading venture that took place
in the 17th and 18th century. This trading company (the first company to be
capitalized on the basis of tradable shares) was a private company but its east-
west trade was protected by the Dutch State. Dutch VOC traders were allowed to
bring their own soldiers on board of the ships; sometimes in case of real trouble
the State sent its national army.

There are no indications of military interference by the Assyrian state and the
karums were probably no military strongholds, but it is legitimate to assume that
Assur exercised some influence or even dominance (military and politically) on
the other (regional) kings along the OAT. Did the palace in Assur control the
trade and the traders? Could everyone participate in this trade or only certain
selection of traders? Did states participate in the local markets and could they
influence or make market prices? We do not know. But we are certain that traders
had to pay for the use of the trade road in the form of taxes, tolls and priority
purchase rights.
II. **Scientific and archaeological evidence of trade. A theoretical approach.**

i. **Scientific and archaeological evidence. Qualification of creditability.**

Finding evidence and testing theories are part of the activities of archaeologists. In my opinion there is no difference between “normal” scientific evidence and “archaeological” evidence. In fact archaeological evidence is a special type of scientific evidence which is based on material remains and obtained in accordance with generally approved archaeological rules.

In the early years of the 20th century Karl Popper publicly rejected the inductive approach (applied by those scholars who formulate a general rule or theory on the basis of a number of observations) as not being logical (Leezenberg and De Vries 2001, 68-9).

According to Karl Popper’s widely accepted falsification methodology, a theory can be considered being scientifically valid as far as and as long as it fulfills the following conditions:

- The theory should be formulated (a) without ambiguity or tautology, (b) should enable logical conclusions or propositions, (c) can be tested/verified and (d) has not been falsified.

According to him scientists should be constantly active looking for new material or logical evidence in order to test existing theories (Popper, 1935).

In fact we can only prove that a theory or thesis is false, but not that it is true.

Leezenberg and Vries argue in Wetenschap voor geesteswetenschappen (2001, 29) that the falsification theory of Popper is only a useful tool for sciences. Theories in sciences compete and (quite often) exclude each other.

---

1 There are no clear and codified general (international) rules for archaeologists, but most international archaeologists have a communis opinio about practices and codes of conducts.
That differs, according to Leezenberg and de Vries from the position that theories have in the humanities: A theory in humanities reflects its own interpretation and can exist next to other conflicting theories.

However, I believe that we should apply the same rules for humanities, archaeology and sciences.

If all theories can be tested (and falsified if needed), why should we make an exception for some of them (theories of humanities)? All scientific theories are based on arguments and/or evidence and can be verified and confirmed or falsified by other scientists.

**Qualification of creditability of archaeological evidence.**

In archaeology we have scientifically accepted theories, that are valid as long as they have not been falsified (with “valid” I mean broadly accepted and probably true), but simply not true as soon as a theory has been falsified.

I would like to argue that when we evaluate theories there is a wide area between “not true” and “valid” with various shades and gradations of “creditability” or “probability”.

Sometimes we can use statistic formulas to give a grade of probability to a theory. For instance, if a calculated standard deviation is small, we can state that it is almost certain (high probability) that a theory is creditable.

It is a pity that in archaeology we seldom find sufficient and qualitative acceptable data to be used for a statistic analysis.

Does that mean that we have to accept that qualification of the creditability or probability of archaeological evidence is impossible in most cases and that we have no more options than yes, it is valid or no, it is certainly not true?

Should we refrain from giving qualifications to evidence like “poor”, “average”, “probable” or “almost certain” or, as an alternative, marks between 0 and 10 (like for tests and exams), if we cannot use statistics?
I do not agree. It is true, that archaeology is not always a science and that in practice we have to cope with fragmented and insufficient information. Let us be fair and admit that proof (in the sense of 100% true) of archaeological theories is very difficult (according to Popper even impossible) to find and that in most cases evidence has distinct flaws.

Certainly, if archaeologist would give qualitative marks to their own evidence they could place themselves in a vulnerable position. From the other side, qualification of evidence will make investigations and conclusions of scientific research more transparent and verifiable.

This issue is not new. Stuart Piggott was convinced that in most cases one single example was insufficient to make a real case. Like they say in legal courts; one witness is no witness. In his book Ancient Europe (Piggott 1965, 10) he introduces the concept of cumulative credibility. The creditability of evidence or the probability of trueness of a theory is being enhanced if confirmed by other evidence not related to the first one and based on another source. For instance material archaeological evidence confirming historical evidence.

The more confirmation you get from different sources the higher the credibility. The final probability of trueness of a theory is the sum of the creditability of various elements of the evidences.

In my paper I have made one additional step to Piggott’s approach of cumulative creditability.

As a test, in order to see how it could work, I did an exercise/case study with a model based on qualification of each element of my argumentation (I gave a mark of creditability between 0 and 10) plus a weighting score, representing the importance of each element of evidence (between 0 and 100%). The final averaged and weighted marks (see Table 4) give an indication of the probability that my conclusions and theories are true.
ii. What is trade?

Before we discuss how we can find evidence of old Assyrian trade, we should understand what trade was during the MBA.

The last few decades archaeologists and other scientists have argued about the definition of trade and tried to fit this human activity into various strict models. Wallerstein (1983) developed the “World Systems theory”, an economic model that focussed on the pre Second World War colonial system. It was characterized by domination of resource rich colonies by military strong colonizing empires. Trade was more or less exploitation of weaker populations that could not act out of free will.

Algaze has tried to use this model to explain how the Uruk empire expanded through the control of various colonies in the periphery (1993). This theory has been tested in recent research and it turned out that the so-called Uruk colonies had rather complex economies that developed more or less independently from the “center” Uruk (Akkermans and Schwartz 2003, 204).

Polanyi has influenced the mindset of archaeologists for a few decades with his non-market theory (1957). According to him there were no markets, no market places and no private enterprises in early Mesopotamia.

Both Veenhof (Veenhof 1972, 463) and Powell (1999, 8) have a different opinion and give evidence for markets and private ventures in MBA Mesopotamia.

With his theory Polyani made a distinct separation between ancient and modern, capitalistic forms of trade. But today’s scientists start to realize that the development of trade practices is rather fluid and that differences between “ancient” and “modern” trading techniques are rather technical. Only very few really new trading concepts appear in time (Ekholm and Friedman, 1979). According to Adams, Renfrew makes a strict and principle distinction between prehistoric and modern (post-medieval) economy and trading practices. Adams (1974, 239) rejects this idea and says:
“(...) I must question it (he means Renfrew's statement, JK) as a prescription for research. To begin with, it would surely be unfair to assume that the burden of evidence lies entirely on those advocating the similarity of ancient and modern economic motivations and structures.” And further: “A sweeping, rigid distinction between ancient patterns and post-medieval, European-influenced ones involves blindness to the biases and deficiencies of virtually all of the ancient data that has come down to us, whether archaeological or textual”.

Resuming I will use in this essay the following definition of trade:

The (more or less voluntarily) exchange of goods or services between two or more (groups of) people, that is advantageous for at least one of them.

In my opinion trading is a human activity to improve living conditions, which has existed since the early days of the Homo sapiens sapiens. In my opinion most humans are basically mobile, curious and greedy, always interested to increase their material wealth through acquisition of more and “new” goods. Sometimes through robbery or war, sometimes through exchange/trade.

We can distinguish various forms of trade, such as state organized exchange versus commercial trade, local versus long distance trade, trade based on money versus barter and trade between equal partners versus rather unequal partners. They all fit into the above definition of trade.

iii. How to find material/archaeological remains of trade?

Most remains of ancient trade have disappeared. Sometimes we discover goods made of materials that were not “local” (already in the Paleolithic and Neolithic we see indications of trade in flint or obsidian), pottery which stylistically corresponds with other cultures and/or artifacts used for the trade such as seal cylinders, bullae, weights and balances or texts.
Quite often we find nothing, but that does not proof anything. When you find no evidence of trade you have no evidence that there was none.

In the case of the 14th century BC Uluburun shipwreck near the southwest coast of Anatolia they found an interesting cargo: approximate 350 ingots of copper (looking like ox hides), many tin ingots, cobalt-blue and turquoise glass, a large number of amphora, exotic items like elephant tusks etc. Do these items from Eastern Mediterranean regions indicate private trade or “a complex network of exchange and multicultural interaction involving participants from many regions and polities in the Late Bronze Age Eastern Mediterranean” (Alcock and Cherry 2005, 486). or rather just transportation? To me it looks very much like a transport ship, carrying goods traded by merchants living in the Eastern Mediterranean.

In his 2011 lectures in Leiden D. Meijer emphasized that it is very difficult to find archaeological evidence of trade. None of the finds that we mention above do evidence that they have anything to do with trade. They could have been the result of exchange/expansion of cultures (diffusion) or immigration of people taking their own material culture with them. According to him the evidence of long distance trade is mainly based on texts on clay tablets.

I agree with him that the remains mentioned above could also indicate other activities than trade. Pottery or other artifacts of another culture found on the “wrong” spot could be the result of exchange/expansion or diffusion of cultures. But in my opinion trade is the most probable explanation. Trade is a business of everyday life. Diplomatic exchange occurs less often, diplomatic gifts concern luxury goods and should rather be found in palaces or official buildings.

Opposing Meijer I would suggest that we should assume that trade - trade being the normal everyday practice of people- is the basic explanation for finding “non local” goods. Only if we find specific clues, other explanations like diplomatic exchange or
robbery are to be considered. In other words; the burden of evidence is on the side of supporters of the non-trade theory.
III. Archaeological evidence based on stone weights.

As mentioned in the Introduction, I want to answer the following scientific question:

*Can we find additional archaeological evidence that Karum Kanesh was a centre of a network of long distance trade between various trading centers, especially between Assur and Karum Kanesh?*

If it is true that in Karum Kanesh traders were involved in long distance trade with various other trade centers, we should expect to find in Karum Kanesh stone weights that are linked to the weight standards of these trading places. Stone weights of different weight standards give a strong indication of a long distance trade center. According to Hafford:

“(trade) be detected in the archaeological record through the tools used in their everyday conduct of business. Particularly important for mercantile operations were weights, scales and bullion, and these objects are often found together in royal, domestic, religious and burial contexts throughout the Bronze Age eastern Mediterranean and Aegean” (Hafford 2001, 1).

i. Methodology of the investigation.

For the investigation I analyzed 75 stones (called “stone weights” in his report) found in Karum (Özgüç 1986, 77 - 79). Because these stones are presently in museums in Kayseri and Ankara, Turkey I could not see and touch them myself. Therefore I used a picture (Figure 5) and a detailed information scheme (see Annex A) of the Karum Kanesh weights. This sheet mentions for each stone the excavation number, the present location (museum), the length, the thickness, the weight in milligrams, the location/layer where the weights were found and its material (Özgüç 1986, 77). The Photo (Figure 5) shows 46 of the 75 stones. The reports of Özgüç do not give further and more specified information about the contexts and precise locations where the weights have been found.
The collection of 75 Karum Kanesh stones has been analyzed with a metrological-historical method and the results have been compared with an analysis of a test set of 75 random numbers. In addition I investigated a small number of stone weights found in Karum Ḫattuša.

In order to show that the stones found in Karum Kanesh were stone weights and represented local and foreign weight standards I first had to make sure that the stones found were really stone weights. For this investigation I used the so called Ramstorf test (see Chapter III, iii).

Next, to give evidence that in Karum Kanesh long term trade took place with various other trading centers, I had to demonstrate that a substantial number of these Karum Kanesh stones relate to other (non local) weight standards belonging to” foreign” trading centers. For this investigation I developed a metrological-historical calculation model, which enabled me to look for the best possible match of each stone weight with (a fraction or multiple of) one weight standard out of 25 different weight standards.

In the next chapters I will elaborate on these issues. But first some history about weighing.

ii. Some history.

