THE IDENTIFICATION OF SCRIBAL HANDS
ON THE BASIS OF AN OLD ASSYRIAN ARCHIVE

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Vorsitzender der Prüfungskommission: Prof. Dr. Alessandro Bausi

1. Gutachterin: Prof. Dr. Dr. h. c. Cécile Michel

2. Gutachter: Dr. Jan Gerrit Dercksen

Disputation am 26.09.2019

Eidesstattliche Erklärung

Hiermit erkläre ich an Eides statt, dass ich diese Arbeit selbstständig und ohne fremde Hilfe verfasst, keine anderen als die angegebenen Quellen und Hilfsmittel benutzt und die wörtlich und inhaltlich übernommenen Stellen als solche kenntlich gemacht habe.

Ich habe mich erstmals und nur an der Universität Hamburg zur Zulassung zu einer Doktorprüfung beworben. Kein Teil dieser Dissertation ist bislang veröffentlicht.

Hamburg, Januar 2019

Wiebke Beyer

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Chapter 1: Introduction

1.1 Outline

Cuneiform script is one of the oldest known scripts of the world and, with c. 4,300 years, it is also the script with the longest use. It is known that professional scribes existed, and for several occupational groups, such as scholars and priests, it was necessary to be literate. Furthermore, it is assumed that additional parts of the population might have been literate as well, even though on a rather basic level. However, these assumptions, especially for the earlier phases of cuneiform script, are hardly proven yet. The texts are often not signed, and modern studies on this topic are rarely conducted.

The aim of the present study is to develop a method for identifying scribal hands of cuneiform manuscripts. The focus lies on the Old Assyrian period (19th century BC), and the initial point for the study is the delimited and coherent corpus of an archive excavated in 1993 in Kaneš belonging to a small number of individuals. Furthermore, the question of education in this period is addressed by introducing a new approach based on the comparison of cuneiform script. Finally, a preliminary computer program is introduced which aims to cluster objects on the basis of their similarities.

1.2 The Old Assyrian Period – an Introduction[1]

The term "Old Assyrian period" refers to the beginning of the second millennium BC. For c. three centuries, inhabitants of the ancient city of Aššur, located at the Tigris river in modern Iraq, built up a large trading network in central Anatolia.[2] They established several settlements on the Anatolian Plateau with the city of Kaneš (modern Kültepe) as its centre. The ancient settlement consisted of a round citadel with temples and palatial structures, and a surrounding lower town with industrial and residential quarters, protected by a fortification wall. From this lower town, so far only c. nine hectares were excavated in regular excavations from 1948 to 2005.[3] From the 112 houses which could be identified in this area, 49 were presumably inhabited by the Assyrian merchants and their families (Hertel 2014, 27, 30-31).[4] In many of these houses, private archives were found belonging mainly to the Assyrian merchants and

1 For general information about Kaneš see for example Larsen (2015), Michel (2001), Veenhof (2008).
2 For a detailed analysis of the trading network and the Assyrian settlements see Barjamovic 2011.
3 See for the archaeological reports i.a. the bibliography of Hertel (2014, 52-54, especially Kulakoğlu, Mellink, and Özgüç), and Kulakoğlu (2015, with references to the excavation reports of T. Özgüç).
4 For a detailed overview of the lower town, and additional excavated houses see Hertel (2014).

their families,[5] some of whom lived there for several generations.[6] So far, c. 22,500 cuneiform tablets were discovered, which is according to Streck the third largest Akkadian text corpus (2010, 54). Michel (*in press*, 2)[7] noted that 22,460 tablets were discovered in private archives in the residential houses in the lower town, and 40 in the upper town on the mound.[8] From the tablets of the lower town, c. 22,000 are dated into the 19th century (level II), and the remaining 460 into the later phase of the Assyrian trade in the 18th century (level Ib).

These texts contain a lot of information about the large Assyrian commercial network.[9] Donkey caravans transported huge shipments of tin, woollen textiles, and also lapis lazuli from Aššur to Anatolia. Aššur itself was rather poor in resources, they only produced some of the textiles and the equipment for the donkeys (Michel *in press*, 2). Instead, it was an important place of transshipment of goods from the east and south-east. In Anatolia, the merchants sold the commodities for silver and gold which was sent back to Aššur to purchase new goods. Furthermore, the Assyrians also engaged in copper trade in Anatolia.[10]

There are mainly three text categories in such an archive: letters, legal documents, and various private texts like notes and non-commercial documents. Each of these categories reflects the needs of a travelling merchant. Since they were frequently *en route* and travelled between Aššur and Kaneš as well as in Anatolia, letters were an essential communication medium.[11] Consequently, they usually form a large part of the archive of around 40 to 45 % (Michel 2018, 52). In Akkadian, they are named *tuppum* ("tablet") or *našpertum* ("message") and were normal clay tablets without a standard size. Instead, their size depended on the length of the message the sender wanted to convey. Thus, there are letters with only a few lines, and letters with more than a hundred lines (Michel 2018, 52-53). They "contain an enormous amount of valuable information on the trade proper (…), on persons involved in the trade (…), and on the great variety of problems encountered (...)" (Veenhof 2003, 87-88). The original letters can certainly be found in the archives of the addressees, but also the sender himself could

5 Also some Anatolian archives were discovered, but the focus of this study is on the archives of the Assyrian merchants and their families. For literature see Michel (2011b).
6 For detailed analyses of the Old Assyrian archives see Michel (2015d, 2018), and Veenhof (2003, 2013).
7 For a general bibliography of the Old Assyrian texts and their publications see Michel (2003, 2006, 2011a, 2015a).
8 Michel also notes that "for Aššur, the home city of the Assyrian merchants, the Old Assyrian level has not been excavated; only 25 tablets from this period have been unearthed, discarded in later levels" (*in press*, 2).
9 See for a detailed overview of the Old Assyrian trade for example Larsen (1976, 2015), Veenhof (2008).
10 See for a detailed study on the copper trade Dercksen (1996).
11 For more information on letters see Beyer (*unpublished* MA thesis), Michel (2008c, 2015c).

keep copies of his correspondence, as the merchant Imdīlum wrote: “I keep copies of all the letters which I send to you” (Veenhof 2003, 89-90).

The legal documents comprise mainly contracts and judicial records.[12] The contracts concern all areas of the daily life of a trader, such as loans and (re)payments, investments and deposits, service contracts with the caravan personnel and partnerships, etc. And they also concern their private lives like marriage and divorce, adoption and wills (Veenhof 2003, 92). Judicial records include “witnessed depositions, records of private arbitration cases, binding orders, verdicts, etc.” (Michel 2018, 54).[13]

Miscellaneous texts comprise mainly private notes, lists, memos etc. Michel (2018, 56) defines them as all the texts “which have no legal value, and are no letters”.[14] This group of texts makes up 20 to 30 % of an archive, and the majority of them were probably used as memory aid. They are mostly anonymous which often makes their assignment to an individual and the classification of the information into a context difficult (Veenhof 2003, 96-97).

By analysing the dated written material of the Old Assyrian period, Barjamovic *et al*. (2012, 55-60) noticed that approximately 90 % of the corpus was produced in the short period of c. 35 years (c. 1895-1860 BC) by probably not more than 1,000 people. The question is, however, who was able to write?

1.3 Cuneiform Script and Literacy

The oldest tablets are dated into the late 4th millennium BC (c. 3200), the latest examples we have were produced in the 1st century CE. The earliest texts were discovered in ancient cities in southern Mesopotamia, such as Uruk, Fara, and Jemdet Nasr. Because of these early findings, it is believed that the script was also invented in this area between the two rivers Euphrates and Tigris. From there, the script spread over the entire Middle East in the following millennia.[15] Many languages were written with cuneiform script over time, but the two main languages were Sumerian and Akkadian.

12 Old Assyrian legal practices and the respective textual sources were thoroughly discussed by Hertel (2013, esp. 133-183).
13 See for an elaborate study of this material also Hertel (2013).
14 See also Ulshöfer (1995, 14), she defined these private memoranda as “Gedächtnisstütze (…) das Fehlen der Zeugenliste markiert den Text als nicht rechtsverbindlich, es liegt vielmehr eine private Aufzeichnung vor”.
15 There is extensive literature on that topic, for example Charpin (2010), Finkel/Taylor (2015), Lion/Michel (2008).

The first tablets from around 3200 BC contained mainly economic records, and a few word lists (for teaching purposes). The signs written on them were naturalistic pictograms, drawn into the clay. The "texts" contained numbers and objects, but were written without any grammatical element. Therefore, the definite identification of the language is not possible, although Michalowski points out that "phonetic glosses within certain signs, however, strongly suggest that the administrative language was indeed Sumerian" (2004, 20).

Over the course of the next few centuries, the signs changed from a pictographic to a more stylised form by impressing wedges instead of drawing lines (see below n.23). Furthermore, syllabic components were formed. Krebernik and Nissen explain that the first step of this evolution was the depiction of similar sounding words with the same logogram; in the following, the same method was then applied to non-meaning syllables, too (1994, 285). A sign could represent several words, but it could also represent the syllabic value of their pronunciation. The first texts with grammatical elements are dated into the first half of the 3rd millennium BC (c. 2800-2600 BC), and they attest and clearly identify the Sumerian language. It is an isolated, agglutinating ergative language which was presumably spoken for several centuries before it was replaced by Akkadian as everyday language.[16]

The Akkadian language is a Semitic language named after the Akkadian state (c. 24th - 22nd century BC).[17] After the collapse of this state, Sumerian had a short revival in the Ur III period, before it was finally replaced by Akkadian as the everyday language from the beginning of the 2nd millennium BC onwards.[18] While all the early attestations of Akkadian from the 3rd millennium are summarised under the term Old Akkadian, from the 2nd millennium onwards, Akkadian is divided into the two main dialects: Assyrian in the north of Mesopotamia, and Babylonian in the south.[19] While Sumerian was written with a logographic writing system with a rather limited use of syllabic signs, Akkadian is an inflected language featuring multiple grammatical elements which had to be expressed by cuneiform. Therefore, the character of the script was transformed to a predominantly syllabic writing system, mixed with logographic elements. In the course of this adjustment, the sign repertoire became smaller. While logographic systems need many signs to express different words, syllabic

16 For an overview and further literature see Larsen (1989), Michalowski (2004), Zólyomi (2006).

17 The Akkadian state is named after its capital Akkad which must have been located somewhere in northern Babylonia, but it has not been discovered yet.

18 Sumerian was not spoken anymore, but it was still important as as high prestige liturgical language, used in temples and schools. In addition, it was continuously used as a logographic component of the writing system. For the conservative character of cuneiform script, see Larsen (1989, 128).

19 See for an overview of the language Huehnergard (2011, xxiii-xlii), Streck (2006, 44-79).

systems need much less (Larsen 1989, 131-132). Also the appearance of the cuneiform script changed drastically. In general, the signs became progressively simpler over the course of time. The number of wedges decreased, and naturalistic pictograms turned to stylised and abstract signs.

1.4 The Materials and the Mechanical Process

The name cuneiform comes from the Latin term *cuneus* “wedge”, referring to the shape of the single stroke of which the signs consist. The main writing medium for the script were tablets made of fresh clay. With a stylus, the wedges were impressed into the clay. The stylus was called GI DUB(-BA) in Sumerian, and *qan tuppi* in Akkadian. Both can be translated as “tablet reed”. This indicates that originally the stylus for cuneiform writing was made of reed (Cammarosano 2014, 65). This material must have been always available along the rivers where the ancient cities were located (Finkel/Taylor 2015, 74). Cammarosano investigated the material and identified *Arundo donax*, the so-called giant reed, as the most likely source for the ancient writing tool. The plant grows up to 9 m, and has a diameter of 3,5 cm. For the stylus, the cane was cut to a convenient length, and the tip was cut with three angles which was important for the triangular impression of the wedges. The exact form of the styli, however, is unknown today because no exemplar survived. In addition to reed, from at least the beginning of the 2nd millennium BC onwards, also other materials were presumably used like bone, antler, and horn, but also wood (in Anatolia), and precious metals like gold and silver (Cammarosano 2014, 65-68, 71-72).[20]

The most common writing material for cuneiform script was clay. Taylor remarked that “visual survey makes it clear that scribes used varying qualities of clay for different tablets, according to place, genre, and other factors” (2011, 7). Clay soil can be found everywhere in Mesopotamia. Therefore, the material for the tablets could be taken on site at any time. It was then processed by the scribe, who certainly cleaned the clay soil from larger inclusions like stones and vegetation before he added water to enhance the plasticity of the clay (Taylor 2015, 5-6, Sallaberger 2014, 89). The clay was then kneaded and formed into a tablet. This process is “surprisingly difficult, and scribes must have learned it properly during their training” (Taylor 2011, 8). There seem to have been several ways to mould a tablet such as simply kneading them from a lump of clay. Additionally, some tablets show folds of clay, and

20 See for further reading also Bramanti (2015), Messerschmidt (1907), and Finkel/Taylor (2015, 74-75).

there are even tablets which consist of a core and a thin layer of clay which was wrapped around the centrepiece (Taylor 2011, 11).[21]

There is no standard size for the clay tablets, but most of them were not bigger than hand size so they could be held and inscribed easily. But there are also exemplars that are 30 to 40 cm long. Their size was usually dependent on the length of the inscribed text, and an experienced scribe was able to guess the size of the tablet in advance (Taylor 2011, 8, Michel 2015, 52). With the stylus, the cuneiform was then impressed into the clay.[22] Therefore, the tip of the stylus with the three angles was pushed into the surface of the clay tablet at a low angle so that the tip of the stylus formed the head of the wedge,[23] and its shaft the tail of the wedge.[24] The image (fig. 1) illustrates the impression of the stylus into the clay surface. The point P_t marks the position of the tip of the stylus, which is also the deepest point of the impression, and the centre of the wedge. The shaft of the stylus (in the image "Schneidkante") forms the tail of the wedge. The latter's length depends on how much of the shaft was impressed into the clay as well (see for a detailed description of the wedge chapter 1.10 Terminology and Descriptions).