In the early days of mankind, people used simple means of weighing (the use of the hand palm etc.). Probably the first balance was invented in the 5th or 4th millennium BC in Egypt and/or Babylonia. Parts of early scales from this period have been found (Rahmstorf 2006a, 18), although the dating is somewhat unclear. Old engravings found in Egypt and Mesopotamia show pictures of two arms balances (see the illustration on the cover of this paper).

Petrie found a large number of very early Egyptian stone weights, that he dated to approximately 3.300 BC, but without sufficient context. According to Rahmstorf the oldest archaeological evidences of the use of weights have been discovered in
Mohenjo-Daro (Indus Valley), the Aegean, Egypt, Anatolia, Syria, Mesopotamia
and the Persian Gulf. They all date from the 3rd Millennium BC (2006a, 15).
People used all kind of forms and material as weights. For “relative weighing”,
which is the comparing of the weight of two items, you do not need a (stone)
weight, but in case of “absolute weighing”, which is the measuring of the weight
and/or value of one item, (stone) weights are needed.
Probably the first stone weights were simple stones that individuals used and were
saved for weighing purposes. Later primitive, but more or less standardized, stone
weights were used.
The early stone weights in the Near East/ Aegean region had various shapes like
disks, cubes, rectangular-, cone-, hemisphere-, oval-, ellipse-, dome or duck forms
(Bobokhyan 2009, 20) and were made of different types of hard stone. But most
weights were ellipsoidal/sphendonoid2 or barrel formed and made out of
haematite 3. Later (after circa 1700 BC) bronze duck shaped weights became more
popular.

Discussions about weight standards.

I could imagine that for modern people it is rather difficult to understand what local
standards mean. In (most of) Europe we have one coin and one decimal system.
Many forget that as late as the Napoleonic times most cities had their own standard
of length, weight and value. Also in the Netherlands we used to cope with different
standards. To give a few examples (all in meters): Amsterdamsche el (0,68781),
Delftsche el (0,68323 ), Duim (0,025 ), Groningsche toorenmaat (5,47651 ), Knoop
(15,432 ), Nijmeegse el (0,682 ) and Uur gaans (5651,046 ).
There are reasons why people do not always want standardized weights. In his book
Seeing Like a State, Scott (1998) explains the difficult process of standardization of
measures in history (he focuses on the early modern period). Apparently rulers,
cities and/or states favored different city standards in order to be able to change

2 Sphendonoid means “shaped like a sling stone” (from the Greek word σφενδόν) and is a name
given by Evans (Evans 1906, 348) to the almond, olive or barrel shaped weights. Widely used in
texts about ancient weights.
3 For haematite see page 36.
their own standard (at will) - mainly for tax reasons- and/or to benefit from the differences between standards (weight manipulation).

We have written evidence that standardization of weights took place during the reign of Sargon the great of Akkad (2334 – 2279 BC) and that the system was improved by his successor Naram-Sin (2255 - 2219 BC). The ‘Manah’, a standard weight of 498 grams, was introduced by king Shulgi, of the dynasty of Ur, who lived between about 2029-1982 B.C.

In order to identify the various standards of stone weights in use in the Near East, archaeologists have investigated sets of stone weights found in various places. It turned out that official weights were used almost everywhere, but mainly in administrative “offices” in palaces and near trading places. These investigations offered evidence of different weight standards used by various ancient cities like Bronze Age Troy (Bobokhyan 2009, 19).

To give a few examples of what has been found:

**Standard weights found in Ebla** (Ascalone and Peyronel, 2006, 50-6).
All weights in grams:
A “local” Shekel of 6,66.
A 7,80 Shekel for trade within its territory, with Northern Syria and Upper Mesopotamia. This is the Ebla standard.
A 9,40 Shekel for trade with Southern Syria, Palestine and Egypt.
They also used the Anatolian Shekel of 11,40 for trade with Anatolia and Aegean coast.

**Standard weights found in Karum Kanesh** (Zaccagnini 2001, 1203 -9).
All weights in grams:
The average Old Assyrian Shekel of 8,257, the Underweight OA Shekel of 8,1 and the so-called traditional or overweight OA Shekel of 8,48.
The Hittite Shekel of 11,75, the “aban matim” or weight stones of the land, almost exclusively used for the Anatolian copper trade by Assyrian traders.
Syrian Shekel (overweight) of 9.7.
A Karkemish Shekel of 7.83.
Other (probably Egypt/Levant/Indus) Shekel of 6.6.

To get a good impression how important weighing procedures were in case of the production of gold and silver artifacts one can read the article of Francis Joannes (Joannes 1989). Below I give a short summary.
The officials of the palace in Mari during the reign of Zim-Lim (approximately 1750 BC) followed strict weighing procedures. For instance when the king put precious metal at the disposal of a manufacturer to make an object for him (the king); he wanted to be informed about what happened with that metal. With other words he wanted to be sure that the producer did not steal, lose or change the alloy of the metals borrowed from the palace. Weighing gave this information. They could trace the amount of precious metal used and the alloy of the precious metal in the end product. During the total process of production the weight and the quality/grade of the metals/objects were being measured at least three times by one or two palace weighing officials (‘ebbu’), sometimes in presence of the king himself.
The standards weights in Mari were the Manah, the Talent - the equivalent of 60 Manah-, the Shekel - corresponding with 1/60 Manah- and the grain – the equivalent of 1/180 Manah. In two offices of the palace they have found (royal) weights from 5 grain up to 10 Manah (5 kg.).
iii. The Rahmstorf test. Are these stones real stone weights?

Schliemann once came across some stones that he identified as “Schleuderkügel” or sling stones. He asked himself why people spend months polishing stones that were lost the moment they were being slung. Eventually H. Schmidt found out that they were stone weights. (Rahmstorf 2006a, 68). This shows how difficult it is to identify stone weights.

In his interesting essay “In search of the Earliest Balance weights” Rahmstorf gives 10 characteristics to help to define balance/stone weights:

“

1) Weights should have a regular shape, forming a distinct, recognizable class of objects.
2) A similar material should be used for the manufacture of most, if not all, of them.
3) The material should be dense, hard and not easily breakable.
4) When made of stone, they should be polished and can have one or more flat surfaces.
5) At best, they can be marked by incisions and/or inscriptions.
6) There should be indications from archaeological contexts that they were used in sets.
7) There should be a range of different examples from light to heavy, i.e. they should not roughly weight all the same.
8) They should be found more in settlements than in graves, hinting at their practical function.
9) Weighing scales or depictions of scales should be known from contemporary sites and assemblages where possible balance weights came to light. And
10) the underlying weighing system – multiples of a standard unit of mass – should be consistent, forming a logical sequence. “
Rahmstorf adds: “suspected balance weights should fulfill most, if not all, criteria”. (Rahmstorf 2006a, 9-10).

I believe that this is a rather long list of conditions evidencing the use of a stone. It is theoretically not always possible to meet all selection criteria because some weights are made of metal (not in compliance with condition 4) and most have no incision (condition 5).

In addition to Rahmstorf’s requirements I have introduced one (my own) extra criterion: Are these stones authentic and found in context? I gave this additional criterion the consecutive number 1a and the previous number 1) the new consecutive number 1b).

1a) Are these stones authentic and found in context?

The excavations by Özgüç have been precise and professional, just as the documentation of these stones. The stones used for our investigation all originate from the old trading center (Karum) in Karum Kanesh (Özgüç 1986 77 – 1). All these stones have been excavated by classified archaeologists, properly documented and have been found in situ (Levels II and Ib) and in context. The Özgüç reports do not give further and more detailed information of the precise spot where each stone has been found.

The Levels II and Ib correspond with the MBA.

In my opinion the stones are authentic. I give a creditability mark of 7,5.
Figure 5. A few (46) stone weights from Karum Kanesh (Özgüç 1986, 77).
Let us see if the 75 stone weights, as described in Annex A, are real stone weights.

The Rahmstorf test:

| NB Marks. Each element of evidence has been considered carefully and received a creditability mark (see Chapter III i). I am fully aware that these marks and weightings are subjective. Nevertheless I believe that giving subjective marks of credibility between 0 and 10 – if transparent- is to be preferred to a (also subjective) simple qualification as yes or no. |

1b) They should have a regular shape, forming a distinct, recognizable class of objects.

If you look at pictures of stone weights found in regions like Egypt, Mesopotamia, Syria, Anatolia and even India the similarity of size, form and is amazing (Bobokyan 2009, 19-64). Figure 5 shows 46 Karum Kanesh stone weights and the scheme made by Özgüç (Annex A) describes all the 75 stones.

In addition to above information I wanted to know how ancient stone weights really look like and I visited the British Museum and the Petrie Museum in London. The shapes, sizes and material of these stone weights are very similar to the stones found by Özgüç; they have a regular shape and form a distinct, recognizable class of objects.

Result: All stones have regular shapes. A creditability mark of 8.

2) A similar material should be used for the manufacture of most, if not all, of them.

Of the 75 stones 67 (90%) were made of haematite. The others stones were made of another hard stone material. Most Early and Middle Bronze Age weights were made of haematite and it makes sense to assume that most people recognized haematite

---

4 Haematite is mineralized iron (III) oxide and mined as main ore of iron. It has various colors like black, silver-gray, brown, brown-red or red
stones as being stone weights.
A creditability mark of 8.

3) The material should be dense, hard and not easily breakable.
As mentioned before, most stones are made of haematite. Haematite is an ideal material for making weights and jewelry, because it is dense, hard, not easy breakable and easy to polish.
The few others are made of rock crystal or another hard stone.
A creditability mark of 10.

4) When made of stone, they should be polished and can have one or more flat surfaces.
All stones are polished and many have one or two flat surfaces.
A creditability mark of 10.

5) At best, they can be marked by incisions and/or inscriptions.
One stone (see nr 33 on Figure 5) has a mark (four dots) on it and in 13 cases\(^5\) bars are visible. But there is no indication that these incisions refer to their weights.
In general very few stones have been found with weight marks. Incisions on stones influence the weight and it is probable that the corresponding weights were indicated on wooden set holders in which the weights were placed.
Result: only a few have marks. But as Rahmstorf added “at best” to this criterion, I did not give to this criterion a heavy weighting.
A creditability mark of 5.

6) There should be indications from archaeological contexts that they were used in sets.
The Karum Kanesh stones were found closely together in the layers II and Ia, but not in complete sets. We have no precise information about the exact location of each stone weight.
It is not surprising to find no complete sets, because we have to do with an incomplete selection of all kind of weighing stones found on various locations. Because of the concentration of the large number of stones found in the Karum,

\(^5\) Nrs 11, 15, 16, 19, 32, 35, 42, 43, 49, 56, 58, 63 and 66 (Bittel 1957, 251).
mainly in what has been recognized as offices, we assume that they were used in sets.

A creditability mark of 7.

7) There should be a range of different examples from light to heavy, i.e. they should not roughly weight all the same.

In Karum Kanesh stones of different weights have been found. See the diagram below for the distribution of the stones on the basis of their weights.

Table 1. Histogram of the distribution of the Karum Kanesh stone weights to their weights, made by the author.

In the collection of Karum Kanesh stones, we see an unbalanced distribution. Please be aware of distortion of the histogram in the range 100-500 g.! The lighter weights are over-represented and the heavy weights are under-represented. I could think of the following explanation:
The weights were probably being used to weigh small quantities of valuable tin (small amounts of tin were used as “money”), silver or gold. Therefore very precise balances and a lot of small weighing stones were needed.

The stones found in Karum Kanesh range from light to heavy, but with an emphasis on light weights.

Result test 7: the stones are in compliance with this rule.
A creditability mark of 8.

8) They should be found more in settlements than in graves, hinting at their practical function.

Only a few stones were found near graves in the houses of Karum Kanesh. The importance of this requirement of Rahmstorf is rather unclear to me. As Bobokhyan states (Bobokhyan 2009, 45): “the best contexts for weights are hoards, houses, temples, palaces, tombs and shipwrecks” and: “weights are also frequently found in palatial and storage contexts, revealing their use in accounting, administration and redistribution”. I agree with Bobokhyan but would only like to replace the word “redistribution” for “trade”.

Result: All the stones have been found in what has been identified as private houses in the Karum of Kanesh. This is a strong indication of the practical function. Some stones were found in graves (under floors in house).
A creditability mark of 7.

9) Weighing scales or depictions of scales should be known from contemporary sites and assemblages where possible balance weights came to light.

Scales are very old. It is assumed that the first balance was invented in the 5th or 4th millennium BC in Egypt and/or Babylonia. Parts of early scales - possibly from this period- have been found (Rahmstorf, 2006, 18), however the dating is doubtful. We have at least one MBA rock engraving on the so-called Rassam Obelisk of Ashurnasirpal showing a two scaled weighing balance (see illustration 1). A creditability mark of 7.

10) The underlying weighing system – multiples of a standard unit of mass –
should be consistent, forming a logical sequence.

Because of the complexity and size of the investigation I devoted a separate chapter to this issue.

iv. The underlying weighing system. Standard weights, multiples or fractions thereof. The metrological-historical investigation.

The discovery of weight standards of MBA cities.

As broadly discussed in Chapter III, ii: “Discussions about weight standards”, the issue of the weight standards and weighing systems used in various cities in the MBA is a very complex one. Only a very few weights carry inscriptions indicating the name of the weight.

The major experts in ancient weights, Rahmstorf, Powell, Zaccagnini, Melville, Ascalone, Peyronel and Bobokhyan, investigated weights in various cities and attested “home” weight standards for (almost) each major city. Their results do not deviate much from each other.

See for a recent summary of the broadly accepted and attested weight standards Figure 10 in Annex C (Bobokhyan 2009, 44).

For my investigation I have used the standards described by Zaccagnini, Melville and Duncan and Ascalone and Peyronel (see references in notes on this page6).

These standards are (all in grams):
1) 0,21 (Halluru/ Old Mesopotamian)
2) 0,33 (Giru/ Old Mesopotamian),
3) 0,35 (Giru/ Old Mesopotamian overweight),
4) 0,69 (Mahat/ Old Mesopotamian),
5) 1,04 (Bitqu/ Old Mesopotamian),

---

6 Numbers 1, 2, 3, 4, 5, 6, 19, 25 from Melville 2006
Numbers 7, 8, 10, 11, 12, 20, 22, 24 from Ascalone and Peyronel, 2006, p 50-56,
Numbers 13, 14, 15, 16, 17, 18, 21, 23 from Zaccagnini, 2001 p 1203 -1209.
6) 4.17 (Zuzu/ Babylonia),
7) 5.5 (Aegean Shekel),
8) 6.5 (Egyptian/Palestine Shekel),
9) 6.6 (Egyptian/Indian trade Shekel),
10) 6.66 (Ebla Shekel),
11) 6.8 (Ebla Shekel/overweight),
12) 7.8 (Ebla Shekel for N Syria and Upper Mesopotamia),
13) 7.83 (Karkemisch Shekel),
14) 8.1 (Old Assyrian Shekel/underweight),
15) 8.257 (Old Assyrian Shekel/average established by Dercksen),
16) 8.3 (Old Assyrian Shekel/average),
17) 8.4 (Old Assyrian Shekel/old standard),
18) 8.48 (Old Assyrian Shekel/underweight),
19) 9 (Babylonian Shekel),
20) 9.4 (Syrian Shekel),
21) 9.7 (Syrian Shekel/Old),
22) 11.4 (Hittite Shekel),
23) 11.75 (Hittite Shekel/overweight),
24) 473 (Ebla Manah) and
25) 497.7 (Old Assyrian Manah).

Deviations.
Veenhof discovered substantial deviations (1972, 59) between actual weights and their standards and believes that they were mainly the result of wear and tear caused by use and or of inaccuracy during the production.

“The inaccuracy on the part of the stonecutter who fashioned the weight; abrasion and damage due to its use; intentional adjustment of private nature or in the frame of an economic reform; and the co-existence of two slightly different weights”
Powell added later (Powell 1979, 83):

“The data indicate that Mesopotamia precision weights tolerated an inaccuracy of about 3% (….), which accords closely with the range of accuracy indicated for ancient balances”.

But is it logical to assume that the technicians of the past were not very accurate and that they lacked skills to make high precision balances and weights? A weighing balance is not a very complicated instrument and can be calibrated to a high precision without too much technical knowhow. Stone weights of haematite can be polished to get the right weight. It just takes a lot of time. It makes sense that merchants demanded high precision instruments and weights when dealing with small quantities of precious metals. Haematite weights are very hard and do not brake or wear easily. When I look at the stones and the pictures thereof I see that they are very clean and that they look almost new. No wear or tear to be seen.

If my thesis is right, we should expect low deviations in the outcome of my analysis of the Karum Kanesh stones.

So if you find a stone weight, how do you calculate the underlying weight standards and system?

Rahmstorf (Rahmstorf 2006a, 11) offers three different methodologies.

a) The intuitive method. One could look for obvious clusters around certain masses in a sample of artifacts. If you can easily understand the basic unit, the calculated weighing system is probably real.

b) The mathematical method. One tries to demonstrate the probability of a possible unit with the use of statistics. The calculated outcome should be logical and simple in the every-day use.

c) The metrological-historical method. This method makes use of old texts and mathematical models.
I have chosen for the last methodology, metrological-historical method. The Rahmstorf first option a) the intuitive method is not really a scientific approach. The second option b), the mathematical method, is based on statistics and in this case we do not have sufficient data to use statistics. Which leaves us the last, but not least option c).

It combines historical information (mainly about standard weights) with a mathematical matrix calculation model and a “best fit” selection.

The metrological-historical investigation.

In order to give evidence that the underlying weighing system – the standard, (its logical fractions, JK) and multiples – are consistent, forming a logical sequence, I have to show that the stones found in Karum Kanesh can be traced back to one of the city standards or a logical fraction or multiple thereof.

I made use of a matrix mathematical model in Excel where the 25 standards (see pages 41 and 42) formed the horizontal X axis of the scheme and the weights of the 75 Karum Kanesh stones the vertical Y axis. In each of the 1875 matrix cells I calculated the fraction of each standard (thus dividing the weight of each stone by the standard weight).

Next, I looked for each Karum Kanesh stone the best matching standard (“best fit” selection) taking into account two considerations:

- The factor must be 1 (=the stone equals the standard for 100%) or a logical\(^7\) fraction or multiple of a standard, and
- The deviation from a standard or logical fraction/multiple should be less that 2% (NB Rahmstorf and Powell mention 3%).

\(^7\) See page 46 The logical composition of fractions and multiples.
Figure 6. Photo of a computer output. Analysis of Karum Kanesh stones.
J. Kool 2012
### Table 2. Part of the matrix scheme regarding the analysis of the Karum Kanesh stones. J. Kool 2012

<table>
<thead>
<tr>
<th>毫无</th>
<th>地区(0.21)</th>
<th>频率(0.33)</th>
<th>小时数(0.60)</th>
<th>Efa (0.66)</th>
<th>Eba (0.73)</th>
<th>Kar (9.0)</th>
<th>OAS (0.25)</th>
<th>OAS (0.27)</th>
<th>OAS (9.0)</th>
<th>OAS (0.9)</th>
<th>Rab (9.0)</th>
</tr>
</thead>
<tbody>
<tr>
<td>38.90476</td>
<td>24.7578</td>
<td>23.3426</td>
<td>11.84058</td>
<td>7.85769</td>
<td>1.599226</td>
<td>1.485345</td>
<td>1.256923</td>
<td>1.239787</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>200</td>
<td>127.2727</td>
<td>120</td>
<td>66.6697</td>
<td>40.3849</td>
<td>120.077142</td>
<td>7.3663636</td>
<td>6.486318</td>
<td>6.364618</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>15.9524</td>
<td>73.7878</td>
<td>65.57142</td>
<td>35.23986</td>
<td>23.41349</td>
<td>3.8393285</td>
<td>4.4272725</td>
<td>3.746154</td>
<td>3.689394</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>38.3333</td>
<td>24.3934</td>
<td>14</td>
<td>11.6667</td>
<td>7.740385</td>
<td>1.345056</td>
<td>1.4536366</td>
<td>1.238462</td>
<td>1.219697</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>29.5734</td>
<td>190</td>
<td>179.1429</td>
<td>20.98957</td>
<td>60.28869</td>
<td>15.039571</td>
<td>11.4</td>
<td>9.646134</td>
<td>9.5</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>3.095238</td>
<td>1.969667</td>
<td>1.675142</td>
<td>0.942092</td>
<td>0.625</td>
<td>0.155875</td>
<td>0.118118</td>
<td>0.1</td>
<td>0.069485</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>18.0052</td>
<td>11.35215</td>
<td>10.85124</td>
<td>5.077246</td>
<td>3.658686</td>
<td>0.931271</td>
<td>0.690291</td>
<td>0.580625</td>
<td>0.577585</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>40.47945</td>
<td>26.75758</td>
<td>24.28572</td>
<td>12.31884</td>
<td>8.173071</td>
<td>2.083969</td>
<td>1.545345</td>
<td>1.307692</td>
<td>1.287875</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>38.3333</td>
<td>24.3934</td>
<td>14</td>
<td>11.6667</td>
<td>7.740385</td>
<td>1.345056</td>
<td>1.4536366</td>
<td>1.238462</td>
<td>1.219697</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>857.1429</td>
<td>545.4545</td>
<td>514.2857</td>
<td>26.08956</td>
<td>173.7079</td>
<td>41.165464</td>
<td>32.717271</td>
<td>27.69231</td>
<td>27.272727</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>30</td>
<td>0.9909</td>
<td>18</td>
<td>2.130483</td>
<td>6.079982</td>
<td>0.150069</td>
<td>0.149540</td>
<td>0.969231</td>
<td>0.950543</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>59.5238</td>
<td>37.87875</td>
<td>35.17429</td>
<td>11.85134</td>
<td>12.19251</td>
<td>0.970059</td>
<td>2.7272725</td>
<td>1.920777</td>
<td>1.939159</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>839</td>
<td>240.0519</td>
<td>510</td>
<td>256.8937</td>
<td>171.6094</td>
<td>48.20505</td>
<td>39.401055</td>
<td>27.692452</td>
<td>27.046045</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>12.7691</td>
<td>8.121212</td>
<td>7.657143</td>
<td>3.834658</td>
<td>2.576942</td>
<td>0.6428577</td>
<td>0.4872772</td>
<td>0.413208</td>
<td>0.408883</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>1180.952</td>
<td>75.15152</td>
<td>706.75742</td>
<td>59.4200</td>
<td>236.6415</td>
<td>59.47242</td>
<td>0.093089</td>
<td>0.091585</td>
<td>0.2757576</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>14.52311</td>
<td>9.242424</td>
<td>7.14286</td>
<td>5.857143</td>
<td>4.585445</td>
<td>0.466321</td>
<td>0.462112</td>
<td>0.457958</td>
<td>0.4568539</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>75.0478</td>
<td>29.0697</td>
<td>25.2857</td>
<td>8.139099</td>
<td>8.578462</td>
<td>3.0361818</td>
<td>2.553945</td>
<td>2.125125</td>
<td>2.025125</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>36.3754</td>
<td>24.54545</td>
<td>23.14266</td>
<td>11.73153</td>
<td>7.784642</td>
<td>1.942446</td>
<td>1.621544</td>
<td>1.621544</td>
<td>1.227273</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>18.0052</td>
<td>11.35215</td>
<td>10.85124</td>
<td>5.077246</td>
<td>3.658686</td>
<td>0.931271</td>
<td>0.690291</td>
<td>0.580625</td>
<td>0.577585</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>32.14036</td>
<td>20.45455</td>
<td>15.28572</td>
<td>7.502099</td>
<td>6.045835</td>
<td>1.615656</td>
<td>1.2272727</td>
<td>1.227272</td>
<td>1.027275</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

The table presents part of the matrix scheme used in the analysis of the Karum Kanesh stones by J. Kool in 2012.
The logical composition of fractions and multiples.