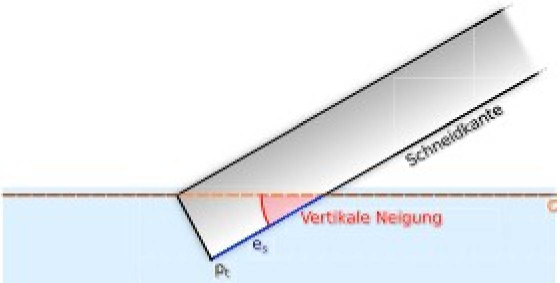


Fig. 1: The image was taken from Cammarosano et al. 2014, 13. *It illustrates the impression of the stylus into the clay.*

The impressed wedges can be differentiated into three to five different types, depending on whether the differentiation is based on the orientation of the stylus, or on the appearance of the wedge on the tablet. In case of the latter, there are five different types: vertical, horizontal, oblique downward, oblique upward, and the so-called Winkelhaken (see fig. 2).[25] In regard of the orientation of the stylus, however, there are only three wedges: the horizontal, the vertical and the oblique wedge

Fig. 2: The different wedge types: horizontal, vertical, oblique downward, oblique upward, and the Winkelhaken.

21 See also Faivre (1995).

22 Cammarosano discusses the handling of the stylus in detail as well as the influence of the movements on the appearance of the cuneiform wedges (2014).

23 Taylor remarks that "in the early days of writing, a combination of impressing and incising was used, leaving wedge-shaped marks and curved lines. The curved lines are gradually replaced by impressed wedges, and the script assumes a more abstract appearance" (2011, 13).

24 For more detailed information on the mechanical writing process see Cammarosano (2014, 74-84, with additional literature).

25 See for this classification also Huehnergard (2011, 68).

(Taylor 2015, 78). Oblique upward and downward are considered to be the same orientation, because the stylus is not handled differently, just the leading hand is turned. The Winkelhaken is impressed in the same way as an oblique wedge, but with a shorter tail. Each cuneiform sign is constructed with these wedges. There are very simple signs consisting of only one wedge, and very complex ones that are formed with many wedges.

In the timespan relevant for this work, the script was written from left to right, and on the clay tablets, it was arranged in lines. The text began on the obverse of the tablet and was continuously written on the following lower edge, the reverse, and the upper edge. When the text was too long for the tablet, especially in case of letters, the left edge was also inscribed. The right edge was used as a kind of margin on which protruding words of obverse and reverse were finished (Lion/Michel 2008, 32).

1.5 The Use of Cuneiform Script

As written above, cuneiform script is a mixed logographic and syllabic writing system, and its signs are polyvalent, i.e. they can be used as logograms (word signs), syllabograms (syllabic signs), or determinatives (classifier).[26] As explained earlier, Sumerian was mostly written with logograms, i.e. one sign or a sign group usually represented one word or expression without reproducing them phonetically (Krebernik/Nissen 1994, 277). Akkadian was primarily written syllabically, but logograms were still used as well. For example the Akkadian word for silver *kaspum* is in the Old Assyrian texts usually expressed with the Sumerian sign combination KÙ.BABBAR ("white metal"). Furthermore, the cuneiform signs can also represent syllabograms. Veldhuis explains that they "much like alphabetic characters, represent the sound shape of a word – with the difference that each character corresponds to a syllable, rather than to a single phoneme (2011, 68). They can be classified into four types, depending on the combination of consonants and vowels. These are vowels (V), consonant + vowel (CV), vowel + consonant (VC), and consonant + vowel + consonant (CVC).[27] Furthermore, the signs are often polyphonous. Polyphonous signs represent more than one phonetic value, and these signs are not necessarily phonologically related (Huehnergard 2011, 70). For instance, the second sign of the combination for silver (BABBAR) can be read as *ud, ut, uṭ,* u_4 and *tam*. The value u_4 shows another attribute of cuneiform script: its homophonous character. Different signs can represent the same phonetic value. In the transliteration, they are marked

26 Krebernik and Nissen give an overview of the different functions, use, and history of cuneiform script (1994). See also Lion/Michel (2008), and Finkel/Taylor (2015).
27 For a detailed explanation see Huehnergard (2011, 69-70).

with acute and grave accents or subscript numbers, in case of the vowel /u/ for example U (to be read as "u one"), Ú (= "u two"), Ù (= "u three"), and U_4 (= "u four").[28] Syllables were also added to logograms as so-called phonetic complements to define their reading. For example in Old Assyrian texts, often the sign ÁP is added to the term of "silver" to indicate its construct state of a genitive compound, in the transliteration written as KÙ.BABBAR$^{\acute{a}p}$.[29]

The third function of cuneiform signs is their use as semantic classifiers, the so-called determinatives. They are usually logograms, which either precede or follow the word that they classify. They were presumably not pronounced, and in the transliteration, they are written in superscript capital letters. For example "Aššur" can denote either a god, or his city. Therefore, it can either be written with the logogram for god DINGIR[30] = ^{d}Aššur (= the god Aššur), or it is written as Aššur^{KI} (KI = place/city), referring to the city of Aššur.[31]

The polyvalent, homophonic, and polyphonic character of the cuneiform script made reading and writing a complex and complicated matter. Especially when one considers also the large number of cuneiform signs. In several publications[32], the number of cuneiform sign varies between 600 and 1.000 different signs (the different readings excluded). Veldhuis (2011, 69) describes that over the course of time, signs were abandoned while new ones were created so that the corpus and its number of signs changed continuously. Furthermore, there are also combinations of signs which have their own value, but in combination, they create a new one. A clear definition whether they should be considered as an independent sign, or a combination of signs is not always possible. Therefore, as Veldhuis argues, the number of cuneiform signs cannot "be established with any accuracy" (2011, 69).

1.6 The Question of Literacy

Literacy is a highly discussed topic in Ancient Near Eastern studies. For a long time it was believed that only professional scribes, well trained and educated over several years, were able to read and to write. And in addition, some other groups of people like kings, priests, and

28 See also for example Huehnergard (2011, 70).
29 For more information on the phonetic complements see for example Krebernik/Nissen (1994, 277).
30 Usually, the determinatives are expressed as logograms. But there are a few exceptions. For example the sign DINGIR (can also be read as AN), which can also be used to classify the names of deities, is in such a case written as *d*, an abbreviation for the Latin word *deus*.
31 See for more information on determinatives and their use for example Caplice (2002, 5-6), Krebernik/Nissen (1994, 279).
32 See for example the "standard" sign lists Borger (1988), and Labat (2011), but also Krebernik/Nissen (1994, 276), and Charpin (2004, 501).

merchants.[33] However, Powell (1981, 436) already pointed out – although in regard of the widespread of literacy – that there are different levels of literacy from the professional scribe to the "illiterate" person who was only able to write his name.

Since then, the question of literacy was addressed by several scholars. Wilcke (2000) analysed the topic on the basis of archaeological evidence, grammatical and lexical observations, and orthographical peculiarities. He concluded that private citizens have most likely been literate since the Old Babylonian time, perhaps even earlier, and have been able to manage their own correspondence and daily writing activities.

Charpin (2004) came to a similar conclusion. Furthermore, he argued that even though the number of signs we know today comprises several hundreds of different signs with even far more readings, not all of them were used or are attested in every period. Furthermore, not all the sign values are attested in the different text genres. To manage every day documents, an Old Babylonian scribe would not have needed more than 112 signs and 57 logograms. Thus, learning cuneiform script was not as complex as it seems for the modern scholar. Furthermore, literacy is not necessarily limited by a complex writing system as the Japanese system shows (Charpin 2004, 501-503, Charpin 2010, 83).

From the Old Babylonian period at the beginning of the 2nd millennium BC a school curriculum could be reconstructed that gives insight into the learning content of the scribal students at that time (for more information on the curriculum see ch. 4). The content of this curriculum was mainly composed in Sumerian, which was not spoken anymore at that time. Following Michalowski, the students would probably no longer need the Sumerian language after graduation. Instead, they had to adjust their writing skills for practical use to Akkadian, and "for purposes that were only studied in passing in school: the writing of bills, contracts, letters, and similar documents" (2012, 41). Thus, not all the knowledge students learned during the scribal education was necessary, and consequently, it is questionable to what extent, or how long they were educated. Since several years it is believed that perhaps not all the students followed the complete curriculum to the highest levels (Tinney1998, 49), and that there were different levels of literacy (see above Powell, and ch.4).

Veldhuis distinguishes three levels: functional, technical, and scholarly literacy. The technical literacy, as he defines it, includes enough knowledge about basic cuneiform writing. A person

33 For an overview of older opinions on the topic and the change during the last few decades see Charpin (2004).

with this level of literacy was not able to read every text, but could manage everyday texts like letters and common documents (2011, 71, 80). Technical literacy refers to certain text genres with a peculiar orthography or a specific sign inventory like omens, divinations, or mathematical texts which are mainly important for specific professional groups (2011, 73-74). Scholarly literacy refers not only to the reading and writing skills, but also to the "knowledge of the writing system for its own sake, collecting all possible and impossible readings of each sign and sign combination and studying the history of its use and palaeography" (Veldhuis 2011, 74). While most of the scribal curriculum points especially to the scholarly literacy, the practical knowledge of formulating a letter, or an administrative account was presumably not taught during the scribal education, and Veldhuis suggests that functional and technical literacy might have been rather taught through apprenticeship (2011, 85, with reference to Robson 2008, 52-53).

These theories are educated guesses which are hardly proven yet, especially in regard of the functional literacy of the common people.

1.7 Literacy in the Old Assyrian period

Considering the Old Assyrian merchants with their large private archives, it is strongly believed that at least most of them were indeed literate. Larsen wrote (1976, 305):

> "There are indications that a great many Assyrians knew how to read and write so the need for privately employed scribes may not have been so great. The system of writing was highly simplified with only a limited number of syllabic signs and quite few logograms, and many of the outrageously hideous private documents constitute clear proof of the amateurishness of their writers."

In his article *What they Wrote on Clay* (1989, 133), he specifies that in the Old Assyrian texts, only around 100 different signs are frequently written. Additionally, logograms are mainly used in traditional shorthand, and used for materials related to the trade and divine names.[34] Barjamovic (2015, 60) adds that for most texts not more than 80 signs were necessary. In any case, the number of different signs in the Old Assyrian texts is rather limited, and the use of logograms is mainly restricted to a specific use.

34 The suggested number of 100 signs can only be an approximation. Kryszat, for instance, suggests that they used c. 120 different signs (2008, 231), and Michel estimates 150 to 200 signs, presumably including logograms (2008b, 354).

Another indication for a possibly wide spread of literacy among the Assyrians is according to Larsen the deliberate simplification of the writing system. He argues that often homophones were preferred which consists of only a few wedges and which are therefore easier to write. In addition, especially CVC-signs tend towards a representation of several vowels (e.g. the sign LIM can also be read as *lúm* or *lam*$_5$), and the "distinctions between voiced and unvoiced, emphatic and non-emphatic and simple and double consonants were generally ignored" (Larsen 1989, 133). Even though the Old Assyrian script has a rather limited sign repertoire, there are also homonyms for certain phonetic values. Kryszat, who studied the Old Assyrian syllabary,[35] noticed two different traditions based on the selection of signs for certain phonetic values. One tradition comprises a group of mainly complex signs like LA, TI, AB, ŠÙR, BI and NE(BÍ), and EŠ.[36] The second tradition is defined by the use of simpler signs like LÁ, DÍ, ÁB, ŠUR, BE (*bi*$_4$), and IŠ. Kryszat observed that writers using one sign of the first tradition, tended to use also the other signs of the same group, while other writers generally preferred the signs of the second tradition. Furthermore, he realised that much more people seemed to have preferred the second group of signs (2008, 232). He also suggests that both traditions can be arranged in a chronological order. Thus, the group with more complex signs can mainly be found on earlier texts, and represents therefore an older writing tradition, while the second one with the simpler signs is rather considered a later, younger writing tradition (Kryszat 2015, 111-112).

Other reasonable explanations of the assumed literacy of the Old Assyrians are the different levels of scribal competence exposed by the tablets. Larsen wrote that they show "the existence of a scale of scribal competence ranging from full mastery to a quite limited literacy" (1989, 133). Furthermore, also the personal living conditions of the merchants have to be taken into account. They had built up a large network, and therefore, they needed to travel long distances, from Aššur to Kaneš, and within Anatolia as well – and at the same time, they had to manage the business, and support their families at home. Such a task was hardly possible without someone able to write. Taking a professional scribes on a trip was certainly an option, but an inconvenient and expensive one. Therefore, it is more likely that at least most of the merchants were able to manage their own correspondence,[37] and probably

35 See for Kryszat's studies on syllabary and palaeography especially 2001, 2004a, 2004b, 2008, 2015. In addition, see also Michel (2008b, 353-355).

36 A first preliminary list was published in Kryszat 2008, followed by a complemented list in Kryszat 2015.

37 Michel notes that these living conditions with separated family members is the reason for the abundance of letters in Kaneš (2010, 82).

even everyday documents (Larsen 1989, 133-134, Michel 2008b, 353-354). In this context, Barjamovic points out that the merchants did not only have to send letters, but most likely, they also had to take notes on the spot. As proof, he names tablet kt 94/k 509 which records some expenses on the road. This tablet is crudely formed, and with a stone embedded into its surface. Barjamovic suggests that the merchant who wrote it, took the clay for the tablet literally from the place were he stood. Because he only made a personal note, he did not bother to clean the clay, or to prepare the tablet carefully. Thus, it was certainly not the work of a professional scribe, but "the quick and dirty note of a travelling salesman" (Barjamovic 2015, 62).

While the findings indicate a high degree of literacy, it is not proven yet. The texts are hardly signed so usually they cannot be assigned to a specific writer. Thus, although for the Old Assyrian period writing seems to have played an important role in people's everyday lives, the actual spread of literacy can only be estimated (Stratford 2015, 117, with reference to Powell 1981, 436). Therefore, Stratford suggested a new approach to the topic, based on a study of handwriting analysis and palaeography.

1.8 A New Approach: Palaeography and the Identification of Scribal Hands

Since the decipherment of cuneiform script c. 160 years ago, hundreds of thousands of tablets were discovered and studied in regard of their content, context, and philological and historical aspects. Exhaustive analyses of the material and palaeographic aspects of tablets and script, however, were behind time. One reason for the late development of palaeographic studies was certainly always the special nature of the script, and the difficult to impossible task of investigating its properties satisfactorily. Biggs formulated the aspects of a palaeographic study as follows:

> "A proper palaeographic study would include description of several technical points such as the angle of wedges (here I mean not the angle between different wedges in a sign, but rather how the impression was made), the evidence for kind and shape of stylus, perhaps even evidence for how it was held and, of course, it would also require detailed analysis and description of each text in terms of such characteristics as size of writing, inclination of signs, distance between lines, relation of signs to rulings (e.g. do they "hang" from the ruling above them), use of ligatures, use of optional elements in signs, etc." (Biggs 1973, 40-41).

Thus, a respective study does not only concern the shape of the signs, but also layout and arrangement of the signs on the writing material, as well as material and tools which influence the appearance of the script. However, Biggs indirectly phrases several problems as well. One is the description of the characteristics. Cammarosano recently summarised the state of the art and pointed to the problem of subjective descriptions (e.g. qualifying terms like "large", "elegant", or "sloppy") and the lack of a common terminology for palaeographical cuneiform studies (2015, 146-151). Another problem is the 3D character of the script and, according to Charpin, for a long time also the insufficient reproduction technique:

> "For a long time, the high cost of photographs meant that Assyriologists were restricted to publishing documents in the form of hand-made copies. In not unusual cases, the copy did not respect the layout of the original or the exact shape of the signs. […] Even with very careful copies or excellent photographs, an essential characteristic of cuneiform writing cannot be reproduced: its three-dimensional quality" (Charpin 2010, 79).

Nowadays, it is much easier to acquire digital photos of the tablets. However, as Charpin mentioned, even pictures are often not completely sufficient because they cannot reflect the 3D character of the script.[38]

Despite these difficulties, in recent years more attention has been paid to materiality and palaeography. The publications Devecchi (2012) and Devecchi *et al*. (2015) are particularly noteworthy in this context.[39] In the following, however, only some contributions will be presented which are relevant for the present work.[40]

In the frame of the project *3D-Joins und Schriftmetrologie*,[41] Michele Cammarosano (2015) approached the topic of handwriting analysis on a quantitative level with the help of 3D-scans and a computer-based approach. He assumed that "selected geometrical properties of the script can be extracted and subsequently processed by analysing high resolution 3D-models of cuneiform tablets under an appropriate theoretical framework in order to extract relevant palaeographical features" (2015, 150). The main aim of his paper is the discussion of the theoretical framework and a description of the computational analysis. However, he also points out that important for an analysis of hands is not the wedge itself because its form

38 Since a few years some projects are engaged with the production of 3D-scans of cuneiform tablets and the development of software for the measurement and evaluation of the models (see for example https://www.geschkult.fu-berlin.de/e/altorient/forschungsprojekte/forschung/laufende_projekte/setting_the_wedge/index.html or http://www.cuneiform.de/projekt/aktuelles.html). But this kind of research still has a long road ahead.

39 There are also several individual studies; Cammarosano (2015, 148 and n. 6) lists some publications of Hittite palaeography, Jursa (2015, 187-188) refers to some studies on Babylonian palaeography of the later periods.

40 For an overview of the state of art see Cammarosano 2015, 146-151.

41 The homepage of the project: http://www.cuneiform.de.

depends on several elements, but rather the “relationships between specific features across different wedge types, as well as wedge configurations, i.e. signs and wedge patterns” (2015, 162). Furthermore, Cammarosano’s article is particularly interesting in the sense that he aims for a more objective method on the basis of a quantitative, and therefore a statistical approach (2015, 150). Even though he works with 3D-scans, a statistical analysis can also be applied to data retrieved from 2D-images. For the analysis of handwriting, such an objective approach is presumably useful in regard of a comparison of different hands because it has to rely on comparable data which is not influenced by visual elements (e.g. the shape of a wedge depends amongst others on clay and stylus, but for a statistical approach, rather the arrangement of the wedges and their number is important).

Michael Jursa studied the palaeography of Late Babylonian texts in the frame of the project *Diplomatics and Palaeography of Neo- and Late Babylonian Archival Documents*.[42] On the basis of a case study, he aims to date the texts as well as identify hands by palaeographical means. Therefore, he focuses on a selection of diagnostic signs. For a possible verification of his observations, he uses texts with a colophon, naming scribe and date. He demonstrates that a rough dating as well as an identification is possible by comparing different signs of the tablets in question. However, especially in regard of the identification of the hands, he states that even though the script is similar on the selected texts, “at least at the present level of analysis there is little in Nādin’s [the scribe’s] handwriting that renders it distinct from other hands found in the same period” (2015, 197). His questions, especially that of the identification on scribal hands, is at the centre of this work. Therefore, his observations and results offer an interesting starting point for similar, and improved studies as well as comparisons.

The are also some palaeographic studies on the Old Assyrian material. As mentioned above, Guido Kryszat published several papers on the syllabary and palaeographic elements, which point to different traditions as well as a change over time (Kryszat 2001, 2008, 2015). Furthermore, he realised that the “use of signs”, i.e. the use of the different traditions as well as a comparison of sign forms can a) support the assignment of texts to a specific person, and the latter’s identification, b) differentiate between individuals with the same name, and c) hint on family traits of writing (2004a, 30-32). While he focused mainly on the different writing traditions, especially his observations in regard of handwriting identification and writing

42 The homepage of the project: https://labasi.acdh.oeaw.ac.at.

traditions in a family are significant for the present study because they provide evidence that further studies in this regard might reveal more insight into the educational background of the Old Assyrian merchants, and the wide spread of literacy in their families.

In 2015, Ed Stratford published a paper on the approach to Old Assyrian literacy focusing on handwriting analysis. Based on modern forensic handwriting analysis (or chirographic analysis), he suggests a two-phase analysis. The first step includes only documents authored by one and the same person to verify his or her hand. For the second part, documents authored by several people and including the one from the first phase would be analysed. A comparison of the hand from the texts from the first phase with the hand(s) on the texts from the second phase would lead to the writer's identification. His method focuses on the comparison of cuneiform signs (their form and position on the tablet and in the line) which occur often and on most tablets. He states that "consistent variation in simpler graphs or elements, composed of fewer wedges, is more significant than variation in more complicated signs" (2015, 1209). The brief study is based on a small number of case studies. Nevertheless, the promising results confirm Kryszat's observations that such an analysis can support the differentiation and identification of different individuals on the basis of their handwriting. They also provide further evidence of the literacy of the merchants. From his observations of texts with several authors he concludes that "the variation exhibited in these cases still supports the notions that literacy was broadly held enough so that merchants held no notions that writing a letter for a group was a privilege reserved for the ranking member of the social group" (2015, 127).

Also Michel (2015b) approached the question of literacy on an archive excavated in 1993, focusing on the letters sent by women. By comparing several cuneiform signs as well as additional elements like the impression of the wedges, or the arrangement of the signs on the tablet, she could demonstrate the usefulness of handwriting analysis, even though the identification of similar writing does not, as she states, necessarily identify the writer of the tablet (2015b, 89). Notable about her study is that she does not focus on the omnipresent merchants, but on the women of the Old Assyrian period, which were, at least partly, presumably literate as well. In addition, she shows that even on a small corpus of only a few texts similar handwriting can be compared and identified.

These preliminary studies have shown that the analysis of handwriting is a promising approach which can help to assign not only letters to their writers, but also anonymous notes and lists to their deceased owner. Furthermore, in a time when people frequently had the same names, the identification of scribal hands can support a differentiation of them. But also in regard of the wide spread of literacy and the educational system, handwriting identification seems to be a useful tool.

1.9 Aim and Approach of the Present Study

The present study aims to combine several of the afore presented approaches, and to develop a method for handwriting identification, connected with the question of the identity of the writer. For such an approach, the Old Assyrian period is probably most suitable. The texts come mainly from closed find contexts, i.e. the excavated family archives, which belonged to families who were most likely literate to a high degree. In a time where homonymic personal names were very common, the advantage of such a closed archive is that the belonging of the texts is easier to establish, and the number of possible writers is limited. Another advantage of this period is the cuneiform script itself. As outlined above, the syllabic and logographic sign repertoire of this period is rather small. Thus, a certain consensus of the use of signs can be expected which is necessary for a comparison of sign forms. On the other hand, there is nevertheless a tendency for different writing traditions in regard of a few specific phonetic values, which can be an important discriminating element as well.

To avoid the problem of a subjective comparison, the approach is mainly based on data which is statistically evaluable. Therefore, a set of discriminating elements (e.g. cuneiform signs and use of signs) is selected in regard of their suitability for a comparison as well as their frequency. The unique character of handwriting, however, cannot be established on objective data only. Thus, the statistical approach will be combined with an individual analysis, including additional discriminating elements like writing material (tablet shape), typeface, and layout. These approaches serve the identification of similar handwriting. However, they cannot answer the question of the writer's identity. In this regard, the content of the analysed material, and the handwriting of further written sources like letters authored by several people and documents of other genres are studied and compared. The combination of the different approaches will be tested and evaluated in a detailed analysis of the letters of the private archive excavated in 1993. Furthermore, the statistical data will be analysed computationally. The aim of this approach is to develop a tool which is able to evaluate large datasets and to cluster objects according to their similarities. In case of the handwriting analysis, it would group cuneiform tablets according to the similar discriminating elements, i.e. similar handwriting.

Another aim of this study is a preliminary analysis of the wide spread of literacy among family members, and an initial attempt to learn more about the educational system of the Old Assyrian society on the basis of a palaeographic comparison. The underlying hypothesis is that writing was taught within families, and children copied the writing style of their parents. The preceding handwriting identification enables such an examination.

1.10 Terminology and Descriptions

In the following part, some terms will be explained which are frequently used in this study. As mentioned above, cuneiform palaeography, and therefore the description of cuneiforms signs is still rather underdeveloped. In the frame of the project *3D-Joins und Schriftmetrologie* a standard terminology was summarised[43], or newly developed focusing on the description of the wedge impression (see especially Cammarosano 2014, 2015, and Cammarosano *et al*. 2014).[44] For the analysis of cuneiform signs, the general terms for the description of a wedge are especially important.

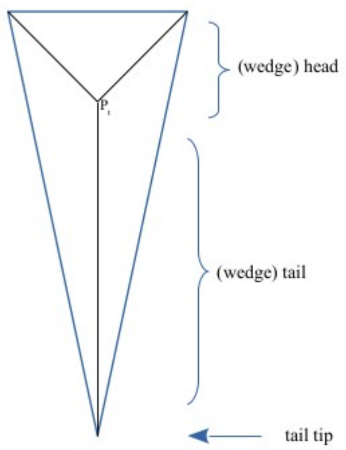


Fig. 3: The idealised image of a vertical wedge is adapted from Cammarosano et al. 2014, 5.

The following image (fig. 3) represents a stylised image of the impression of a vertical wedge (its general structure was adapted from Cammarosano *et al*. 2014, 5, fig. 1). The blue outer lines represent the edges of the wedge visible on the surface of the tablet which form the typical shape of the wedge. The black lines in the middle mark the inner edges of the wedge which are the result of the stylus tip with three angles.

The point P_t marks the position where the tip of the stylus was impressed. This point marks the centre of the wedge, and the outer lines, which form its shape, "evolve" around it. Each wedge is unique to a certain degree (for example the length of the various edges), but each of them has such a centre. Therefore, in the following descriptions of any position of a wedge, it is always referred to this point P_t to describe the exact position of a wedge. For instance a description like "the vertical wedge is impressed on the ruling" refers to P_t of this vertical wedge that is impressed on the ruling. In case that "a

43 See for standard expressions Cammarosano 2015, 152, n.15.
44 A list of terms can also be seen here: http://www.cuneiform.de/uploads/media/terminology.pdf

vertical wedge is impressed slightly above the ruling”, then P_t is slightly shifted upwards, and impressed above the ruled line.

The wide part of the wedge around P_t is usually named the head of the wedge, and the long part is its tail which ends in the tip. The black line in fig. 3 reaching from P_t to the tail tip represents the impression of the stylus shaft and is called the “spine” of the wedge.

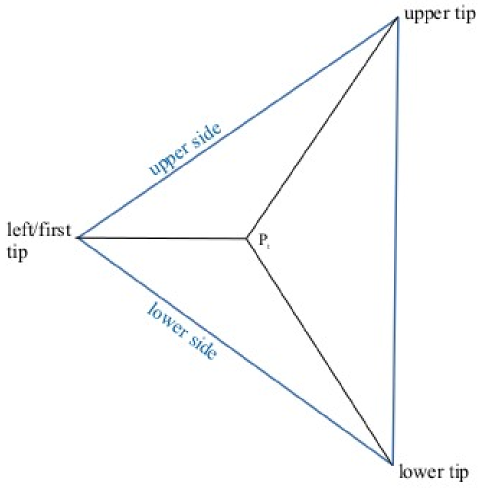


Fig. 4: The idealised shape of a Winkelhaken.

The description of the Winkelhaken is slightly different. This wedge, too, has a P_t which is referred to when its position is described. But since this wedge has a different orientation, and no tail but two edges with – ideally – the same length, its sides are referred to as upper and lower side which end in the upper and the lower tip. Cuneiform is in the Old Assyrian period written from left to right. Therefore, the left tip in following descriptions is also denoted as “first tip” since it is the first one of the wedge in regard of the writing direction.

Regarding the structure of cuneiform signs, their description is made from the observer’s point of view and basically follows the writing direction as well, thus, from left to right, and usually from the top to the bottom.

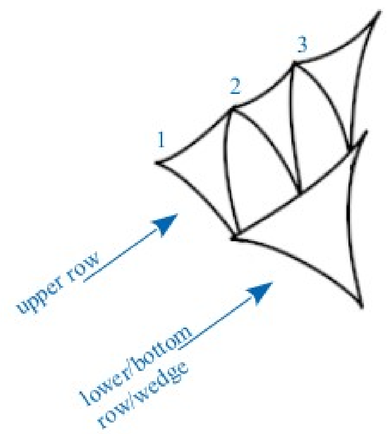


Fig. 5: The arrangement of Winkelhaken divided into two rows.

Specific sign elements consist of several Winkelhaken arranged in a triangle. If this triangular shape would be turned for only a few degrees clockwise, the composition would show a simple triangle pointing downwards, and it could clearly be divided into an upper row consisting of three Winkelhaken, and a second “row” at the bottom consisting of one Winkelhaken. Even though the triangular shape is usually inclined to the side on the tablets, and the “rows” are therefore not horizontal, in the following descriptions they will nevertheless be denoted as such. In addition, especially in case of the upper row of Winkelhaken, usually these wedges are referred to in regard of their position, e.g. (1) left/first, (2) middle, and (3) right/last Winkelhaken of the upper row.

Furthermore, the description of the cuneiform signs refers mainly to their visual appearance, while the mechanical aspects, e.g. stroke order or overlaying wedges, are not consistently explained. For example in case of the Winkelhaken construction above, it appears that the three wedges of the upper row are connected by their lower tips to the upper side of the Winkelhaken at the bottom. The mechanical explanation can be that, for example, the three wedges of the upper row were impressed first. And afterwards, the Winkelhaken at the bottom was impressed on their lower tips, so they are "cut off" and invisible. Consequently, it seems that the upper wedges are "attached", or "connected" to the lower one.