When we find a weight that is lighter or heavier than one of the standard weights, it has to be considered as a possible logical fraction or multiple of one of the standard weights\(^8\). How can we decide that a fraction or multiple logically fits into a weighing set?

In Babylon we have documents indicating that they calculated on the basis of a sexagesimal system, but in other cases we do not know. Biased as we are we assume too soon that they used decimal systems.

And what is logical? When a two armed weighing balance is used, you do not need all kind of different weights, because you can work with the so-called subtraction weighing system.

For instance you do not need a weight for 6, 7, 8 or 9 grams, if you already have a weights of 1, 2, 3 and 10 grams. You simply put the 10 grams on one of the scales and 4, respectively 3, 2 and 1 grams on the other scale (were the goods to be weighted are placed.).

Modern standard weighing sets consist of milligrams 10, 10, 20, 50, 100, 100, 200, 500 and grams 1, 2, 2, 5, 10, 10, 20, 50. These are minimalistic sets that allow you to weigh up to 100 grams (Weegtechniek Holland BV 13/3/2012 http://www.weegtechniek.nl/pages/overzicht_ijk.php\(^9\)).

In practice you probably need a larger set than the minimal set and more than one specimen of each weight in order to speed up the weighing procedure and to reduce the complexity of the calculation (and the chance to make a mistake).

---

\(^8\) Or it could be an unknown city standard. But that assumption needs evidence.

\(^9\) William B. Hafford introduced in his article Hanging in the Balance (Hafford 2012, 36) the so-called Fibonacci \(*) numbers:

0-1-1-2-3-5-8-13-21-34-55-89-144 etc. (simply add each time the two previous numbers).

These numbers are the result of mathematical calculation but hardly useful for weighting in the daily practice and definitely inferior to the above mentioned minimalistic “Weegtechniek” set.

\(*\) The Fibonacci sequence is named after Leonardo of Pisa, who was known as Fibonacci (he was a member of the family Bonacci), but the sequence is probably much older (Old Sanskrit India).
Do we have clues about weight sets used in the MBA? Powell (Powell 1979, 73) investigated weight sets and found units of 10, 15, 20, 30, and 40 Shekels. According to him larger weights (multiples of the Manah) are easily distinguished. The identification of weights below 10 Shekel is uncertain and of weights below one Shekel very difficult. He assumes that weights of 1/3 and 1/2 are logical fractions of the Shekel used for weighing.

In fact we can conclude that we have little information about weight sets used during the MBA.

The logical fractions and multiples of standards found in Karum Kanesh.

As we have explained above, the logical fraction or multiple of the standard is a complicated issue. We have little information about the systems used in the MBA. When looking for the best solutions in our investigation of Karum Kanesh stones we found the following list of multiples or fractions of a standard (in times the standard):

0,2; 0,25; 0,33; 0,5; 1; 1,5; 2; 3; 3,5; 4; 5; 5,5; 10; 20; 30; 40; 50; 60; 65; 70; 100, 300, 625.

One can argue about the logic of multiples, but the most important argument for a logical fraction of multiple of weights is a positive answer to the question: what is efficient and useful when weighing with a two arms balance? I believe that all of the above multiples or fractions could have been used.

I have some doubts about a multiple of 3,5 (occurred once), 5,5 (occurred once), 65 (occurred only once) or of 625 (occurred twice).

First results of the test of Karum Kanesh weights.

(See also Table 2)

1. 70 out of a total of 75 stones show a perfect matching with a standard or its fraction/multiple. This represents 93 % of all stones.
2. 23 of the 75 stones (30,7 %) correspond precisely with one of the city standards (factor 1).
3. In three cases we had more than one possibility of an acceptable fitting and had to choose the best and most logical option.

The control or test group procedure.
In order to be sure of the reliability of our investigation, its methodology and results, we have to do an additional test (but the same as used before) with a random group of weights. The above mentioned calculated outcome of our investigation could have been a coincidence. Therefore I did a test investigation with a control group of random data to see if 75 random weights found anywhere would have given more or less the same result, making our investigation worthless.

I retrieved 75 ad random figures with 4 digits (xx,xx) between 0 and 100 from Random.org\textsuperscript{10} and did the same analysis as used for the Karum Kanesh stones.

The analysis of the test group gave the following results (figures and analyzes available in digital form):
1) In 19 cases I could not find any match with a deviation less than 2\% or any round figured multiple or fraction (to be compared with 0\% for the Karum Kanesh stones).
2) I found 29 hits but with illogical multiples/fractions (5 for the Karum Kanesh stones).
3) There were 10 good hits with a deviation less than 2\% deviation and a logical fraction/multiple. See used fraction/multiples above.
4) No direct hits (precisely the standard) on any of the standards (we had 33\% 1 to 1 hits in the Karum Kanesh stones investigation).
5) An amazing large number of 17 that hit the multiple 10 (4 for the Karum Kanesh stones).

If we compare the results of the two analyses we get the following outcome (See next page):

\textsuperscript{10} I retrieved 150 random double digit figures to get 75 4-digit figures from Random.org program on 29/11/11 at 20.16 hours.
Table 3. Comparison of results of the analysis of Karum Kanesh stones with those of the test group weights. Made by author, January 2012.

<table>
<thead>
<tr>
<th></th>
<th>The Karum Kanesh Weights</th>
<th>The random weights</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Number</td>
<td>%</td>
</tr>
<tr>
<td>Precisely the standard</td>
<td>23</td>
<td>30,67</td>
</tr>
<tr>
<td>Accurate hits *)</td>
<td>70</td>
<td>93,33</td>
</tr>
<tr>
<td>Hits, but no logical fraction/multiple</td>
<td>5</td>
<td>6,67</td>
</tr>
<tr>
<td>No hit</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>Total</td>
<td>75</td>
<td>100</td>
</tr>
</tbody>
</table>

*) deviation of less than 2 %

NB only 17 (24 %) of the KK weights had a deviation > 1 %!
Conclusions from the metrological-historical investigation.

We can state that the results of the analysis of the Karum Kanesh stones are quite satisfactory.

- My calculation proved that of all the 75 stone weights each stone could be traced back to a multiple or fraction of the 25 standards. If we subtract less logical multiples/fractions we have a score of 93% acceptable hits.
- The deviations were very low (all stones below 2%, 83% had a deviation < 1%), substantially below the norm of Rahmstorf and Powell (> 3%).
- The test with random figures showed substantially different results, confirming the usefulness of our tests.
- 23 stones (30%) were precisely a standard (1 to 1)
- The last Rahmstorf test: The underlying weighing system – multiples of a standard unit of mass – should be consistent, forming a logical sequence. Result: yes. The figures are convincing. Mark 8.

v. Were these weights used for commercial trade?

People have various reasons for weighing. Weighing had and has an important meaning and function for the ancient and modern populations. Why do people weigh things?

1) In some cases when the proportions of ingredients are critical for cooking.
2) For production of metal products made of alloy (bronze etc.) to get the right proportions.
3) To measure the amount of the material in stock instead of counting. For instance the counting of individual gains of cereals is not practical.
4) When you borrow goods to someone it is important to make sure that you get it all back.
5) To measure your own wealth. How much gold or other valuables do you have?
6) To make sure nobody is stealing your precious material during the production of artifacts (see silver weighing in Mari).
7) To measure value of commodities when trading (barter or in cash).

8) To measure “near money” in the form of precious metals for payment or calculation of the price of goods (Dercksen 1999, 4) and other reason.

Does that mean that in the MBA everybody used standard weights for these purposes? The logical answer is yes. But that does not say that everybody owned his own set of weights. Weights were very important and probably expensive items.11

They have been found in palaces, other official buildings and near markets, hardly in the local district of Kültepe. I assume that in the MBA high precision weights and balances were too costly to be owned by everyone and that ‘normal’ persons (not being kings or merchants) had to borrow these instruments when they needed them. The relatively large number of Karum Kanesh stone weights found in high concentration near the gate of Kanesh (indication of a market place) give a strong indication of trade activities.

Also Özgüç believes that the weights were owned and used especially by merchants and he states, referring to the Karum Kanesh weights:

“This are commercial weights and measures.(…..). The merchants use them in the archives and workshops and, at the time of the fire, left them behind for prosperity. The merchants carried these weights with them on long business journeys. Hence the number of weights in the leading trade city like Kanesh must have been high.” (1986, 78).

I think that Özgüç is right with his conclusion. The Karum was a merchant village next to the city of Kanesh. The weights were found there in context and consisted

---

11 As mentioned before haematite was a precious material – it was also used for jewelry production and the polishing was time consuming. Even if in those days time (and thus polishing) was cheap, then also the income of potential buyers (depending on their income from labor) was low. This means that haematite precision weighing stones were expensive tools for “normal” citizens.
of groups of stones belonging to various different (foreign) weight standards. That makes it very probable that they have been used for commercial purposes.

But then the question remains: how were the weights used by the merchants in Karum Kanesh? Possibly traders used local and foreign stone weight sets in the following situations in the MBA\textsuperscript{12}:

Closing a trading contract.
When a trader drafted a contract with a “foreign” party he had to agree with the other party about (amongst other issues) a) the weight of goods to be traded, b) the weight standard used and c) the price. If a foreign/ non local weight standard was used in the contract the trader had to convert weights and prices to local standards in order to be able to calculate the gross profit of the transaction. A conversion rate can be calculated with the use of a weighing balance and local and foreign stone weights\textsuperscript{13}.

As an alternative to using weights one can “simply” calculate the “other” weight with a well known and fixed conversion rate. In that case foreign weights are not needed at all. But the fact is that we did find foreign weights; apparently (most) traders preferred to weigh instead of calculate.

I have the following possible explanations for this phenomenon:
- Normal traders could not calculate *)
- Normal traders could not write *)
- Traders had more trust in weights than calculations.
- Using foreign weights was quicker and more efficient.

*) This means that writing contracts and making calculations was the task of specialists.

\textsuperscript{12} It is worth mentioning, that statistical analysis of stone weights found in Nippur, Iraq demonstrated that probably one single system of weights was used. Therefore Hafford (Hafford 2005, 345) concludes in his publication, that Nippur has been isolated “within a socio- economic system and a lack of incoming merchants from distant regions.”

\textsuperscript{13} If for instance the weight of 3 foreign standard weights equals 2 local standard weights, then one local weight = 1,5 foreign weight(s).
Purchase and dispatch of the goods.
For the purchase of the goods on the local market local weights were used. Before packing and dispatching the trader weighted the goods using the foreign weights in order to be sure to comply with the conditions of the contract.

Receipt of the goods.
Upon receipt of the goods the buyer had to verify the weights of the goods by weighing. He used the stone weights belonging to the weight standard (local or foreign) mentioned in the contract.

Traveling merchants.
It is possible that foreign traveling traders came to Karum Kanesh and brought their own weights with them (Özgüç 1986, 78). But why did they leave them in Karum Kanesh in or near the Karum? I believe that most stone weights found in Karum Kanesh belonged to traders living there, not to visiting traders from “abroad”.

A creditability mark of 8

vi. Did these stones refer to weight standards of various cities, indicating long distance trade?