Cammarosano (see above), and also Stratford (2015, 121) summarise and define further terms, to which I mostly comply. Thus, Cammarosano defines script as "general term referring to specific scribal traditions (e.g. Old Babylonian script, Hittite script), or to specific writing styles (e.g. cursive script, library script), or to (cuneiform) writing *tout-court*" (2015, 156). Furthermore, Stratford points out that the characters of the cuneiform script are usually referred to as (cuneiform) signs with the meaning of both *graphem* and *graph*.[45] While both terms refer to the general form of a sign, the term idiograph denotes the peculiar sign shape of an individual (Stratford 2015, 121). Cammarosano (2015, 156) and Stratford (2015, 121) use the terms "hand" and "handwriting" usually to denote the particular handwriting of an individual, but in case of the former, it can also refer to the physical hand of the writer.

As described above, the Old Assyrian merchants and their families were most likely not professional scribes but laymen in the field. In Assyriology, professionally trained writers are usually called scribes or professional scribes. To prevent any confusion, in the following study, the word "scribe" will therefore be used for the occupation of a professional scribe, and the term "writer" as the general expression for the writer of a text.

45 A grapheme is defined as the smallest meaningful unit of a writing system, a graph is the smallest unit of a writing system. A grapheme can therefore be a single graph, or consist of several graphs (grapheme = graph = "k"; grapheme = ch → graph "c" + "h").

Chapter 2: A Theory of Handwriting

In 2002, Srihari *et al.* published a paper on the individuality of handwriting. The aim of the study was to validate the hypothesis that the handwriting of an individual is unique and can therefore be distinguished and identified. Srihari *et al.* pointed out that even though this hypothesis is a fundamental idea of handwriting analysis, it had never been proven scientifically (Srihari *et al*. 2002, 1). Therefore, "a database was built representing the handwriting of 1,500 individuals from the general U.S. population" (Srihari *et al*. 2002, 16). Each subject had to copy a specifically designed source document[46] three times by hand and with their natural handwriting. These handwriting samples were analysed, and handwriting attributes were obtained to discriminate the handwriting of one person from another. The collected data was finally statistically analysed by using machine-learning approaches to prove the uniqueness of handwriting, and it was confirmed with a 95% confidence. In addition, the authors pointed out that "by considering finer features, we should be able to make this conclusion with a near 100% confidence" (Srihari *at al*. 2002, 16).

2.1 Handwriting

The examination of handwriting and its comparison by an expert was already permitted in the Roman Empire under the Justinian Code of 539 AD (Koppenhaver 2007, 48).[47] Nowadays, document examination, or handwriting identification, is a discipline of forensic science that "seeks to determine the history of a document by technical or scientific processes" (Huber/Headrick 1999, 8). It includes the analysis of material aspects of a document like writing material, writing surface, and shape as well as the analysis of the writing, handwritten or printed (Huber/Headrick 1999, 8-9).

The term handwriting denotes both the manual process of forming letters and characters with a writing tool like a pen or pencil, and the particular writing style of an individual (Oxford Dictionary online, keyword: handwriting[48]). It is a complex acquired skill which has to be learned and trained. The physical task of writing combines several actions including hand-eye coordination and the ability to precisely control the muscular system of arm, hand and fingers

46 This source document was designed for the study, it contained all characters, letters as well as numbers, specific character combinations, etc. Each character "occurred in the beginning of a word in upper case and lower case and in upper case in the middle and end of a word" (Srihari *et al*. 2002, 2).

47 For an overview of the history of handwriting identification see Huber/Headrick 1999, 3-8, and Koopenhaver 2007, 47-54.

48 English Oxford Dictionaries, keyword "Handwriting": https://en.oxforddictionaries.com/definition/handwriting, accessed 09.08.2018.

to operate a writing tool. Huber and Headrick describe that the hand contains 27 bones and more than 40 muscles, partly situated in the lower arm. They influence the finger movements necessary for writing, and "the precise ordering and timing of the movements determines the structure and pattern that is recorded by the pen or pencil" (1999, 11). Consequently, the physical abilities of a writer play a part in a person's handwriting skills. Handwriting is a learned skill. It is only accomplished by practice, the physical factors go hand in hand with attitude and discipline of the writer. For a smooth and comfortable execution of writing, the movements for every letter, and the handling of writing tools and materials have to become automated habits which are not consciously controlled (Huber/Headrick 1999, 11; Koppenhaver 2007, 8-9).

Handwriting identification is based on two basic assumptions:

1. Handwriting is habitual.
2. Handwriting is unique.

Habituation

A basic premise for the identification of handwriting is the assumption that the writing of letters is an habitual process which leads to the forming of characters with a consistent shape. As mentioned before, writing is a learned skill. As long as a person learns writing, every movement is made consciously, and the person is focused on forming the letter or character. With consistent training and practise, the learned movements become more automatic and skilful, so that they are no longer carried out consciously, but unconsciously. Consequently, their execution becomes habitual and with less variations between executions, and the writer can focus more on the content than on the writing process (Hueber/Headrick 1999, 73, 82-83).

However, even though graphic maturity, i.e. a consistent and habitual handwriting, is generally reached after some years of practice, an individual's handwriting will nevertheless change slightly but constantly during his lifetime.[49] In addition, since handwriting is a manual task, each performance will vary slightly from any other performance, and will contain small deviations. These imprecisions are called natural variations (Koppenhaver 2007, 7, 12). Their occurrence depends on the writer's skill, his current condition, and the writing conditions. The more skilful and experienced the writer, the less variation (Huber/Headrick 1999, 82-83).

49 Huber and Headrick point out that the greatest changes occur during the earliest and the latest stage of a life, but it also depends on the individual itself (1999, 83).

Uniqueness

The second principle of handwriting identification is that every individual's handwriting is unique (Huber/Headrick 1999, 74). Even before children learn writing, they develop a concept of what writing looks like by observing inscribed objects around them. When they finally learn to write they trace standard penmanship forms of a specific writing system[50] which is taught at their school, and by their teacher. Thus, every pupil of such a specific class learns certain common so-called class characteristics. These class characteristics are not restricted to the writing style of a school, but they "are those aspects, elements, or qualities of writing that situate a person within a group of writers, or that give a written communication a group identity" (Huber/Headrick 1999, 42).[51]

However, even though pupils of a class learn the same copybook style, from the moment they begin to write, they also deviate from that style. Reasons for this are that everyone sees and remembers the shape of letters slightly differently. Consequently, the reproduction of the letters turns out differently as well. In addition, the fine motor skills of each child's hand are different, and therefore the execution of the letter shapes becomes individual (Koppenhaver 2007, 8-9). A writer might also copy elements of a writing style that he or she likes, or experiment with different forms according to his or her aesthetic taste. In addition, every writer usually develops habits and ticks, often unconsciously executed like pressure patterns or hooks, which are peculiar to this specific writer. These individual habits, the so-called discriminating elements or individual characteristics, distinguish his or her writing from every other writer (Huber/Headrick 1999, 46; Koppenhaver 2007, 12). However, it does not necessarily mean that every writer develops unique characteristics. On the contrary, many writers may have similar peculiar handwriting characteristics. But none of them will share all the same characteristics with any other person. The uniqueness of a person's handwriting consists of the unique combination of discriminating elements (Koppenhaver 2007, 14).

50 Huber and Headrick define a writing system generally as "the combination of basic letter design and writing movement prescribed by a publication or taught in school" (1999, 411), and they mention that for the United States and Canada 76 different systems or publishers of systems are known from the last half century (1999, 27-28). They refer here to Latin systems, but the term refers also to other "subordinate" systems like alphabetical, logographical, etc., such as Cyrillic, Hangul, or Arabic.

51 Koppenhaver mentions also family characteristics and refers to the child's copying the style of a parent. She adds that also other groups like professional groups, or citizens of a specific country can share common writing characteristics (2007, 13). Especially the latter, however, is called National Characteristics by Huber and Headrick (1999, 45).

Factors influencing Handwriting

When a writer is finally able to execute the process of writing automatically and the forming of letters becomes habitual, he has reached graphic maturity. However, this status can still be disturbed by intrinsic or extrinsic physical or mental factors.

As mentioned above, one factor is simply time. Handwriting changes over a lifetime. But also other temporary factors can influence handwriting; the physical or mental condition of the writer like a disease or an injury, drugs, stress and fatigue (Huber and Headrick 1999, 175).[52] Additional factors are the emotional state of the writer, or the familiarity with topic and vocabulary (Koppenhaver 2007, 28).

Some influencing factors are rather of extrinsic or mechanical nature like the position of the scribe. Standing, sitting, or lying can affect the writing movement, and thereby the appearance of the script. Other factors can be lighting or writing tool and material. If the light is dim, it is probably difficult for the writer to follow the line. If it is too bright, the script might become distorted as well. The writing material, a sluggish ballpoint pen or rough paper, can cause the writer to change the writing pressure or speed which can alter the handwriting as well (Koppenhaver 2007, 28-29). However, many of these factors do not change the handwriting of an individual to the point that it cannot be identified anymore (Koppenhaver 2007, 12).

2.2 Handwriting Identification

Handwriting identification is a discriminatory process. Through comparison, it aims to identify handwriting habits that on the one hand identify the handwriting of the same person, and on the other hand distinguish between the handwriting of different individuals (Huber/Headrick 1999, 33; Srihari *at al*. 2002, 2). The typical procedure of the comparison consists of three phases. The first step is to analyse and identify the discriminating elements. In modern forensic handwriting analysis, usually a legally disputed document, or a handwriting like a signature is examined. Consequently, for the comparison, the document in question has to be compared with an identified example. The next steps then include the comparison of the discriminating elements of the known and the unknown item, and the evaluation of the observations.

52 For a detailed discussion on these factors see also Koppenhaver 2007, 27-35.

Discriminating Elements

The discriminating elements "are quantitative measurements that can be obtained from a handwriting sample in order to obtain a meaningful characterization of the writing style" (Srihari *et al*. 2002, 5). They can be relatively discrete elements which vary "observably or measurably with its author and may, thereby, contribute reliably to distinguishing between the inscriptions of different persons, or to evidencing the sameness in those of common authors" (Huber/Headrick 1999, 90). Huber and Headrick (1999, 89-141) selected 21 different discriminating elements which they classify into two main categories and two additions. The main categories are elements of style and elements of execution. Further categories are consistency or natural variation, and lateral expansion:

1. Elements of style: arrangement, class of allograph, connections, construction and design, dimensions, slant, spacing.
2. Elements of execution: abbreviations, alignment, commencements and terminations, diacritics and punctuation, embellishments, legibility, line continuity, line quality or fluency (speed), pen control, writing movement.
3. Attributes of all writing habits: consistency, natural variations, persistency.
4. Combinations of writing habits: lateral expansion, word proportions.

Koppenhaver (2007, 14-24) developed a similar system with comparable discriminating elements, but arranged them in different categories:

1. Movement: direction, slant, rhythm, pressure, line quality, speed.
2. Spatial relationships: size, proportions, spacing, utilization of space, arrangement, alignment.
3. Form: letter design, method of construction, initial strokes, terminal strokes, medial strokes, connecting strokes, embellishments.
4. Individual characteristics

Modern handwriting analysis, and consequently the range of discriminating elements, was developed for modern documents and cursive writing. Cuneiform script, however, is another writing system including different elements and writing movements. Therefore, not all of the discriminating elements suggested by Huber/Headrick and Koppenhaver, can be adopted as they stand. Some have to be adapted, and some have to be excluded.

2.2.1 Movement[53]

This group of discriminating elements contains features correlated with the movements of a writer's hand which is in turn connected to the direction of writing. Cuneiform script on Old Assyrian tablets was usually written from left to right and from top to bottom. The newly formed clay tablet was progressively inscribed with rulings and cuneiform script. On several tablets it can be observed that the tips of the vertical wedges are "cut off" by the ruling underneath. It proves that the tablet was not previously prepared with ruled lines, but they were drawn line by line (see fig. 6). The cuneiform wedges are "hanging" from the ruling, i.e. the heads of the vertical wedges are usually placed on or below the ruling, the tail of the respective wedge is positioned under the ruling. In other words, the script is not placed on or above the ruled lines, as it is common for modern, western scripts, but is oriented towards the upper ruling.

Fig. 6: An example how the lower ruling cuts the tips of the vertical wedges, here on AT714.

Line Quality	This element refers to the execution of the lines forming a letter, or words respectively, e.g. smooth or crude, uncontrolled or resolute.
	This feature is not entirely applicable on cuneiform script since the wedges are not drawn but impressed into the clay. It has to be adjusted by focusing on the quality of the impression and the recognisability of the wedges. These elements, however, certainly not only depend on the ability of the scribe, but also on the moistness of the clay when inscribed, and the quality and form of the stylus. Cammarosano *et al*. describe that the surface of the tablet, being flat or convex, as well as having small irregularities or not, influences the outer edges of the wedge impression. Furthermore, also the plasticity, viscosity, and solidity of the clay are important for the shape of the wedge impression (2014, 10). But not only clay and tablet form influence the shape of the wedge, but also the shape of the stylus, i.e. "on the three

53 I use the classification of Koppenhaver, but include elements of Huber/Headrick as well, if applicable.

angles of the stylus edges at the writing tip, as well as on the respective positions of stylus and writing surface for every point in time during the impression process" (Cammarosano 2014, 81). Nevertheless, even these factors can reveal information on the writer like his or her preferences for writing material, and possibly his or her level of experience. Therefore, the "line quality" is an important discriminating element.

Pressure

For Koppenhaver, this element is an independent feature (2007, 15-16), for Huber/Headrick it is subject to pen control in general (1999, 121-131). In any case, the pressure used for writing certainly is a discriminating element for the identification of handwriting, and it is influenced by the ability of the writer to manage his writing tool. It includes the pressure with which he is holding the writing instrument, as well as the pressure to press it on the writing surface and to actually write. Koppenhaver (2007, 15) points out that for example the pressure applied on upstrokes and downstrokes can be different. And these pressure patterns are very individual.

In case of cuneiform script which is impressed into clay and has therefore a significant 3D character, such pressure patterns can be clearly observed in regard of size and depths of the wedge impressions. In addition, another observable feature here is the angle of the respective impression, which provides an indication on the writer's handling of the stylus.[54] These elements, however, are difficult to measure or to evaluate with the naked eye.

Rhythm

This feature refers to the consistency of slant and, especially in case of

54 For a detailed analysis of this factor, one either needs access to the original tablet, or even better, to a full 3D-scan and a measurement supporting the computation of angles and depth. When working with 2D images, one can only rely on subjective observation on the depth and size of wedge impressions. Regarding 3D scans of cuneiform tablets, and possibilities regarding the analysis and identification of handwriting, there are two noteworthy projects in Germany. One of them is the so-called project *Setting the Wedges* under the direction of Prof. Dr. E. Cancik-Kirschbaum, Berlin, Prof. em. Dr. U. Smilansky, Jerusalem, and Prof. Dr. J. Marzahn, Vorderasiatisches Museum Berlin, at the Freie Universität Berlin (https://www.geschkult.fu-berlin.de/e/altorient/forschungsprojekte/forschung/laufende_projekte/setting_the_wedge/index.html). The other project *3D-Joins und Schriftmetrologie* is under the direction of Prof. Dr. G.W. Müller, Julius-Maximilians-Universität Würzburg, Prof. Dr. h.c. G. Wilhelm, Akademie der Wissenschaft und der Literatur, Mainz, and Dr. F. Weichert, Technische Universität Dortmund (http://www.cuneiform.de/projekt/aktuelles.html).

modern cursive scripts, to the even writing and returning to the baseline. A well trained and skilled writer has usually an even rhythm, while uneven writing points to a lower level of writing skills. In regard to cuneiform script, slant or the inclination of the signs to the right or left can be clearly observed, and therefore also its consistency. In regard of the script returning evenly to the baseline, for the Old Assyrian script it is probably rather the position of the wedges to the upper ruling. As mentioned above, they can be impressed on, but also underneath, or even above the ruled line.

Slant

Huber/Headrick define slant as "the angle or inclination of the axes of letters relative to the perpendicular to the baseline of the writing" (1999, 107). The authors add that the slant of a handwriting can be a significant discriminating element. However, not every individual's writing has a consistent slant.

Cuneiform script can also be written with an inclination, usually to the right. Its angle and consistency, however, might also depend on the circumstances of the text's creation, for example whether the writer was in a hurry.

Speed

Every writer has his own writing pace, and usually, the higher the speed, the more illegible the writing. Several factors indicate a faster writing, e.g. the simplification of letters, abbreviated and unrecognisable word endings, etc. On the other hand, very slow writing has its own specific characteristics like a very exact, almost stiff execution of letters, correctly placed i-dots and t-bars, and an even pressure.

An individual discriminating element in Huber and Headrick's list is *Abbreviations* (1999, 110-112): It refers to the contraction of words by omitting letters as well as the simplification of sign shapes, often related to a higher pace of writing.

In Old Assyrian texts, both cases can be observed. Regarding the contraction of words, especially the prepositions *ina* and *ana* can be abbreviated by eliminating the syllable (and cuneiform sign for) -*na*.

Personal names can be abbreviated like the name Ahu-waqar to Ahuqar. This feature, however, is not necessarily connected to fast writing but rather to a personal preference of the writer, to save space, or maybe also an oral habit transferred to the textualization as well (C. Michel, in a conversation). Regarding the simplification of signs, certain indications can be observed. Cuneiform signs often have so-called filling wedges, small and thin wedges filling a certain space between larger wedges. These filling wedges can be either impressed very weakly, their number can be reduced, or they are completely dropped. In such cases, however, it is still questionable whether the writer was in a hurry, or whether it was his habit.

These discriminating elements comprise important features of the script and habits of the writers. However, most of them are hardly measurable, like the slant of the script or rhythm and pressure. Therefore, any description is very subjective and depends on the examiner. For a statistical analysis, they are hardly usable.

2.2.2 Spatial Relationships

This group includes elements related to space such as size, proportions and spatial arrangements of strokes, letters, and words among themselves, and in relation to other elements on the writing surface like ruling, decorative elements, margins, etc.

Alignment

The term refers to an individual's habit of writing without ruled lines, whether his successive letters, words, and complete lines are written on a straight (imaginary) line, or whether the lines ascend or descend. As mentioned before, on Old Assyrian clay tablets, lines are usually drawn on obverse and reverse, and often on lower and upper edge as well. The writing is usually following the ruling, consequently, it is rather the shape of the hand-drawn ruling which has to be observed. Only the left edge is not prepared with ruled lines. Thus, it offers the possibility to analyse the alignment of the script. However, the lines on the left edge are often influenced by the shape of the tablet, e.g. is the tablet convex, then most likely the lines on the left edge are also curved. Therefore, the focus should probably be more on the script and how the lines are positioned to each other, and not on their individual alignment.

Arrangement — This discriminating element contains several factors concerning the arrangement of the script on the writing material, e.g. spacing, paragraphing, margins, or location of different elements of the text like heading, signature, etc. It has to be noted that depending on type and genre of text and document, several of these elements might be determined and not freely arrangeable by the writer. For the present study, however, mostly private letters were studied for which hardly any formalities are determined in regard of the script's arrangement.

Proportions — Proportions of letters are usually consistent and independent of script size. For modern cursive writing, the penmanship system regulates the proper proportions, especially in regard of height (e.g. the loop of *d* + its long stroke), however, the horizontal expansion is less defined and gives therefore more room for individual preferences. In cuneiform script, especially the horizontal expansion, the length of the horizontal wedges can probably be considered as an individual trait. However, the length of horizontal wedges strongly depends on the available space. A writer had to estimate the length, and therefore the size of the tablet beforehand.[55] A miscalculation led to a squeezed writing which also influenced the length of the horizontals. Therefore, this feature cannot be a decisive one.

Punctuation — This feature can probably be classified as an element related to spatial relationship because punctuation is a part of the visual arrangement of a text. Huber and Headrick declared that "punctuation marks are used in the English writing system to clarify the meaning of sentences by attempting to control the reading of a passage to correspond to certain elements of the spoken language" (1999, 114). Punctuation as it is known today, was not used for cuneiform script. Words and sentences were usually not visually separated. However, a noticeable element of the Old Assyrian tablets are the so-called word dividers, single vertical wedges that are placed between two words, by some writers frequently, by some less or not at all. Larsen interpreted them as a

55 See also Taylor 2011, 8.

reading aid for inexperienced readers since they simplify the identification of a word's ending, and beginning respectively (2015, 57). Thus, their use and placement can probably be considered as discriminating elements. However, both aspects (use and placement), and therewith the intentions of the writer, cannot be explained clearly.

Size — In modern writing system the size is more or less regulated. Still, a script's size varies depending on the circumstances.

The size of cuneiform script can vary strongly, too, depending on the ability and habits of the writer as well as on the size of the tablet. Therefore, it has to be analysed from tablet to tablet, and from writer to writer.

Spacing — With this term, Koppenhaver refers mostly to the space between letters as well as the space between words, but adds the feature *Utilization of Space* referring to the ability of the writer to adjust his text to the given space (2007, 19-20). Huber and Headrick, on the other hand, include all the different spacings between letters and words, between lines, writing, and ruling as well as the dimensions and uniformity of margins, and self-drawn or written lines (1999, 109-110).

For cuneiform writing spacing is an interesting aspect. On the studied material, there is usually no extra space indicating the end/beginning of a new word. Instead, the space between single signs and words is mostly consistent on a tablet. There can be differences, for example if a writer realises that he has more to say than there is space left on his tablet so that he begins to squeeze the text (see also above, Proportions). However, space between signs, rulings, signs and ruling, etc. differs, and depends on the writer.

Like the first group, too, this group of factors can mainly be evaluated subjectively on the basis of the available tools[56]. The only exception is the punctuation, i.e. the use of word dividers. Since their exact use, however, does not seem to follow fixed rules, any result of an analysis is rather vague.

56 The computational evaluation of 3D scans offers certainly quite different possibilities in this respect.

2.2.3 Form

This group contains discriminating elements concerning form, construction, and connection of letters and words. Several elements which play a crucial part for the identification of modern cursive handwritings, like initial, terminal, medial, and connecting strokes as well as embellishments do not exist in cuneiform writing, and therefore, they won't be discussed here.[57]

A feature which is classified by Huber and Headrick as an individual discriminating element is the *Class of Allograph* chosen by the writer (1999, 95-96). This term refers to different writing styles like cursive writing, manuscript or script writing, and composites e.g. of cursive writing and handlettering. Often, different writings styles are applied for different text genres like an official document or a private note. However, some individuals also prefer only one style, or a composite in general, and especially in the latter case, several particular habits can be developed. In case of cuneiform script, such different classes do exist. Cammarosano refers especially to cursive and library script, and points out that "in case of cuneiform script, cursive script is normally not as deeply impressed as library script and moreover, simplified sign variants are more frequent than on other tablets" (2015, 167, and n. 40).

The analysed material of the present study are private letters. According to Cammarosano's definition, a cursive script has to be expected, but this would have to be analysed from tablet to tablet. On the other hand, because of the homogeneity of the source material, one should probably not expect different writing styles at all.

Consistency or Natural Variation

As mentioned above, natural variations are a writer's deviation of his handwriting habits. They are not restricted to any specific factor, but every discriminating element can have natural variations. Some writers use more than one design for a letter form, depending on the occasion of the text (addressee, content, genre), or the position of the letter in the word (beginning, middle, end). The more practise a writer has, the fewer variations his or her handwriting usually shows, and the more consistent the execution of all his or her habits is.

Regarding cuneiform script, the consistent handwriting can mostly be

57 For general information on these aspects see Koppenhaver (2007, 21-22). Huber and Headrick use different terms for similar elements like Commencement and Termination, Embellishments, and Line Continuity (1999, 113-116, 118-120).

	observed comparing the number of wedges and their arrangement (which will be discussed in detail below).
Legibility of Writing Quality	Huber and Headrick define this element as “the ease of recognition of letters, usually stemming from the adherence to copybook designs” (1999, 116). One of its main aspects is the uniformity of the script, comprising the consistency of elements like alignment, or letter shape. Further factors are for example the quality of the strokes which form the letter, and the comparability with the copybook design. The legibility of cuneiform script is closely connected to other discriminating elements like the line quality, i.e. the quality of the wedge impressions and their connections, as well as the spacing of the wedges, and words.
Letter Design	This aspect has to be understood as a group of discriminating elements dealing with the letter form in general, including the peculiarities of a specific writing system, number and arrangement of strokes in the letter construction, the use of different forms for one character, and character combinations (one letter influencing the neighbouring ones). All these elements are applicable to cuneiform script and play a major part in the identification of cuneiform handwriting. While this study contains only documents written in the Old Assyrian cuneiform script, some writers also included signs from other places and times. Such observations might give important clues about background and identity of the writer. Another very important discriminating element is the number of wedges and their arrangement. Taylor stated that “it is commonly the general shape of a cuneiform sign that is key to its identity, rather than the exact number and placement of its component wedges” (2011, 13). However, the constellation and consistent or inconsistent number of wedges probably depends on both, the specific sign and the writer. While there are cuneiform signs with a fixed number of wedges, other signs allowed the writer to be more creative.
Method of Construction	“Writers develop consistent habits regarding the construction of letter forms” (Koppenhaver 2007, 21) which includes the order of strokes,

their relative positioning and their placement on the line.

Especially the stroke, or wedge order is an interesting topic for the analysis of cuneiform script. Taylor observed a strong consistency of practice with only few variations from the Early Dynastic period (first half of the 3rd millennium BC) until the end of cuneiform usage (1st century AD). Furthermore, he noticed that on the Old Assyrian material, presumably written by laymen, the typical wedge sequence was mostly maintained. Nevertheless, Taylor also acknowledged occasional divergence (Taylor 2015, 18-22, 16).

This group of elements can probably be considered to be the core for cuneiform handwriting analysis. The main focus is on the character shape and its construction. In case of cuneiform script, these are elements which can be described objectively. Thus, they are qualified for a statistical comparison.

2.2.4 Individual Characteristics

The afore listed characteristics do not cover every single peculiarity of an individual handwriting. People develop their handwriting on a conscious, as well as on an unconscious level. The consciously acquired habits are those which the writer deliberately cultivated. Often, they concern the letter design, slant, writing pace, and skill level. These characteristics are easily altered. On the other hand, a writer is often not aware of his unconscious writing habits, like hooks and ticks, or initial and terminating strokes. These subconscious elements are difficult to identify, but they are also the best identification features (Koppenhaver 2007, 22-23).

2.3 Cuneiform Handwriting Identification

As mentioned before, one of the most common aims of modern forensic handwriting analysis is the identification of forgeries. Therefore, a document analyser compares the unknown (the document in question) with the known (a document with an identified handwriting). The analysis of cuneiform handwriting aims for different results. As discussed above, many people in the Old Assyrian period must have been literate. However, even though parties of legal matters are mentioned in the documents, and a letter sender names him or herself in the letter head, none of them usually identifies himself as the writer. Consequently, the main aim of cuneiform handwriting analysis cannot be the validation of a legal document, but it is rather the discrimination and identification of handwriting habits of individuals by comparing the unknown with the unknown.

The procedure of the study, however, is comparable to the approach of a modern handwriting analysis and consists of data collection and feature extraction as well as of analysis and comparison.

Sources: Private Letters

The main part of this study will focus on Old Assyrian private letters discovered in family archives, and excavated in the ancient city of Kaneš. This selection has several advantages: The Old Assyrian private letters are textual witnesses dealing with trading activities and everyday matters of the travelling merchants and their families and partners. Even though these letters discuss issues essential for a merchant's life, they are usually formulated as private texts.[58] As such, they are hardly subjects to regulations in regard of stylistic or orthographic conventions.[59] Hence, it can be assumed that they are written with the natural handwriting of the respective writer.

In addition, letters are the only text genre in which the writer might possibly identify himself without a supplementary colophon. Every letter begins with a letterhead naming sender and addressee of the text. Provided that the sender is also the letter writer, he would identify himself. However, it can hardly be confirmed for sure whether the named sender is also the letter writer. Hints for a possible identification can only be drawn from content and context of an individual's letter corpus.

Another advantage are the family archives of the Old Assyrian merchants which usually contain texts of several family members, and from which additional clues about family, their whereabouts, and social background can be obtained. The present study includes letters of three Old Assyrian families, and two unrelated individuals.[60] Two of the family archives, the

58 Official letters do exist (see for further information e.g. Beyer (unpublished MA thesis), Kryszat (2004b), Michel (2015c)), but they won't be discussed in this study.