The larger trading centers had and used weight sets representing standards of various cities. These various different sets were needed to do business with other trading centers.
My analysis shows that the 75 Karum Kanesh stone weights represent Anatolian/Hittite, Syrian, Ebla, Aegean, Old Mesopotamian Old Assyrian and Karkemish weight standards (or fractions or multiples thereof). These cities were at long distance of Karum Kanesh which indicates long distance trade. See the table below.
Table 4. Distribution of stone weights according to their links to city standards.
Made by the author 2012

<table>
<thead>
<tr>
<th>Numbers</th>
<th>City standard*</th>
<th>%</th>
</tr>
</thead>
<tbody>
<tr>
<td>32</td>
<td>Old Assyrian Shekel</td>
<td>42,67</td>
</tr>
<tr>
<td>8</td>
<td>Babylon Shekel</td>
<td>10,67</td>
</tr>
<tr>
<td>8</td>
<td>Egyptian Shekel</td>
<td>10,67</td>
</tr>
<tr>
<td>6</td>
<td>Aegean Shekel</td>
<td>8</td>
</tr>
<tr>
<td>5</td>
<td>Hittite Shekel</td>
<td>6,67</td>
</tr>
<tr>
<td>3</td>
<td>Syrian Shekel</td>
<td>4</td>
</tr>
<tr>
<td>3</td>
<td>Ebla Shekel</td>
<td>4</td>
</tr>
<tr>
<td>3</td>
<td>Manah Old Mesopotamia</td>
<td>4</td>
</tr>
<tr>
<td>3</td>
<td>Bitqu Old Mesopotamia</td>
<td>4</td>
</tr>
<tr>
<td>2</td>
<td>Halluru Old Mesopotamia</td>
<td>2,67</td>
</tr>
<tr>
<td>1</td>
<td>Karkemisch Shekel</td>
<td>1,33</td>
</tr>
<tr>
<td>1</td>
<td>Giru Old Mesopotamia</td>
<td>1,33</td>
</tr>
<tr>
<td>75</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

*) = standard or logical fraction/ multiple

A large number (42,67 %) of the weights were Assyrian standard weights (or logical fractions/ multiples thereof). This is hardly surprising for weights found in the Assyrian merchant colony of Karum Kanesh. Also the existence of some local Hittite weights in Karum Kanesh is to be expected. The substantial number of non Assyrian and non local weights found in Karum Kanesh could be an indication that merchants from other areas (Babylon, Egypt, Aegean region, Syria, Ebla etc.) visited Karum Kanesh to trade their products. But I prefer another explanation, as mentioned on the previous page. “Foreign” weights could demonstrate that merchants in Karum Kanesh entered into contracts with foreign parties and that these contracts contained “foreign” weight standards. Both explanations are strong indications that Karum Kanesh was involved in long distance trade.

Taking into account that the stones found in Karum Kanesh accounted to only 75, the above results have to be handled with care. But it is pleasantly surprising that
the outcome confirms the indication of trading activities in Karum Kanesh as mentioned in the clay tablet texts.

A creditability mark of 8

vii. Final conclusions of the investigation of the Karum Kanesh stone weights.

In the above analysis I have shown that the stone weights found in Karum Kanesh:

1) were genuine stone weights (Rahmstorf test),
2) could successfully be linked to weight standards of various different long distance trading centers,
3) The test with random figures confirms the usefulness of our methodology.
4) had very small deviations (83% < 1 %) and
5) consisted for almost 43 % of stones that correspond with the Assyrian weight standard or a logical multiple or fraction thereof. The remaining stones indicate links with other regions. It demonstrates that Karum Kanesh merchants traded at long distance, predominantly but not exclusively, with Assur.
6) I presume (see page 52-3), that the “foreign” stone weight stones belonged to (Assyrian) traders living in Karum Kanesh - not to visiting traders from “abroad” - and that they were used for the execution of long distance trade contracts that contained “foreign” weights.

This gives additional archaeological evidence that Karum Kanesh was a centre of a network of long distance trade routes between various trading centers, especially between Assur and Karum Kanesh.
IV. Archaeological evidence based on clay tablets.

This chapter describes my investigation with regard to the second scientific question; *are the clay tablets found in Karum Kanesh authentic, their texts unbiased and as such reliable (historical) sources of information?*

I wrote in the Introduction about historical evidence: “In these cases it is recommended to look for additional archaeological evidence based on material finds in order to mitigate the subjectivity of the written source”.

In my opinion clay tablets are material and archaeological artifacts. Their narratives may give historical evidence, but the material objects and the type of texts/language themselves can be looked at, analyzed and interpreted and can give archaeological evidence. I used this methodology to show that the clay tablets found in Karum Kanesh were genuine, that their texts are not biased and as such a reliable (historical) source of information.

On the next page you see a summary scheme of clay tablet texts written between 2025 and 1600 BC (Larsen 1987, 48). Most finds concern small amount of texts, but the Karum Kanesh and the Mari tablets were numerous. Wiggermann (Wiggermann 2002, 56-7) gives a concise explanation of texts on clay tablets:

“The texts are written on clay tablets: moist, carefully cleaned and well kneaded strips of clay. A clay tablet may vary in size from a few centimeters to a few decimeters. Large tablets are always square, but smaller ones are sometimes rectangular. (...) They wrote on clay tablets using a reed stylus a few decimeters long, called reed of the tablet by the ancient Mesopotamians. (...) Text recording important transactions were sealed in clay envelopes. To prevent fraud, the transaction was also mentioned on the envelope. If there was disagreement, the envelope was opened and the envelope text was compared with the original document. Fortunately, objects made of clay can be kept indefinitely once they have been dried or fired (...).”
<table>
<thead>
<tr>
<th>Time</th>
<th>Place</th>
<th>Type of document</th>
<th>Contacts</th>
<th>Imports</th>
<th>Exports</th>
</tr>
</thead>
<tbody>
<tr>
<td>2025–2000</td>
<td>Ur</td>
<td>admin.</td>
<td>Magan</td>
<td>copper, stone</td>
<td>textiles, wool, oil, barley</td>
</tr>
<tr>
<td>1930–1865</td>
<td>Ur</td>
<td>admin.</td>
<td>Dilmun</td>
<td>copper, ivory, pearls, spices</td>
<td>wool, silver, wheat, sesame</td>
</tr>
<tr>
<td>1920–1840</td>
<td>Kanesh</td>
<td>private</td>
<td>Assur East Anatolia</td>
<td>tin, textiles copper, wool</td>
<td>silver, gold, tin, textiles</td>
</tr>
<tr>
<td>1810–1790</td>
<td>Ur</td>
<td>private</td>
<td>Dilmun</td>
<td>copper</td>
<td>silver</td>
</tr>
<tr>
<td>1810–1765</td>
<td>Kanesh</td>
<td>private</td>
<td>Assur</td>
<td>textiles, tin?</td>
<td>silver</td>
</tr>
<tr>
<td>1785–1760</td>
<td>Mari</td>
<td>dipl. and admin.</td>
<td>Susa/Assur? Syria Babylonia Anatolia Cyprus</td>
<td>tin wine, wood</td>
<td>tin</td>
</tr>
<tr>
<td>1785–1600</td>
<td>Sippar</td>
<td>private</td>
<td>Eshnunna Zagros Syria Assur</td>
<td>tin slaves wood, wine, oil, aromatics</td>
<td>tin</td>
</tr>
</tbody>
</table>

Figure 7. Summary of main textual sources. Larsen 1987, 48.
i. The methodology of the investigation.

As I did not have access to the clay tablets themselves and cannot read the Old Assyrian/ Akkadian texts I made use of a large number of books, articles and archaeological reports about the OAT (Veenhof 1972, Özgüç 1986 and many others). See Bibliography.

On the basis of these reports and texts I have investigated the clay tablets in order to evaluate the authenticity and reliability of these tablets. The reliability depends mainly on the following elements:

1) The authenticity and dating of the tablets.
2) The site and context.
3) The purpose of the text.
4) The translation and interpretation by the translator.

All these elements will be discussed below.

ii. The authenticity and dating of the tablets.

Not all Karum Kanesh clay tablets have been found at the same time and under the same conditions/contexts (see for instance Palfi 2008, 3-4). We could divide them into three groups (Veenhof 1972, 456).

* The tablets found with low quality excavation techniques or found during clandestine (local habitants) excavations between approximately 1880 and 1925 AD.
* The tablets found during the first excavation of the Karum in 1925 AD by the Czech archaeologist Bedrich Hrozny.
* The tablets found between 1948 and 1990 AD by the Turkish archaeologist Tahsin Özgüç and from 2005 AD on by Fikri Kulaçoğlu.

In the late 19 century AD clay tablets appeared on the Istanbul and Kayseri markets. Nobody knew were they came from but one assumed that they came
Eventually Hrozny found the Karum and later a large number (1034) of clay tablets.

Özgüç worked in an archaeologically much more sophisticated way than Hrozny and found various stratigraphical layers in Kültepe and Karum. This allowed him to define an archaeological chronology of the Anatolian Middle Bronze Age. The main mound of Kültepe gave evidence of occupation during the early Bronze Age and the Middle Bronze Age. The Karum was only occupied during the Middle Bronze Age. The earliest levels of the Karum (Levels IV and III) yielded no tablets. Level II was apparently the most active period and produced many tablets (approx 19,000). These tablets have been dated to a period between approximately 1920 to 1830 BC (middle chronology) on the basis of stratigraphy and the references on the clay tablets to Assyrian rulers and eponym officials. Veenhof supplies a complete list of the eponyms during this period (2003).

Shortly after 1830 BC the village was destroyed and burned down during wars between regional princes. These fires baked many clay tablets which explain why most Level II tablets date to the second half of this first active period of trading. The karum and the city were abandoned for at least one generation. The fired clay tablets have been well preserved
Level Ib delivered much less clay tablets (520). Level Ia represents the last period of occupation; no clay tablet has been found in this level.

The clay tablets we know of have been transported to National Museum of Antiquities in Prague (the 1035 Hrozny tablets), the Anatolian Civilizations Museum at Ankara (more than 11,000 found by Özgüç and Kulaçoglu) and the Kayseri Archaeological Museum at Kayseri, near Kültepe (found by others). The clay tablet texts found by Hrozny are all published. In 1999 the Old Assyrian Text Project was started in order to update the translation of the Prague texts

---

14 The Old Assyrian Text Project has been established by a group of scholars: Gojko Barjamovic, Jan Gerrit Dercksen, Karl Hecker, Thomas Hertel, Bert Kouwenberg, Guido Krysztat, Mogens Trolle Larsen, Agnete Lassen, Cécile Michel, Nibal Muhesen, Xiaowen Shi, Ed Stratford and Klaas Veenhof. The project is sponsored by The Carlberg Foundation.
The tablets found clandestinely (local habitants) between approx. 1880 and 1925 have been traced to Layer II of the Karum on the basis of the type of texts, the Limmu names and the similarity with other texts found later.

Conclusion.
The authenticity and dating of the tablets have been well documented. Context and cross references of texts confirm the authenticity. In connection with the clandestine (local habitants) excavations by local habitants between approx. 1880 and 1925, I give a creditability mark 6,5.

iii. The site and context.

Kültepe was a town/city with five commercial quarters and local (autochthones), Assyrian and other “foreign” inhabitants (Palfi 2008, 3). They found in the Karum Assyrian texts in at least 70 different archives in buildings next to bullae (seals), pottery, metal objects and other stone objects (moulds, weights etc.). Apart from using their own Assyrian language and their Assyrian seals, the Assyrians lived in the Karum like the locals; they had Anatolian houses and used Anatolian tools and everyday pottery.

In local quarters in Kültepe typical Mesopotamian pottery has been found.

The number of clay tablets that has been discovered in the houses of the local (non-Assyrians) population is small.

Remains from the Karum Level II remind us to Pompeii:

A 2 meter high wall and a cooking pot abandoned on the burning hearth. There was apparently no time to remove the tablets from the hearth were

---

The database currently includes ca. 34.000 personal name entries drawn from ca. 6200 texts out of a total of ca. 10.000 available texts . [http://oatp.net/](http://oatp.net/) 12 5- 2012, 15:40.
they were fired. Jars filled with provisions. Pottery ready for sale in storage places, tools ready for use. (Özgüç 1986, IXX).

The disaster that hit Kültepe turned a lively and wealthy town – and especially the Karum – into a true time capsule for archaeologists. This enabled the excavators to define the locations of archives, houses, shops, workshops and places of manufacture and trade in the Karum. It is slightly disappointing that the precise location of the “Commercial Office”, temples, shrines, the court-house and the large storage building mentioned in the texts have not been found yet.

The report of Özgüç (Özgüç 1986, 2-21) gives us much information about the location where the clay tablets have been found and to which period (layer II or Ib) they belong. We can read in great detail about contexts, conditions and positions in specific houses.

To recite only a few examples:

- (Level II square B-C/9, Second building) “The store rooms have stone floors (…). One storeroom was chockfull of the handsomest pottery. All of it was new; none of it had been used in the household. It must have been stored as merchandise. On the floor of this storeroom we found four envelopes and a tablet impressed with a cylinder seal. (…). This is the only tablet with a cylinder seal (in level II, JK).”

- (Level II square A-B/9-10, Sixth building) “We came across (…) the presence of half fired archive tablets and unopened envelopes in the hearth (…) on top of the ashes. This find provides evidence that the merchants baked the tablets in their own houses.”

- (Level II square C-D/11-12, Fifth building) “One of the richest archives of the Karum of Kanesh was discovered. (…) This structure measures 14 x 8 m. In room 6, in the collapsed burnt debris of the upper floor, we found
1600 tablets and 400 envelopes of an Assyrian Merchant. (..). It is clear that the tablets at the time of conflagration fell from an upper archive room into the room on the ground floor.”

- (Level II square M-N/11-13, First building - belonging to merchant Shupi-ahshu-, room 8) “This room is at the lower level and the room has no doorway; it must have been a cellar reached by a stepladder. Both compartments (of the room, JK) were full of pots; because of the limited space, the vessels were stacked one on top of the other against the wall. The pots themselves contained smaller vessels. The small archive of Shupi-ahshu, consisting of tablets and unopened envelopes was found in this room on the floor near the pottery. (…) Archives are found to have been stored in pots, baskets and boxes on shelves and on straw matting in a room corner.”

The number of clay tablets found in Level Ib is much smaller than those found in level II. Probably the trade with Assur was declining (Özgüç 1986, 17). The tablets of Ib were discovered lying on dirt floors near walls, in a scattered fashion or were dispersed hoards. Other than those of level II, level Ib tablets have not been found stored in jars on shelves.

As a result of human interference (new buildings, agriculture) in the modern period, a few tablets have been mixed with tablets of other layers. This explains why some older tablets were found on the surface.

We have some, but not many, texts from other cities that mention Karum Kanes in connection with the long distance trade (see Figure 8). In EBA (approx 2300 BC) texts in Ebla (Larsen 1977, 120) we find a reference to trade between Assur and Karum Kanesh.

The texts (mainly royal inscriptions and administrative documents) found in Assur give only some background information about trade with Karum Kanesh and the OAT. We have to be aware, that the correspondence and administration found in
Karum Kanesh consisted of (copies of) letters from Karum Kanesh to Assur as well as from Assur to Karum Kanesh. Larsen describes the contacts between members of the family of Assus-idi, on the basis of 126 letters (Larsen 1977, 121). In these texts we can read a lot about Assur, Karum Kanesh and many other cities, Anatolian karums, small market places, customer/tax offices.

I have little doubt about context of the tablets found in Karum.

A creditability mark 8.

iv. The purpose of the texts.

The few texts found in the palace of Kültepe consist mainly of administrational information and official correspondence. The texts found in the Karum were quite different. There they were legal contracts, records of court cases, business correspondence, notes and commercial memos.

It is important to understand the difference between contracts and historical texts. Narrative texts that record historic or social events tend to give information as the writers want to see it. Commercial contracts are not written to give a personal opinion, but to register agreements and rights between two parties. Both commercial parties use these contracts to make sure that each one of them will fulfill his obligations. A contract can and will be used to check and control the execution of the agreement. That makes this type of text a very reliable source of information. Clay tablets that recorded important transactions were signed by the parties involved and their witnesses, put in clay envelopes and sealed. Probably duplicate tablets were made, one copy for each party. In fact they did everything in order to evidence the real existence of the agreement or contract.
The fact that most texts refer to commercial contracts and commercial administration forms a very strong basis for the reliability of the texts. Creditability mark 9.

v. The translation and interpretation by the translator.

The Karum Kanesh tablets were written in Old Assyrian, a dialect of Akkadian. The Assyrian languages of the tablets in the Layers II and Ib differed slightly, which corresponds with texts found in other places. Dr Dercksen gave me the confirmation that linguists and specialists in Akkadian languages have no doubt that the type of Assyrian language used in the Karum Kanesh texts is in accordance with the language used in other Assyrian texts of the same period. The quality of the translations is rather high due to the fact that quite a number of translators from different universities over a long period of time found only minor mistakes in previous translations. Creditability mark 8.

vi. Final conclusions of the investigation of the clay tablets.

All the above elements of evidence regarding the authenticity of the clay tablets and reliability of the texts contribute to the conviction that we can use the tablets and the texts as reliable source of information about the OAT.
Conclusions.

In this paper I have investigated two scientific questions about the OAT:

I. Can we find additional archaeological evidence that Karum Kanesh was a centre of long distance trade between various trading centers, especially between Assur and Karum Kanesh? This question has been answered on the basis of an analysis of 75 stone weights.

II. Are the clay tablets found in Karum Kanesh authentic, their legal and contractual texts un-biased and as such reliable (historical) sources of information?

Ad I. (Analysis of stone weights).

The various tests and the analyses of the Karum Kanesh stone weights confirm the existing hypothesis that Karum Kanesh was a centre of long distance trade, especially between Assur and Karum Kanesh. Let us look to the outcome of the tests.

Calculations indicate that almost all (93%) of the weighing stones can be retraced to standards of different trading centers/cities in the region. The majority of the weights (43%) can be linked to the Assyrian Shekel. Next came weights referring to Babylonian, Egyptian, Aegean, Hittite, Syrian, Ebba, Old Mesopotamian and Karkemish standards. This is in conformity with texts mentioning trade between these cities.

The deviations of the stone weights from the standards (in 83 % of the cases deviation was below 1 %) are much smaller than the 3 % mentioned by Rahmstorf and Powell. It could mean that the weighing balances used in Karum Kanesh were more precise than previously presumed and that the craftsmen were able to cut and polish the stone weights with a lot of precision.
The distribution of the stone weights shows a clear bias to lighter stones. I gave a few possible explanations on page 39. The most likely conclusion is that in Karum Kanesh merchants were specialized in trade of tin and other precious metals, like silver and gold. These metals were possibly used for payments, which explains why relatively light weights were used.

Few of the Karum Kanesh stone weights had weight marks. I assume that the weighing merchants used wooden boxes or wooden boards in or on which they placed the weights. One could read the weight of each weighing stone on (the side of) these boxes or boards.

The test with random figures confirms the usefulness of the methodology and the results of my investigation.

It is interesting to compare the results of my analysis of Karum Kanesh weights with the outcome of the investigations of weights found in Ḫattuša (see the results of my analysis in Annex B of this paper) and in Nippur (Hafford 2005, 345).

The weights found in Karum Kanesh could be linked to various other city weight standard and clearly indicate long distance trade. This is in contrast with the weights found in Ḫattuša and Nippur, that are almost exclusively weights of their local standard and indicating local trade. Hafford concludes (2005, 345) that Nippur has been isolated “within a socio-economic system and a lack of incoming merchants from distant regions.” The few Ḫattuša stones that I have analyzed give the impression that MBA Ḫattuša was a center of local trade with no or only a few contacts with other larger cities, that had other weight standards.

Ad II (Analysis of clay tablets).

The investigation of clay tablets show that they are authentic (on the basis of origin, context, and consistency with other texts) and can be dated and traced back (based on “limmu” names, language and function of the texts). They confirm an Assyrian origin. The fact that we have to do with legal and commercial contracts,
often signed by both parties and witnesses make these texts (other than most “normal” historical narratives) reliable sources of information.

The creditability of the evidence.
In addition to my decisive conclusions (see above), I add a qualitative approach of evidence finding, as explained in Chapter II i. It is an attempt to give a graduation of probability or creditability to specific evidence. In this case we have to do with various elements of evidence and each element has its own (subjective) importance and value.

I have given each element of evidence a mark for its creditability and a weighting of its importance, in the same way as a university gives marks to students for their exams and weightings (ECT’s) for the subjects studied.

This concluded (see Table 5 below) to an average and weighted final mark of 8 for the weights and 7,6 for the tablets. I am fully aware that these marks as well as weightings are subjective and can be criticized by others.

Table 5. Final weighted cumulative creditability of evidence. J. Kool 2012.

<table>
<thead>
<tr>
<th>Weights</th>
<th>Marks</th>
<th>Weighting</th>
<th>%</th>
<th>score</th>
</tr>
</thead>
<tbody>
<tr>
<td>genuine</td>
<td>7,5</td>
<td>15</td>
<td>1125</td>
<td></td>
</tr>
<tr>
<td>regular shape</td>
<td>8</td>
<td>10</td>
<td>0,8</td>
<td></td>
</tr>
<tr>
<td>similar mat.</td>
<td>8</td>
<td>8</td>
<td>0,64</td>
<td></td>
</tr>
<tr>
<td>dense</td>
<td>10</td>
<td>8</td>
<td>0,8</td>
<td></td>
</tr>
<tr>
<td>polished</td>
<td>10</td>
<td>5</td>
<td>0,5</td>
<td></td>
</tr>
<tr>
<td>incisions</td>
<td>5</td>
<td>2</td>
<td>0,1</td>
<td></td>
</tr>
<tr>
<td>in sets</td>
<td>7</td>
<td>3</td>
<td>0,21</td>
<td></td>
</tr>
<tr>
<td>range</td>
<td>8</td>
<td>5</td>
<td>0,4</td>
<td></td>
</tr>
<tr>
<td>settlements</td>
<td>7</td>
<td>4</td>
<td>0,28</td>
<td></td>
</tr>
<tr>
<td>scales</td>
<td>7</td>
<td>5</td>
<td>0,35</td>
<td></td>
</tr>
<tr>
<td>standards</td>
<td>8</td>
<td>5</td>
<td>0,4</td>
<td></td>
</tr>
<tr>
<td>context of trade</td>
<td>8</td>
<td>15</td>
<td>1,2</td>
<td></td>
</tr>
<tr>
<td>long dist trade</td>
<td>8</td>
<td>15</td>
<td>1,2</td>
<td></td>
</tr>
</tbody>
</table>

100 8
Clay tablets

<table>
<thead>
<tr>
<th></th>
<th>Marks</th>
<th>Weighting</th>
<th>score</th>
</tr>
</thead>
<tbody>
<tr>
<td>Authenticity</td>
<td>6,5</td>
<td>30</td>
<td>1,95</td>
</tr>
<tr>
<td>Site and context</td>
<td>8</td>
<td>30</td>
<td>2,4</td>
</tr>
<tr>
<td>Purpose of the text</td>
<td>8</td>
<td>20</td>
<td>1,6</td>
</tr>
<tr>
<td>Translation/interpretation</td>
<td>8</td>
<td>20</td>
<td>1,6</td>
</tr>
<tr>
<td></td>
<td>100</td>
<td></td>
<td>7,6</td>
</tr>
</tbody>
</table>

I hope that the transparency and vulnerability of this qualitative system eludes reactions which will contribute to a fruitful scientific discussion. Not so much a discussion about the question if a certain hypothesis is “valid” or “not true”, but (as long the thesis has not been falsified) about the gradation of creditability of arguments and final conclusion.
Summary

More than four thousand years ago active trading took place in Mesopotamia. In this paper I focus on the (Middle Bronze Age) Old Assyrian Trade between Assur in North Iraq and Karum Kanesh (the present date Kültepe) in the centre of Anatolia. We know quite a lot about this route because of the approximate 20,000 clay tablet texts found in Karum Kanesh/Kültepe. These texts consist predominately of commercial contracts and (legal) letters and they allow us to get a rather detailed impression of that trade. Clay tablets texts are good sources of information, but we have to be careful. Historical texts are not always accurate, often biased (propaganda) and as such not completely reliable. This means that we need additional information. In my investigation I have looked for archaeological confirmation of the existence of the long distance trade (OAT) using material evidence: stone weights and clay tablets found in Karum Kanesh.