59 Letters do have certain structures and formulae which depends on the relative hierarchy of sender and addressee (for further information on this topic see for the Old Babylonian period Sallaberger (1999), and for the Old Assyrian period Beyer (MA thesis 2014, unpublished); it influences content and formulation, but its affects on the personal handwriting are not studied yet.

60 For the complete list of included tablets see the document Appendix_tablets on the attached CD-ROM.

91/k-archive[61] and the 93/k-archive[62] belonged to two brothers, Ali-ahum (93/k) and Elamma (91/k), and were regularly excavated. The archive of the third family, the family of Aššur-idī, was reconstructed by M.T. Larsen.[63] Finally, two individuals from the c/k-archive[64], excavated in 1950, are included into this introductory part of the study to provide additional material. The main part of the case studies is based on letters which were sent by a single person. Old Assyrian letters can be addressed to a group of addressees as well as being authored by a group of individuals. But for the latter, it is more difficult to assign the handwriting to one of them. Therefore, such letters are mostly excluded here. However, an important factor for handwriting identification of unknown individuals is the number of examples. If only very few letters sent by a specific person remained, additional letters sent by a group including that particular person were included into the study as well.

The comparison: two approaches

The term master pattern denotes the range of writing of a writer (Koppenhaver 2007, 97-98), including all the unique patterns, habits, and peculiarities which characterise the handwriting of a person. Some writers have a very consistent writing which is easily recognisable, others have a more versatile hand and frequently use different designs for the same letter. However, for the identification it is usually not necessary to find the full range of writing. Instead, it is more important to identify the most crucial characteristics which are unique to one particular individual. Consequently, not every habit and every feature of a document needs to be compared. What matters is "to match sufficient characteristics to identify an individual as being the only one who could have created this combination of traits that make up the handwriting" (Koppenhaver 2007, 98).

Accordingly, one approach will be an individual one, the other one will be a statistical analysis. The latter approach compares elements of the manuscripts – e.g. cuneiform signs and use of signs – for a statistical and computer based analysis and clustering. Each element will be observed on the source material and categorized into sub-categories according to its peculiarities, and the data will be registered in a table. While this approach is helpful to get an

61 The texts were published by K.R. Veenhof in AKT VIII (2017), the included tablets will be numbered according to their numbers in the volume (and not according to their excavation numbers). For the pictures courtesy Cecile Michel.

62 This archive will be published by C. Michel who is in charge of it. The pictures of the tablets were kindly provided by Cecile Michel as well.

63 See Larsen 2002. For the pictures courtesy Cecile Michel, Klaus Wagensonner (II114), and the Trustees of the British Museum (II116, II117, II118).

64 In charge of these texts is J.-G. Dercksen, my gratitude for images and material.

overview of general features of the manuscript and script as well as to cluster the analysed material according to superficial observations; it is rather difficult to incorporate very specific details and idiosyncrasies (or most of the elements of the two groups Movement and Spatial Relationships). In addition, such a statistical approach is only useful if data is analysed which can be found on most of the manuscripts and in sufficient quantity. Very unique habits, only observable on few examples, cannot be added to the data.

Therefore, also individual habits are observed and analysed which are not common, but might nevertheless support an identification of handwriting. Both approaches complement each other and should be used together.

2.3.1 Tablet Shape and Layout

As mentioned before, forming a tablet was most likely the task of the scribe himself, and the process of producing a decent one required expertise and practice. The clay was formed to a tablet, either hand-moulded, or with the help of some tools. Taylor pointed out that the manual forming led mostly to rugged tablets, probably made by untrained writers or students. Forming a neat and consistent exemplar in this manner took a lot of effort, even for small tablets. Especially tablets larger than a hand show “signs of kneading or rolling against a hard surface” (2011, 11). Taylor presumes that every scribe developed his own method and tablet shape style according to his progressing experience (Taylor 2011, 8). While the method is difficult to reconstruct, the shape is clearly recognizable (provided that the tablet is not badly broken, or a fragment only).

Old Assyrian letters are mostly written on tablets in portrait, or square format, the landscape format is comparatively rare. As it is customary for most of the tablets of all types and periods, the obverse is convex, the reverse is flat (Walker 2014-2016,101). By observing obverse and reverse of tablets, especially their edges and corners show several variations.

The ways of describing the edges of a tablet are various and range from straight or curved out to crooked or sloped. The respective degree is difficult to pinpoint. In addition, the form of the edges is linked to the shape of the tablet corners. They can be

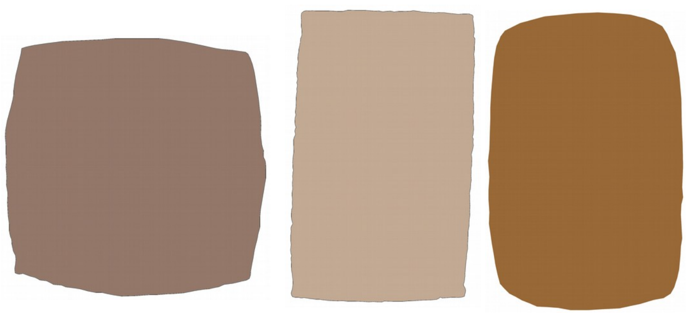


Fig. 7: Examples for the shapes of tablets, their edges, and corners: the silhouettes of AA936, TA143, SI043.

pointy or round and thereby influence the edge shape. Some tablets have remarkably straight edges (see fig. 7, middle). Here, the two edges forming a corner are straight and the corner is therefore pointy. A different case can bee seen in fig. 7 on the left. Here, the edges are slightly convex. In addition, they are squeezed together around the pointy corners (noticeable on the inwardly curved part, e.g. the upper right corner). This tablet shape is the so-called pillow-shape, and it is, with more or less pointy corners, and more or less convex edges, very common. The respective shape of these elements, however, varies greatly. The third main tablet shape is the tablet with round corners (see fig. 7, right). Here, the corners are strongly rounded, and therefore influence parts of the edges. Other tablets show different combinations of elements, for example strongly curved edges and pointy corners. However, because the corners are not squeezed, it is not the typical pillow-shape. Another possibility is that the rectangle of the tablet is deformed, and thus, its edges and corners are deformed, too.

In summary, tablet shapes are various, but defining their specific differences like the determination of the grade of a convex edge or the bending of a round edge is difficult. In addition, each of the four edges and four corners can be different which makes a classification even more diverse. Nevertheless, the general tablet shape can be a decisive discriminating element for the classification of handwriting.

In the case of the studied material some tendencies are notable. For example Šimat-Ištar's tablets are usually long and with round corners (see above fig. 7, on the right SI043). Some of Ali-ahum-c's tablets are deformed to some extent, the right part of the tablets seems to be shifted upwards. Tariša and her brother Aššur-taklāku tend to rather long and straight tablets with straight corners while their father Ali-ahum often sent pillow-shaped tablets. Thus, the shape of a tablet does not suit a statistical analysis, but it should be part of an individual comparison.

The size of the tablet, on the other hand, most likely does not play a decisive role in regard of writer identification. Taylor noted that "tablet size usually depends on the quantity of text to be inscribed, but often a particular type of text will be of more or less standard size" (2011, 8). In case of the Old Assyrian letters, the length of a letter, and therefore the size of the tablet certainly depended on the sender. While some of them probably preferred short texts and small tablets, others seem to simply have written what they had to say. For example Aššur-taklāku, the son Ali-ahum (see below ch. 3) sent several tablets with less than 30 lines (the smallest of these tablets, kt 93/k 599, has the dimensions 3,6 x 3,2 cm), but also several tablets with more than 50 lines (the largest tablet of his selected corpus is kt 93/k 544 with dimensions of 6,1 x 8,7 cm). In general, they still correspond to the standard size of tablets which Taylor defines as fitting into the palm of a hand (see above).

Fig. 8: Three tablets of the sender Aššur-idī, arranged according to their size: AI024, AI006, AI036.

The script on the tablets is not necessarily connected to the size of the tablets. The three tablets AI006, AI024, and AI036 were written by the same person (see below, ch. 4, Aššur-idī). The exact measurements of the tablets are missing, but the photos were taken with a measuring device. Hence, it is possible to compare the relative size of tablets and script. The size of the three tablets is very different. At the same time, also the size of the script changes, and while on the smallest tablet AI024 the script seems to be the largest, on the largest tablet AI036, the script seems to be the smallest.

Fig. 9: The two tablets UI165 and UI206.

On the other hand, the size of the script was certainly also depending on the expertise of the writer. For example the two tablets UI165 and UI206 (see below, ch. 4, Ummī-Išhara) were authored by the same person, but written by different writers. The two tablets have a similar size, but the size of the script differs greatly (see fig. 9). Thus, neither the size of the tablet nor the size of the script can generally be considered as very suitable discriminating elements for the identification of a writer. On the other hand, especially very small script like the one on UI206 points to a very experienced writer which can support an identification as well as hint to a possible professional education of that person. Furthermore, there are certainly writers who rather tend to small tablets while others preferred larger tablets. Therefore, particularities of the tablet size as well as the size of the script can still be very useful for an analysis.

Layout

This term refers to the arrangement of the text on the tablet, including ruling, lines, margins, and script arrangement. These features are hardly measurable, their perception and description is mostly subjective. Nevertheless, already Stratford noticed that “the general appearance of a tablet, the layout of the graphs, can be an initial indicator of different hands” (2015, 127).

Basically every side of an Old Assyrian letter can be ruled, except the right edge which is usually used for protruding word endings but not for complete lines. While the script on obverse and reverse is always written in marked lines, the lower edge is most commonly, the upper edge less often ruled. Ruling on the left side is rather exceptional, however, it can also be identified as a habit of an individual. A reason might be that often the text on the left side is very small and squeezed. Additional ruling would make these parts of the texts even more illegible.

Fig. 10: Examples for the beginning of the ruling, from left to right: AA191, AT295, TA301, EL016.

In the following section, the main focus will be on the ruling on obverse and reverse. The ruling usually begins on the left side, and ends on the right edge. Depending on the convexity of the edge, the end is visible on the obverse, or ends unseen at the side of the tablet. The beginning of the ruling on the left depends on the preferences of the scribe. It can be at the very left, almost reaching the edge (see fig. 10, left, AA191), or indented to a certain degree (see fig. 10, centre-left, AT295). The beginning of the ruling is often covered by the first and uppermost wedge of the first sign of the respective line. The left example of fig. 10 (AA191) shows a case where the writer partly paid attention, but not always. Thus, in the upper line, the beginning of the ruling is hidden under the vertical wedge. In the lower row, he positioned the sign A right below the ruling. The beginning of the ruling can roughly be shaped like the head of a horizontal wedge (see fig. 10, centre-right, TA301), which indicates that the ruling was impressed like a wedge. In other cases, it begins like an incision in the clay (see fig. 10, right, EL016).

The ruling can be straight from one side to the other. If it is constantly drawn that way, even the bottom line is completely visible (see fig. 11, top, EL016). But the ruling can also be oblique, or curved (see fig. 11, bottom, AA192). In the latter case, the ruling begins rather straight, but bents upwards at a certain point. In such cases, the bottom line is usually not completely visible, or the end of the first line of the edge is visible on the left. In addition, non of these types has to be consistently written on a tablet.

Fig. 11: The last lines of the obverse on EL016 (top), and AA192 (bottom).

Stratford suggests that the slanted rulings might be caused due to the writer's effort to manage the available space on the tablet. To finish a word in one line, a writer sometimes reduced the size of the signs at the end of the line. Since the next ruling was only drawn consecutively, it then followed the "edge" of the cuneiform signs above, and was therefore rather upward oblique (Stratford 2015, 120). While the reduction of the script size is indeed often notable, I believe the intention of saving space is certainly one possibility, but there are other options as well. From own writing experiences, I noted that without a framed line (including upper and lower ruling) my script becomes often smaller by accident. The same can be applied to the writing of the Assyrians since there was only a ruling at the top of the signs. Consequently, one reason of the slanted ruling might have been the intention of saving space. However, I rather believe it depended on the abilities of the scribe. Usually a straight ruling was intended, but an unskilled or untrained hand, and possibly also speed or carelessness, led to a curved or crooked line. For example on AA317, at the bottom of the obverse, the script becomes smaller, but the writer nevertheless drew the ruling in a basically straight way and "wasted" space (see fig. 12).

Fig. 12: On AA317 space is left between the signs and the lower ruling.

Thus, an analysis of the ruling might show tendencies of the respective writer, and his level of training. Like many of these subjectively evaluated discriminating elements, tendencies and peculiar deviations from the standard should be marked, but because of the typical inconsistency of writing, the ruling in general is rather no decisive discriminating element.

Margin

Fig. 13: Three examples for the margin, on AA192, AA343, UI206.

A margin is generally defined as "the blank space around the main body of text extending to the edge of a page" (Suarez *et al*. 2010, 915 "margin"). On Old Assyrian cuneiform letters, as much space as possible is used to fill in text. It usually begins at the uppermost border, and runs transition-free from the obverse to the lower edge, reverse, and upper edge. The right edge, as described above, is used for finishing words, and therefore signs often protrude. The only possible area for a margin is therefore the space to the left of the text which is related to the beginning of the ruling.

Defining "blank space" on a tablet filled with tiny wedges is difficult because the proportions of the different visual elements are very small, and one has to distinguish between a consciously made blank space and the unconscious made space to write a sign legible. For the analysis, a margin is therefore defined as blank space of the width of at least one vertical wedge. The writer could have shifted the beginning of the line further to the left for the width of at least one more vertical wedge, but decided against it.

However, it is problematic that often the left edge of the tablet is convex, and the obverse often is curved as well. Therefore, it is partly difficult to distinguish between the left border of the obverse and the left edge of the tablet. The corners are probably not affected by any curvature, because the clay was formed into a very specific shape here. Thus, an observation should focus mainly on the corners, and include the central part only for a verification of consistency.

2.3.2 The Selection of Diagnostic Signs

While the individual approach may include all the details on a tablet which might be discriminating, for a statistical approach a selection has to be made. In a list made by Veenhof *et al*.[65] 200 cuneiform signs, including syllables, logograms, numbers and fractions, used in Old Assyrian texts, are compiled with c. 400 different readings. However, usually not all of these signs were used in the texts. Instead, the range and number of used signs certainly depend on the expertise of the writer and the text's content. In the analysed material for the present study the following number of signs and readings were used:

65 The list was compiled by Th. Hertel and M.T. Larsen, the signs were drawn be K.R. Veenhof and R. Labat (version 20.02.2006).