A metrological- historical analysis of the stone weights demonstrates that almost each of the 75 stone weights belongs to one of the 25 known MBA city weight standards. In combination with their contexts they strongly indicate that Karum Kanesh was a centre of long distance trade. The (few) stone weights found in Nippur Hafford (2005, 345) and Ḫattuša indicate that these cities were different from Karum Kanesh. These cities were probably centers for local trade, with no or only a few contacts with other larger cities, which had other weight standards. I give a total weighted average creditability mark of 8 for the conclusion of the investigation of stone weights.

My investigation of the clay tablets has demonstrated their authenticity (origin, context, consistency with other texts and dating) and confirms an Assyrian origin.
The contents of the clay tablets (legal documents and contracts) make these texts (other than most historical narratives) relatively bias-free and as such reliable sources of information.

I give a mark for creditability and probability of 7.6 out of 10. This means that the texts are sufficiently reliable to be used for further investigations and conclusions.
Samenvatting.

Meer dan vier duizend jaar geleden was er al een levendige handel in het Nabije Oosten.

Mijn belangstelling gaat in het bijzonder uit naar de handel tussen Assur, de hoofdstad van Assyrië, gelegen in het noorden van het huidige Irak aan de voet van de rivier de Tigris en Karum Kanesh (het huidige Kültepe) in Cappadocië, Anatolië, gedurende de Midden Brons Tijd. Daarover weten wij aanzienlijk meer dan over de andere routes uit die tijd, dankzij de vondsten in Kültepe van ongeveer 20.000 kleitabletten.

Deze kleitabletteksten bestaan voornamelijk uit commerciële brieven en contracten en stellen ons in staat een redelijk gedetailleerd beeld te krijgen van langeafstandshandel in die tijd.

Kleitabletteksten leveren veel informatie op, maar de bronnen zijn eenzijdig. Historische teksten blijken niet altijd accuraat en vaak geschreven met een (bij-) bedoeling (bij voorbeeld propaganda), zodat de informatie veelal onbetrouwbaar is. Er is aanvullende informatie nodig.

In heb in mijn onderzoek van materiële vondsten - gewichtstenen en de kleitabletten, gevonden in Karum Kanesh- archeologische bevestiging gezocht voor het bestaan van deze lange afstandshandel.

Na een metrologisch-historische analyse van de gewichtstenen heb ik kunnen aantonen, dat nagenoeg ieder van de 75 Karum Kanesh gewichten behoort bij een van de 25 bekende stadsstandaarden voor gewichten uit die periode. Samen met de context van deze stenen duiden zij sterk op langeafstandshandel. Ik geef een hoge (maar subjectieve) waarschijnlijkheidsbeoordeling aan deze stelling (zie, Conclusions).

Mijn analyse van de Ḫattuša gewichtstenen en een onderzoek van Hafford (2005, 345) in Nippur duiden er op dat deze steden afwijken van Karum Kanesh. Zij hadden waarschijnlijk voornamelijk locale handel en onderhielden wellicht weinig
contact met andere grote “buitenlandse” (buiten de regio) handelssteden die andere gewichtsstandaarden hadden.

Hoe betrouwbaar waren de teksten op de kleitablen? Deze vraag heb ik onder andere onderzocht aan de hand van de vindplaatsen van de tabletten, context, consistentie met andere teksten en aanwijzingen op de tabletten (zegels, “Limmu” namen, taalgebruik, de functie van de teksten).
Hieruit blijkt dat de betrouwbaarheid vrij hoog is. Ik geef een ruime voldoende voor de betrouwbaarheid van deze stelling (zie Chapter IV, vi).
Dit betekent dat de teksten goed bruikbaar zijn voor verdere analyses en conclusies.
Bibliography

Adams, R., 1974. Anthropological Perspectives on Ancient Trade, Current Anthro-

pology 15, 239-57.

Cambridge: Cambridge University Press.


Ascalone, E. and L. Peyronel, 2006. Early Bronze IVA at Tell Mardikh- Ebla, in
Italiano di Numismatica, 49-7.


Holtorf and H. Karlsson (ed.), Philosophy and Archaeological Practice:
Perspectives for the 21st Century, Göteborg,153-72.

Verlag Gebr. Mann.

-64.


Dercksen, J.G., 1996. The Old Assyrian Copper Trade in Anatolia.
Istanbul/Leiden: Nederlands Instituut voor het Nabije Oosten.

Ancient Mesopotamia. Istanbul: Nederlands Historisch- Archaeologisch Instituut,
1-4.

Dercksen, J.G., 1999b. On the financing of Old Assyrian merchants, in J.G.

Dercksen (ed) Trade and Finance in Ancient Mesopotamia. Istanbul: Nederlands

het Nabije Oosten.


Joannes, F., 1989. La Culture Matérielle a Mari (IV) : Les Méthodes de Pesée.


Ankara: Turk Tarih Kurumu.


List of Figures:


2. Scheme of long distance trade in the MBA.

3. Chronological and geographical scheme of cities which were active in trading. Author, January 2012.

4. Some routes of the OAT.


7. Summary of main textual sources.
   Larsen M.T., 1987, Commercial networks in the Ancient Near East, Chapter 5 of *Centre and periphery in the ancient world* of M. Rowlands, M.T. Larsen and K. Kristiansen (eds), Cambridge University Press, Cambridge, 87

Tables (all made by the author 2012)

1. Histogram showing the distribution of the Karum Kanesh stone weights to their weights.
2. Part of the matrix scheme regarding the Karum Kanesh stones. Calculation model of author, January 2012.
3. Comparison of the results of the analysis of Karum Kanesh stones with those of the test group weights. Made by author, January 2012.
4. Distribution of stone weights according to their links to city standards.
5. Final weighted cumulative creditability of evidence.
Annexes.

A. List of Karum Kanesh stone weights.

<table>
<thead>
<tr>
<th>Series No.</th>
<th>Excavation Inv. No.</th>
<th>Museum Inv. No.</th>
<th>Length</th>
<th>Thickness</th>
<th>Weight gr.</th>
<th>Building level</th>
<th>Stone type</th>
<th>Plate</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>kt. a/k 690</td>
<td>130-30-64</td>
<td>4 cm</td>
<td>0.9 cm</td>
<td>8.17 Ib</td>
<td>Hematite</td>
<td>131,7</td>
<td></td>
</tr>
<tr>
<td>2</td>
<td>kt. b/k 271</td>
<td>—</td>
<td>3.7</td>
<td>1.3</td>
<td>68 Ib</td>
<td>Hematite</td>
<td>131,1</td>
<td></td>
</tr>
<tr>
<td>3</td>
<td>kt. b/k 317</td>
<td>2530</td>
<td>4.8</td>
<td>2.4</td>
<td>89 Ib</td>
<td>Hematite</td>
<td>131,2</td>
<td></td>
</tr>
<tr>
<td>4</td>
<td>kt. b/k 322</td>
<td>2652</td>
<td>5.3</td>
<td>2.5</td>
<td>81 Ib</td>
<td>Hematite</td>
<td>131,4</td>
<td></td>
</tr>
<tr>
<td>5</td>
<td>kt. b/k 323</td>
<td>2653</td>
<td>5.6</td>
<td>2.2</td>
<td>80 Ib</td>
<td>Hematite</td>
<td>131,4</td>
<td></td>
</tr>
<tr>
<td>6</td>
<td>kt. b/k 472</td>
<td>5048</td>
<td>4.4</td>
<td>1.9</td>
<td>42 Ib</td>
<td>Hematite</td>
<td>131,4</td>
<td></td>
</tr>
<tr>
<td>7</td>
<td>kt. e/k 50</td>
<td>125-4-64</td>
<td>5.7</td>
<td>1.4</td>
<td>24.35 x Ib</td>
<td>Hematite</td>
<td>131,4</td>
<td></td>
</tr>
<tr>
<td>8</td>
<td>kt. e/k 380</td>
<td>125-110-64</td>
<td>2.8</td>
<td>1</td>
<td>8.05 II</td>
<td>Hematite</td>
<td>131,8</td>
<td></td>
</tr>
<tr>
<td>9</td>
<td>kt. f/k 131</td>
<td>116-39-64</td>
<td>5.8</td>
<td>2</td>
<td>62.70 II</td>
<td>Hematite</td>
<td>131,9</td>
<td></td>
</tr>
<tr>
<td>10</td>
<td>kt. f/k 144</td>
<td>—</td>
<td>1.3</td>
<td>0.3</td>
<td>0.65 Ib</td>
<td>Hematite</td>
<td>131,4</td>
<td></td>
</tr>
<tr>
<td>11</td>
<td>kt. f/k 205</td>
<td>116-6-64</td>
<td>2.8</td>
<td>0.8</td>
<td>3.80 x II</td>
<td>Hematite</td>
<td>131,4</td>
<td></td>
</tr>
<tr>
<td>12</td>
<td>kt. f/k 400</td>
<td>116-85-74</td>
<td>3.4</td>
<td>0.9</td>
<td>8.10 Ib</td>
<td>Tomb Hematite</td>
<td>131,8</td>
<td></td>
</tr>
<tr>
<td>13</td>
<td>kt. g/k 44</td>
<td>117-24-64</td>
<td>3.3</td>
<td>1</td>
<td>8.5 Ib</td>
<td>Hematite</td>
<td>131,10</td>
<td></td>
</tr>
<tr>
<td>14</td>
<td>kt. g/k 114</td>
<td>117-6-64</td>
<td>3.5</td>
<td>1</td>
<td>8.05 x Ib</td>
<td>Hematite</td>
<td>131,10</td>
<td></td>
</tr>
<tr>
<td>15</td>
<td>kt. i/k 47</td>
<td>27-6-64</td>
<td>6.9</td>
<td>3.2</td>
<td>180 x II</td>
<td>Hematite</td>
<td>131,12</td>
<td></td>
</tr>
<tr>
<td>16</td>
<td>kt. i/k 38</td>
<td>127-7-64</td>
<td>2.5</td>
<td>1</td>
<td>6.30 x Ib</td>
<td>Hematite</td>
<td>131,12</td>
<td></td>
</tr>
<tr>
<td>17</td>
<td>kt. i/k 6c</td>
<td>127-8-69</td>
<td>4.1</td>
<td>1</td>
<td>12.50 II</td>
<td>Hematite</td>
<td>131,14</td>
<td></td>
</tr>
<tr>
<td>18</td>
<td>kt. i/k 185</td>
<td>405</td>
<td>6.3</td>
<td>3.6</td>
<td>178.5 II</td>
<td>Hematite</td>
<td>131,14</td>
<td></td>
</tr>
<tr>
<td>19</td>
<td>kt. i/k 267</td>
<td>17-10-64</td>
<td>1.8</td>
<td>0.7</td>
<td>2.68 Ib</td>
<td>Hematite</td>
<td>131,14</td>
<td></td>
</tr>
<tr>
<td>20</td>
<td>kt. i/k 184</td>
<td>19571</td>
<td>2.2</td>
<td>1.2</td>
<td>16.50 II</td>
<td>Hematite</td>
<td>131,14</td>
<td></td>
</tr>
<tr>
<td>21</td>
<td>kt. m/k 226</td>
<td>116-63-64</td>
<td>2.0</td>
<td>1.4</td>
<td>4.05 Ib</td>
<td>Hematite</td>
<td>131,11</td>
<td></td>
</tr>
<tr>
<td>22</td>
<td>kt. n/k 205</td>
<td>120-120-64</td>
<td>2.2</td>
<td>0.8</td>
<td>3.05 II</td>
<td>Hematite</td>
<td>131,11</td>
<td></td>
</tr>
<tr>
<td>23</td>
<td>kt. n/k 256</td>
<td>120-121-64</td>
<td>4.4</td>
<td>1.3</td>
<td>16.60 II</td>
<td>Hematite</td>
<td>131,11</td>
<td></td>
</tr>
<tr>
<td>24</td>
<td>kt. o/k 135</td>
<td>126-64-64</td>
<td>3.1</td>
<td>0.9</td>
<td>8.10 Ib</td>
<td>Hematite</td>
<td>131,11</td>
<td></td>
</tr>
<tr>
<td>25</td>
<td>kt. p/k 10</td>
<td>94-100-64</td>
<td>1.8</td>
<td>0.8</td>
<td>3.95 II</td>
<td>Hematite</td>
<td>131,11</td>
<td></td>
</tr>
<tr>
<td>26</td>
<td>kt. p/k 165</td>
<td>94-83-64</td>
<td>2.4</td>
<td>1</td>
<td>6.75 Ib</td>
<td>Hematite</td>
<td>131,11</td>
<td></td>
</tr>
<tr>
<td>27</td>
<td>kt. p/k 172</td>
<td>94-87-64</td>
<td>8.8</td>
<td>2.2</td>
<td>185 Ib</td>
<td>Hematite</td>
<td>131,11</td>
<td></td>
</tr>
<tr>
<td>28</td>
<td>kt. r/k 124</td>
<td>5048</td>
<td>4.2</td>
<td>1.6</td>
<td>14.5 x</td>
<td>Rock Crystal</td>
<td>131,17</td>
<td></td>
</tr>
<tr>
<td>29</td>
<td>kt. r/k 195</td>
<td>5049</td>
<td>3.5</td>
<td>1.5</td>
<td>10.2 x Ib</td>
<td>Rock Crystal</td>
<td>131,18</td>
<td></td>
</tr>
<tr>
<td>30</td>
<td>kt. s/k 53</td>
<td>177-6-74</td>
<td>3.3</td>
<td>0.9</td>
<td>24.50 x II</td>
<td>Hematite</td>
<td>131,23</td>
<td></td>
</tr>
<tr>
<td>31</td>
<td>kt. s/k 54</td>
<td>177-7-74</td>
<td>3.3</td>
<td>0.9</td>
<td>8 x II</td>
<td>Hematite</td>
<td>131,24</td>
<td></td>
</tr>
<tr>
<td>32</td>
<td>kt. s/k 55</td>
<td>177-8-74</td>
<td>3.6</td>
<td>0.6</td>
<td>3.22 x Ib</td>
<td>Hematite</td>
<td>131,32</td>
<td></td>
</tr>
<tr>
<td>33</td>
<td>kt. t/k 77</td>
<td>5776</td>
<td>3.6</td>
<td>0.8</td>
<td>8.6 x II</td>
<td>Hematite</td>
<td>131,32</td>
<td></td>
</tr>
<tr>
<td>34</td>
<td>kt. v/k 74</td>
<td>6502</td>
<td>4.9</td>
<td>1.5</td>
<td>24.5 x Ib</td>
<td>Stone Hematite</td>
<td>131,20</td>
<td></td>
</tr>
<tr>
<td>35</td>
<td>kt. y/k 33</td>
<td>101-16-74</td>
<td>2.9</td>
<td>0.4</td>
<td>1.80 x Surface</td>
<td>131,20</td>
<td></td>
<td></td>
</tr>
<tr>
<td>36</td>
<td>kt. y/k 37</td>
<td>71-115-116</td>
<td>4.9</td>
<td>2</td>
<td>41 Purchased</td>
<td>Stone</td>
<td>131,20</td>
<td></td>
</tr>
</tbody>
</table>