	Abbreviation[66]	Different Readings[67]	Different Signs[68]	(Letters[69])
Ali-ahum (93/k)	AA	188	114	(17)
Aššur-taklāku (93/k)	AT	217	121	(30)
Tariša (93/k)	TA	165	110	(7)
Šimat-Ištar (c/k)	SI	155	95	(7)
Ali-ahum (c/k)	AL	191	117	(11)
Elamma (91/k)	EL	135	96	(7)
Ennam-Aššur (91/k)	EA	123	88	(3)
Ummī-Išhara (91/k)	UI	107	72	(2)
Aššur-idī	AI	180	112	(12)
Aššur-nādā	AN	124	87	(6)
Ilī-ālum	IA	151	102	(6)
Aššur-taklāku (AS), son of Aššur-idī	AS	137	93	(4)
Iddin-Ištar	II	129	89	(4)

Table 1: Overview of the 13 letter senders and their use of signs.

This list only gives a very superficial impression of the use of signs and readings on the different tablets. Several factors are not included. Especially in case that not all the tablets were written by the same person, such a general overview of readings becomes invalid. Another factor is the actual number of tablets as well as their length. In the 30 letters sent by Aššur-taklāku, son of Ali-ahum, certainly more different topics, and therefore different vocabulary and writings, were addressed than in the four tablets sent by Aššur-taklāku, the

66 The abbreviations consist mostly of the initials of the name, for instance in case of Ali-ahum = AA, or Aššur-taklāku of 93/k-archive = AT, or the first two letters form the abbreviation like TA for Tariša. The abbreviations simplify the assignment of texts to a specific sender. In further chapters, these abbreviations are usually followed by a number. This number can refer to the excavation number of the unpublished texts of the 93/k-archive (e.g. Tariša's letter with the excavation number kt 93/k 198 is abbreviated to TA198), or the publication number under which the respective tablet is published (e.g. Elamma's letter kt 91/k 350 is published by Veenhof in AKT VIII with the number 16, therefore, in this study, it will be referred to as EL016 according to its publication number).

67 Cuneiform signs are often polyphone, which means one sign can be read in different ways (e.g. the sign BI can also be read as *bé*, *pé*, and *pí*). The numbers in this column include all the different readings of the sign written in the corpus of the respective sender. Excluded are numbers, word dividers, and personal name markers.

68 While in the column of the "different readings" all the readings are itemised and counted, in this column, specifically the number of different signs in the corpus are listed.

69 This column lists how many tablets were analysed in the present study (see ch. 3 and 4). The following chapters will give more information about the individual letters, their length, the number of different signs and readings, etc.

son of Aššur-idī. In addition, some letters contain only a few lines of text like AT468 with 23 lines (61 different signs), while another text of the same sender, AT544, contains 65 lines (84 different signs). Furthermore, some tablets are partly broken, or only fragments. Consequently, any number of signs and readings is incomplete.

Nevertheless, such a list is useful for a general overview because it shows that there are certainly huge differences, in regard of both the use of signs as well as different readings. It also reveals a problem for any comparative methods: First of all, the table shows that neither all the signs which are known as being used during the Old Assyrian period, nor their possible reading range is fully utilised. The range of used signs shows a difference of 49 (from 72 to 121 signs), the reading range a difference of 110 (from 107 to 217 readings). This result demonstrates that not every sign was used by the different writers. Therefore, a comparison of all the written signs is plainly impossible. In addition, as mentioned above, these numbers only record the general use of signs of the respective letter sender, but not the sign range of single tablets, which can also differ widely. For example on the seven letters sent by Elamma, all in all 96 different signs were used. However, on the individual tablets the range of represented signs lies between 48 and 64. Since a comparison is only reasonable if the compared elements are represented on most of the studied objects, rarely written elements should be excluded from such a statistical comparison.

The application of several signs (and readings) depends on the topic of the letter, but also the writing preferences of the writer, and can therefore be infrequent. For example, personal names or commodities and materials can be written with a specific sign or logogram. The logogram NA_4 is only used to determine stones and stone artefacts. Thus, its usage strongly depends on the content of the text. The same applies for personal names, which may comprise rare logograms and CVC-signs. For example the sign TÁK is frequently used in the 93/k-archive texts because it can be a component of the name of Aššur-taklāku. However, especially in the texts of his sister Tariša his name is preferably written with the sign combination *ta-ak* instead of *ták*. In the letters of the c/k-archive this name is not mentioned, and the sign is not used.

Another example of the writer's preference is the sign IN (another reading is *en*$_6$) which can be used for every word class.[70] On Elamma's letters it is only written on tablet EL079 as the finalising syllable of a verb (*lá i-lá-mì-in*, l.23). As opposed to this, on Aššur-taklāku's (AT) letters, the same sign is written, often several times on 22 out of 30 tablets. And it is used especially for names, verbs, and the irrealis particle *-men*[71]. These observations do not necessarily mean that the writers of these letters did not know the signs, but maybe they preferred other spellings, or, at least in these texts, they had no use for them.[72]

Sticking to the use of signs as an important element of the study, it appears that, on the tablets of this study, only four signs are represented on every letter: A, MA, NA, and UM. The first three signs are among the most commonly used signs on the respective tablets. Reason for the sign UM being written on every tablet is mostly that the analysed texts are letters and usually include the mandatory *um-ma* "thus, as follows" in the letterhead, introducing the sender(s) of the respective letter. Another fixed part of the letter head is the verbal expression *ana* PN *qibi-ma* ("to PN speak!", imp. 2sm of *qabā'um* "to speak" + the enclitic *-ma*).[73] While *ana* is written with the signs A and NA which are in any case written on every tablet, the verbal form consists of the syllables qi and bi. Even though this expression is a fixed part of the letter head, both signs are not always written on the tablet. Reason is that in case of the syllable bi there are three different signs representing this phonetic value (BI, BÍ, and BE(BI$_4$)[74]). Thus, there is no consistent use of a specific sign. The syllable qi is always written with the sign KI. In some cases, however, this part of the tablet is simply broken. Therefore, the letterhead is not completely preserved, and this expression is missing.

A comprehensive comparison of all elements is, as demonstrated on the basis of the use of signs, not possible. A comparison of the four signs which are represented on every tablet is apparently not enough. Consequently, a selection has to be made, and some inaccuracy has to be taken into account: For a comparison, not only signs written on every tablet should be

70 "All words belong to categories called word classes (or parts of speech) according to the part they play in a sentence, e.g. noun, verb, adjective, adverb, etc." (English Oxford Living Dictionaries online (https://en.oxforddictionaries.com/grammar/word-classes-or-parts-of-speech), keyword "word class", accessed on 29.08.2019).

71 See Kouwenberg 2017, 739-742.

72 Therefore it is also reasonable that the higher the number of analysed texts, the higher the number of signs in use, as it can be observed in the table above. There, AT is the one with the highest number of letters, and he has also the highest number of syllables and used signs. For more information on the use of signs see the individual case studies in the following chapters.

73 For more information on letterheads, see Kienast/Volk (1995, 4), Larsen (2002, xxxviii-xl), Michel (2008c, 126-127), and Sallaberger (1999, 22, 29, 37-39).

74 For this study, the reading of BE as BI$_4$ is more important, therefore, I will refer to the sign mostly as BI$_4$.

included, but also signs that are written on at least a certain percentage of the tablets. As the list above shows, the quantities of letters are in most cases rather small (table 1). Thus, the number of tablets changes only insignificantly in regard to an increasing or decreasing percentage. In case seven letters of an individual survived, ¾ of this corpus would be five tablets (exactly 5,25), and 2/3 of the corpus would be four tablets (c. 4, 67).

To increase the selection of signs, for this study it was decided to include all the signs which are written on at least ⅔ of the tablets, and in addition a few signs which promise a diversity of variants.

Making a selection on the basis of such a system, however, is also very vulnerable because a single person with very particular writing habits can overthrow its validity.

For the present study, such an individual is Aššur-nādā. In case this study would be performed without his corpus, then there would be 27 signs which are commonly written on at least ⅔ of the analysed material.[75] However, not all of these 27 most common signs are also common on Aššur-nādā's tablets. On the contrary, six of these common 27 signs are not frequently written on his tablets.[76] And consequently, they would have to be excluded from the list of possible diagnostic signs according to the selection process.

To counteract the instability of individual corpora, and therefore the inconsistency of the most common cuneiform signs, for the present study, the selection of diagnostic signs is only loosely based on the list of signs which are represented on at least ⅔ of tablets of each letter sender. Furthermore, some additional signs have been added, which promise a great variety, but are not commonly used in the corpora of all the senders.[77] Thus, the list comprises a total of 33 cuneiform signs: A, AM, ÁŠ, BA, DÍ, DU, HI, I, IŠ, IM, KÀ, KI, KU, KÙ, LÁ, LI, MA, MÌ, NA, NU, RA, RI, ŠA, ŠÍ, ŠU, TA, TIM, Ú, Ù, UM, UT, ZI.[78]

2.3.3 Writing Systems: Variant vs. Individual Writing Habit

Modern cursive scripts are classified into different writing systems which predetermine the handwriting of an individual to a certain point because every system features some specific letter forms and their construction to a certain extent (see also above "class characteristics"].

75 These signs are A, BA, DÍ, HI, I, IŠ, IM, KÀ, KI, KU, LÁ, LI, MA, MÌ, NA, NI, NU, RA, RI, ŠA, ŠÍ, ŠU, TA, Ú, UM, UT, ZI.

76 These signs are HI, IŠ, KÀ, NU, RI, ZI.

77 For example only Ali-ahum is not using the sign AM very often,

78 I am referring to these signs with their most common reading in my material, therefore it is for example KÀ and not GA, and MÌ instead of ME.

Cuneiform Script is usually classified according to its period and the regional use. For example from the second millennium onwards, the Akkadian language was verifiably divided into two dialects, Babylonian and Assyrian. And even though both dialects were written with cuneiform script, each developed idiosyncrasies in regard of the use of signs, their shaping and reading. Hence, the Old Assyrian dialect[79] was generally written with a specific set of cuneiform signs, formed in a peculiar way. Such a system, or set, however, is not entirely fixed. It depends on content, context, educational and familial background. Historicising sign shapes and characters from other geographical places, their reading values and form, were included as well.

In addition, the form of the "typical" Old Assyrian cuneiform signs is not always completely determined. Small details like the number of wedges or their arrangement can vary. Such different forms are called variants. Whether these variants came from different schools[80], writing methods (like modern penmanship methods), or whether they were the result of individual habits and preferences still needs to be investigated.

On the other hand, there are cuneiform signs with a determined number of wedges, and a fixed arrangement. Nevertheless, minor variations can be observed like the changing space between two neighbouring wedges, or the size of a specific one. In case such a detail is written consequently on a tablet, it can be considered the writing habit of an individual. Such individual habits can also be observed on sign variants. In the following section, the different executions of variants are referred to as sign variations.

2.3.4 Comparing Cuneiform Signs

For a comparison, not only the number of discriminating elements is important, but also the sign's suitability for such a comparison. Not every sign consists of elements, be it the number of wedges or their arrangement, which clearly vary, and are therefore classifiable. Signs without such classifiable elements do not have much value for a comparison, especially for a statistical analysis.

For the discussion on suitable cuneiform signs, six private letter writers were chosen: from the 93/k-archive Ali-ahum (AA) and his daughter Tariša (TA), furthermore his brother Elamma (EL), whose archives was excavated in 1991, and from the c/k-archive Ali-ahum-c (AL) and

79 For a brief placement of the Old Assyrian dialect and its idiosyncrasies see Kouwenberg (2017, 10-14).
80 See also Taylor who suggests that "specific sign compositions could potentially be used to identify scribal schools, if not individuals" (2011, 13-14).

Šimat-Ištar (SI). Out of this selective corpus, one example of each potential diagnostic sign was randomly chosen from always three to five randomly selected letters of each sender.[81]

The following description and analysis of the potential diagnostic signs is based only on these randomly chosen examples. Its aim is to observe the discriminating elements of each sign, and to verify their suitability for a statistical analysis. Thus, not every sign variant and individual habit or variation is discussed, but only varying elements which may lead to a discrimination, on the basis of these random chosen examples. Other discriminating elements, including signs, use of signs, etc. will be discussed for every letter writer individually.

Consistency in Cuneiform Script

As mentioned above, there are writers with a very consistent handwriting, and there are writers with varying handwriting, using several designs for one letter or character. To examine the consistency of a writer's hand, ideally, all the occurrences of one character on tablets should be compared. Decisive is also the number of appearances. For a verification of a writer's handwriting consistency, the respective signs should be written more than once or twice to confirm either consistency, or versatility. However, in case of a long text and a very common sign[82], probably not every single occurrence has to be checked, but at least enough to ascertain habits and tendencies of the writer. On the other hand, there are of course also signs which are common in general, but only occur once or twice on a tablet. In such a case, an analysis should be executed on the basis that the result is not necessarily conclusive.

In this study, consistency in cuneiform script refers to the consistency of cuneiform design, the number of wedges, their arrangement, and certain pressure patterns, i.e. which wedges are emphasised in any way (be it their length, size, or depth). An overview of source material and a selection of signs (BA, DÍ, KÀ, KI, KU, LI, MA, ŠA) has shown that usually, variants are written on tablets consistently. Hardly ever does one specific variant change to another one (in opposition to variations that can occur frequently). However, not only the variant influences the appearance of a sign, but also the individual habits can give a character a very specific appearance even though the general structure does not differ from other occurrences.

81 See for the pictures of the selected signs the file Appendix_ch2_general-comparison on the attached CD-ROM.

82 For example Aššur-taklāku's letter kt 93/k 544 comprises 65 lines, the sign A is written 78 times, and the sign MA 70 times.

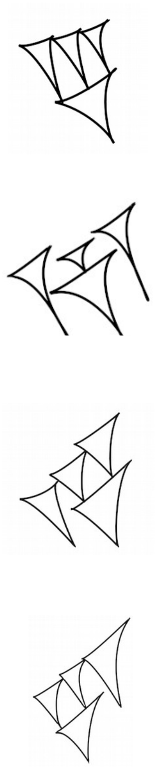


Fig. 14: One variant, four variations.