Figure 9. List of Karum Kanesh stone weights (Özgüç 1986, 79).
B. Analysis of weights found in Boğazköy III (Ḫattuša).

Boğazköy is the modern city in Turkey where the remains of the old Hittite city of Ḫattuša have been found. In the period between approx. 1750 and 1400 BC Ḫattuša was the main city of the Old Hittite Empire. Assyrians were important traders and had a karum (colony) near the city, just like in Karum Kanesh. The Karum in Ḫattuša was smaller than Karum Kanesh; its existence partly overlapped with the latter. According to Özgüç (Özgüç 1986, 12) the architecture of the buildings in Karum Kanesh level II are very similar to those found in Boğazköy.

It is interesting to look if we can find differences of trading practices between these two karums on the bases of stone weights.

In an excavation by a German group headed by Kurt Bittel between 1952 and 1955 five stone weights have been found in Boğazköy, two stones (nrs 4 and 6) in Boğazkale and the others in the karum (Bittel 1957, 31-32). Boehmer found one stone (Boehmer 1979, 55, pl 33). All these stones date from approximately 1750-1400 BC.

I have analyzed the six stone weights mentioned above (see Table 6) with the same model and method that I used for the Karum Kanesh weights and came to the following conclusions:

1) The 6 stone weights cannot be representative for the (sets of) stones that probably have been used in Ḫattuša. We have little information about the contexts, which means that the conclusions have to be regarded with care.

2) Are these stones stone weights? If we apply the Rahmstorf criteria we can conclude that the Ḫattuša stones are in conformity with the requirements 1, 2, 3, 4, 8 and 9. We cannot find any incisions on the stones (requirement 5). The number of six stones is too small to be able to decide if they were use in sets (requirement
6), to see a range of different examples of weights from light to heavy (requirement 7) or to establish a logical sequence of weights (requirement 10). I conclude that we have a reasonable probability that the Ḫattuša stones are authentic weighing stones.

3) Two stones had low weights (3 resp. 5.76 grams), four had much higher weights (59.0 grams; 115.7 grams; 140 grams; and 513 grams). This could indicate that other than in Karum Kanesh the weighing did not exclusively concern small and light amounts of precious metals. One stone was in a form of a duck, one stone was made of lead in a disk form. One stone had a trapezoid form. The others were made of stone (probably all of haematite) and had langoval forms. Stone nr 4 date to the 14th century BC. And nr 6 to the late Old Hittite period.

4) The Analysis based on low deviations and logical fractions/multiples of weight standards link five of six stones to a heavy (11.75 grams) or light (11.4 grams) Hittite Shekel. One stone (nr 5) could be either a stone of 45 Hittite Shekel (with a deviation of 0%), one Manah (deviation of 3.1%) or 60 Old Assyrian Shekels (deviation of 0.825%). I did not find other logic and better fits to any other of the 25 weight standards.

5) This result gives an indication that merchants living in the Ḫattuša in the LMA used predominately local Hittite weights.
Table 6. Part of Excel model for the analysis of the Ḫattuša stone weights. J. Kool

<table>
<thead>
<tr>
<th>Ḫattuša</th>
<th>Boğazköy</th>
<th>6,8</th>
<th>7,83</th>
<th>8,1</th>
<th>8,257</th>
<th>8,3</th>
<th>8,4</th>
<th>8,48</th>
<th>9</th>
<th>9,4</th>
<th>9,7</th>
<th>11,4</th>
<th>11,75</th>
<th>473</th>
<th>497,7</th>
</tr>
</thead>
<tbody>
<tr>
<td>Ebla</td>
<td>Kar S</td>
<td>OAS uw</td>
<td>OAS D.</td>
<td>OAS av.</td>
<td>OAS old</td>
<td>Bab S</td>
<td>Syr S</td>
<td>O</td>
<td>Hitt S.</td>
<td>Hitt S.</td>
<td>Minas Eb</td>
<td>manah</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>0,441176</td>
<td>0,383142</td>
<td>0,37037</td>
<td>0,363328</td>
<td>0,361446</td>
<td>0,357143</td>
<td>0,353774</td>
<td><strong>0,333333</strong></td>
<td>0,319149</td>
<td>0,309278</td>
<td>0,263158</td>
<td><strong>0,255319</strong></td>
<td>0,006342</td>
<td>0,006028</td>
<td></td>
<td></td>
</tr>
<tr>
<td>0,847059</td>
<td>0,735632</td>
<td>0,711111</td>
<td>0,69759</td>
<td>0,693976</td>
<td>0,685714</td>
<td>0,679245</td>
<td>0,64</td>
<td>0,612766</td>
<td>0,593814</td>
<td><strong>0,505263</strong></td>
<td>0,490213</td>
<td>0,012178</td>
<td>0,011573</td>
<td></td>
<td></td>
</tr>
<tr>
<td>17,01471</td>
<td>14,7765</td>
<td>14,28395</td>
<td>14,01235</td>
<td>13,93976</td>
<td>13,77381</td>
<td>13,64387</td>
<td>12,85556</td>
<td>12,30851</td>
<td>11,92784</td>
<td><strong>10,14912</strong></td>
<td>9,846809</td>
<td>0,244609</td>
<td>0,232469</td>
<td></td>
<td></td>
</tr>
<tr>
<td>20,58824</td>
<td>17,87995</td>
<td>17,28395</td>
<td>16,95531</td>
<td>16,86747</td>
<td>16,66667</td>
<td>16,50943</td>
<td>15,55556</td>
<td>14,89362</td>
<td>14,43299</td>
<td>12,2807</td>
<td><strong>11,91489</strong></td>
<td>0,295983</td>
<td>0,281294</td>
<td></td>
<td></td>
</tr>
<tr>
<td>75,44118</td>
<td>65,51724</td>
<td>63,33333</td>
<td>62,1291</td>
<td>61,80723</td>
<td>61,07143</td>
<td><strong>60,49528</strong></td>
<td>57</td>
<td>54,57447</td>
<td>52,8866</td>
<td>45</td>
<td>43,65957</td>
<td>1,084567</td>
<td>1,030741</td>
<td></td>
<td></td>
</tr>
<tr>
<td>8,676471</td>
<td>7,535121</td>
<td>7,283951</td>
<td>7,145452</td>
<td>7,108434</td>
<td>7,02381</td>
<td>6,957547</td>
<td>6,555556</td>
<td>6,276596</td>
<td>6,082474</td>
<td>5,175439</td>
<td><strong>5,021277</strong></td>
<td>0,124736</td>
<td>0,118545</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Stone nr</th>
<th>weight</th>
<th>choice 1</th>
<th>div</th>
<th>choice 1</th>
<th>div</th>
<th>choice 3</th>
<th>final choice</th>
<th>Div in %</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>3</td>
<td>0,25</td>
<td>2,12766</td>
<td>0,3333</td>
<td>0</td>
<td>0,25 Hit 11,75</td>
<td>2,10%</td>
<td>0,333 Bab Sh. 0%</td>
</tr>
<tr>
<td>2</td>
<td>5,76</td>
<td>0,5</td>
<td>1,052632</td>
<td>0,3333</td>
<td>0</td>
<td>0,5 Hit 11,75</td>
<td>1,05</td>
<td></td>
</tr>
<tr>
<td>3</td>
<td>115,7</td>
<td>10</td>
<td>1,491228</td>
<td>0,3333</td>
<td>0</td>
<td>10 Hitt 11,4</td>
<td>1,49</td>
<td></td>
</tr>
<tr>
<td>4</td>
<td>140</td>
<td>12</td>
<td>0,70922</td>
<td>0,3333</td>
<td>0</td>
<td>12 Hitt 11,75</td>
<td>0,71</td>
<td></td>
</tr>
<tr>
<td>5</td>
<td>513</td>
<td>45</td>
<td>0</td>
<td>3,074141</td>
<td>60</td>
<td>45 Hit 11,4</td>
<td>0,01 manah 3,1%; 60 OAS 0,825%</td>
<td></td>
</tr>
<tr>
<td>6</td>
<td>59</td>
<td>5</td>
<td>0,425532</td>
<td>0,3333</td>
<td>0</td>
<td>5 Hit 11,75</td>
<td>0,425</td>
<td></td>
</tr>
</tbody>
</table>
Figures 9. Scheme of weight standards in the Anatolian Bronze and Iron Age (Bobokhyan 2009, 44)