In case of the sign DÍ, for example, one variant consists of three Winkelhaken, placed on a diagonal upward row. A fourth Winkelhaken is positioned below these three. This variant has several variations (see fig. 14) depending on how the Winkelhaken of the upper row are positioned with regard to the Winkelhaken underneath, be it that all of them are attached to the bottom one with their tail, or be it that only the one in the middle is attached to the bottom one, etc. The consistency of these variations depends on the writer. Some hands show almost no variation, and the wedges are with very few exceptions positioned in the same way. Other writers do not change the variant of a specific sign in regard of the number of wedges and their general form, but their signs do not show a very stable construction. Instead they switch more often from one variation to another. Also notable is that such an inconsistency does not entirely depend on the writer, but rather on the specific sign. For example the writer of Tariša's tablets shows in general a very even handwriting. However, the sign DÍ changes frequently from one variation to another. Consequently, the consistency of handwriting has to be analysed from tablet to tablet, and from sign to sign.

One additional element is the number of wedges. As mentioned above, the change of wedges implies the change of the variant. However, in some cases, the number of wedges is rather unimportant, especially in case of stacked wedges, and sometimes also in case of Winkelhaken. From a visual point of view, some writers seem to have used any kind of wedges rather as a means to fill in some space. In such cases, the wedges and Winkelhaken are often rather thin and placed very tightly. The general shape of the sign, its structure and particular characteristics like pressure patterns do not change whatsoever. Such peculiarities have to be discussed individually as well.

2.3.4.1 Simple Signs

Some of the signs show similar elements or are constructed in a similar way. Therefore, they will be grouped and analysed together. The signs A, LÁ, MÌ, NU, and UT consist of only two to three wedges. Therefore, their construction is very simple. Nevertheless, all of them are frequently used signs and shall therefore be analysed in regard of their suitability for both the general individual comparison as well as for a statistical approach.

A

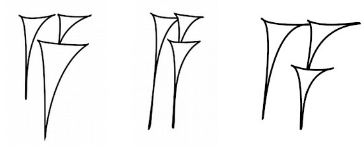


Fig. 15: Examples of the sign A: the left example shows a shortened first vertical, the lower head of the broken wedge is very wide; the example in the middle and on the right show the different heights of the lower head of the broken vertical.

The sign A consists of a vertical wedge which is followed by a second so-called broken vertical wedge, i.e. a second vertical wedge was impressed on a normal vertical one, but shifted downwards so that both heads are visible on top of each other. The sign is consequently written like that, hence it is a sign without variants. Nevertheless, individual habits can be observed especially in case of the position of the lower wedge of the broken one which is not entirely fixed, and therefore changeable. The stroke order of this sign presumably follows the given explanation. Thus, first the normal vertical was impressed, followed by the second vertical which was placed on the same horizontal axis as the first wedge, usually the ruling. The third vertical was finally impressed on the second vertical, but shifted downwards.

The sign A is written on every tablet of the analysed material, and therefore, it is predestined for analysis and comparison. On the other hand, with only three strokes it is one of the most simple cuneiform signs, comparable with the signs LÁ and MÌ which consist of two wedges each. Nevertheless, some varying elements can be observed: One feature is probably the length of the normal and the broken vertical. While in most cases both wedges have the same length evenly impressed, some writers like Ali-ahum have the tendency to shorten the first vertical, or at least impress it more lightly than the following wedge (see fig. 15, left).

Another peculiarity is the impression of the lower part of the broken wedge, which often seems to have the same depth and size as the upper part, but in some cases it is much stronger and deeper impressed so that this second wedge head is wider than the upper one (see fig. 15, left). In addition, the level of the lower head of the broken vertical is not fixed, but is usually placed somewhere between the middle of the underlying wedge and the its head (see fig. 15, middle and right).

However, these three features are often not consistently written on a tablet. A handwriting might show certain tendencies, but because of several tiny variations it is difficult to pinpoint the personal preference for this sign. Additionally, the features are hardly measurable, or classifiable. Therefore, the sign is rather not suitable for a comparison.

LÁ

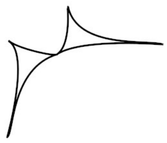


Fig. 16: The sign LÁ.

The sign LÁ is not the only sign for this phonetic value. The other sign with the same phonetic value, LA, is comparatively rarely used.[83] Even though LÁ is not written on every tablet, the number of tablets on which it is not written is very small. On the analysed material of the following case studies (ch. 3 and 4), only four texts out of 98 do not contain the signs. It consists of only two wedges, a vertical one, followed by a horizontal which is placed near the head of the vertical. The single vertical wedge often appears to be inclined to the right. However, the slant should not be part of the individual sign analysis since the study of an isolated sign out of context can give a wrong impression of the complete tablet and handwriting. The vertical wedge of LÁ is never placed on the ruling but usually below. The space between ruling and wedge head, however, differs. In many cases, the distance measures approximately "one horizontal wedge head", but it can also be placed closer to the ruling or further away. For example on Tariša's tablets, the vertical wedge of LÁ is frequently placed in the lower half of the line.

The position of the horizontal wedge in regard to vertical wedge and ruling is variable. While it is usually not placed on the ruling, in some cases it is placed right underneath it. In general, however, the space between ruling and horizontal wedge is determined by the positioning of the latter in regard to the vertical wedge. It is usually positioned next to the head of the vertical wedge, and can, but does not necessarily has to be attached to it. As in fig. 16, the two tips can be connected. But the horizontal can also be shifted further to the left, so that it is right above the vertical, or to the right so that both wedges are disconnected. In addition, it can also be shifted up or downwards so that it is placed on the right of the vertical's head, and in some cases, both are overlapping. The stroke order, however, does not seem to be standardised. Probably depending on the writer, either the vertical or the horizontal wedge were impressed first. Hence, it has to be analysed for every tablet individually.

While the differences in positioning both wedges are quite obvious, they are not consistently written on a tablet. Therefore, it is rather difficult to classify them for a statistical approach. For a general comparison, however, every sign can be suitable. In the case of LÁ probably the stroke order promisses the most insights.

83 As Kryszat noted, LA was a sign more often used in earlier texts of the Old Assyrian period (2015, 111-112). The sources of the present study are from a later time when the writing preferences had already changed.

ME/MÌ

The sign ME.

This sign can be read as either *me* or *mì*. For the present analysis, the phonetic value of the sign does not matter, but only its appearance on the tablets.[84] Because the sign is more often used as *mì* in the Old Assyrian texts, hereafter, the sign will be referred to as MÌ.

Like LÁ, the sign MÌ consists of a vertical wedge, which is followed by a horizontal one. A first difference is the positioning of the vertical wedge. Here, its head is placed on the ruling or even slightly above (SI113, AL120). The horizontal wedge is basically placed in the middle of the vertical, but it is never impressed on the vertical wedge, but with some space so that both wedges are clearly impressed and distinguishable. The height of the horizontal can differ insignificantly. In general, it can be observed that the sign shows even less differences than the sign LÁ and is therefore unsuitable for any comparison.

NU

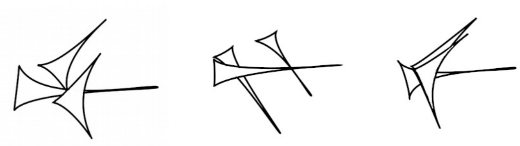


Fig. 17: Three variations of the sign NU.

The sign NU consists of three wedges. One horizontal is usually positioned somewhere between the middle of the line and the upper ruling (there is no example where it was impressed on the ruling, but a few times very close to it). The other two elements are Winkelhaken, or small downward oblique wedges generally placed on an oblique axis crossing the horizontal wedge top down. Their position, however, can vary significantly. The upper Winkelhaken, which is further to the left, can be placed on or above the horizontal. The bottom Winkelhaken is accordingly placed on the horizontal or below. Only in few cases none of the two is positioned on the horizontal wedge.

The two Winkelhaken can both be placed on a diagonal axis so that the upper one blends into the bottom one. Here, like the broken wedge of the sign A, both Winkelhaken can be positioned that both are well visible, or also very tight so that they almost appear like one union (see fig. 17, left and right). Additionally, both wedges can be shifted apart, even to a degree that both of them are completely separated (see fig. 17, middle).

84 The observations of the signs have shown that even in case a sign is polyphone, and several of the values are used in one text, there is no difference in writing (aside from natural variations).

Like the sign LÁ, NU shows several variations, especially in regard of the positioning of the two Winkelhaken. However, apart from such extreme cases like their complete separation, these discriminating elements are often not very consistently written, hence, they are rather difficult to classify.

UT

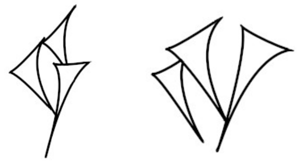


Fig. 18: Examples for the sign UT, once with high positioned Winkelhaken, and once with them on a very low level.

The sign UT has many phonetic values and meanings. It can be read as the syllables *ut, ud, uṭ, u$_4$, tam*, and the logograms UTU and BABBAR. Especially the latter is often used in connection with the logogram KÙ for the Sumerian expression of "silver" KÙ.BABBAR. The sign consists of two Winkelhaken and one vertical wedge. The latter does not have a fixed position, but it can be placed on or underneath the ruling. Like the sign LÁ, UT seems to tend to an inclination to the right. Again, this should not be included into the analysis of the character, but be part of a separate analysis of the slant.

The two preceding Winkelhaken of UT are placed on top of each other, usually positioned on an upward diagonal axis of roughly 45°. The bottom one is usually further to the left, which indicates that it was the first one to be impressed into clay, followed by the upper Winkelhaken and finalised by the vertical wedge. The two Winkelhaken are usually placed close to each other so that the upper one is placed on the upper right tip of the bottom one (see fig. 18). Both are also positioned next to the vertical wedge; often they are even attached to it by their lower tips. The upper Winkelhaken is positioned on the ruling or slightly below it. The Winkelhaken at the bottom can be placed as low as the middle of the line and therefore more or less the middle of the vertical wedge. In connection to the vertical, the Winkelhaken can be placed on a high level, so that the upper one is even above the head of the vertical wedge (see fig. 18, left), or somewhere below it. The constellation depends on both the height of the Winkelhaken as well as on the height of the vertical.

Summary for "simple signs"

By observing the simple signs which consist of only two to three wedges, there are great differences in variation. While the sign MÌ shows hardly any variation, the other four analysed signs actually do. Each sign has some small elements, which change frequently, and from tablet to tablet. However, most of them are too insignificant so that they are neither consistently written nor clearly classifiable. Therefore, only very remarkable variations like the separated Winkelhaken for the sign NU should be taken into account for an individual comparison.

2.3.4.2 Signs with a Winkelhaken cluster

Interesting for the analysis of handwriting is the comparison of similar elements, and how they are written for the different signs. Several cuneiform sign consist, or have an element consisting of a cluster of Winkelhaken. Such clusters tend to be written with several variations in regard of the number of wedges and their arrangement. Some of the most common signs are AM, DÍ, IM, LI, and ZI.[85]

DÍ

Fig. 19: Three variants of the sign DÍ.

A very common sign is DÍ. On the analysed material, only on two tablets it is not written. It is one of the signs with several readings including *de*$_8$, *dí*, *té*, *tí*, *ṭé*, and *ṭí*. In this study, the sign will be referred to as DÍ.

The general shape of this sign is a right-angled triangle with its right angle pointing to the left, and its hypotenuse to the right. It is build of Winkelhaken only which are arranged in two oblique parallel "rows". The first, or "upper row" contains usually three to four wedges positioned on an oblique axis; the first Winkelhaken on the left forms the right angle of the formation. The second, or "bottom row" consists of only one large Winkelhaken finalising the sign. It is usually impressed on the tail tips of one or more wedges of the upper row and forms a unit with them.

There are at least two different variants of this sign according to the number of wedges. As mentioned above, it usually varies between three to four wedges in the upper row. But also individual habits and pressure patterns, especially of the wedges of the upper row, characterise the appearance of the sign. While all the wedges can have the same size, and all their lower tail tips can be overlaid by the Winkelhaken at the bottom (see fig. 19, left), their seize and positioning can also vary and change the pattern of the sign. Regarding the upper row, the Winkelhaken can differ in size. Usually, it is either the rightmost or the leftmost Winkelhaken, or both which are enlarged and protrude (see fig. 19, middle). In addition, the position of the

85 There are several other signs with Winkelhaken clusters like IN, GI, MUŠ, NAM, ŠAR, ŠE, and UZ, however, they are too infrequently used for a comparison. On the respective tablets, however, they are certainly worth an analysis and comparison.

bottom Winkelhaken strongly influences the sign's appearance. Depending on its position and size it overlaps either all of the upper Winkelhaken, or only some of them, be it the one in the middle (see fig. 19, middle) or several on one side or the other. In such cases, usually the rightmost, and/or the leftmost Winkelhaken is not attached to the bottom Winkelhaken, but protrudes next to it (see fig. 19, middle and right).

AM

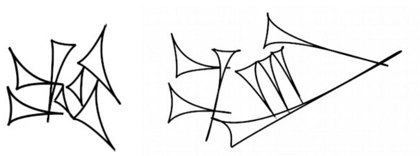


Fig. 20: Two variants of the sign AM.

The standard form of the sign AM consists of two parallel horizontal wedges crossed by a vertical wedge. At the end of the composition a number of Winkelhaken is placed, generally in the basic formation of the sign DÍ. However, the only constant of this sign are the two horizontals, the other elements are changeable, and contribute to the wealth of variants of this sign.

One discriminating element is the small vertical wedge crossing the two horizontals. First of all its number, usually it is only one vertical which can be placed somewhere from the heads of the horizontals to the immediate beginning of the finalising Winkelhaken formation. In some cases, however, there is not one, but two small parallel verticals. In addition, also size and height vary. Hence, its head can be placed on the ruling and thereby above the upper horizontal wedge, with its tail still crossing both horizontals. But it can also be placed on or underneath the upper horizontal. Its tail is either ending on the lower horizontal, or crossing it.

The Winkelhaken formation is the most varying element and also leads to the distinction of variants. The most common form is probably a formation similar to the sign DÍ: a diagonal upward row of several Winkelhaken, generally placed on top of another Winkelhaken at the bottom. A very common pattern here is that the rightmost Winkelhaken of the upper row and the one at the bottom are emphasised pretty much to the same extent (see fig. 20, left). However, the pressure pattern can be different. While the bottom wedge is always larger, the ones in the upper row can have the same size, or the rightmost and the leftmost are emphasised as well.

Furthermore, the number of Winkelhaken of the upper row is not fixed. It varies, including the rightmost possibly emphasised Winkelhaken, from three to six wedges (in the latter case, on EL344, the Winkelhaken are very thin and tightly impressed).

Remarkable is also the stroke order of this sign, which is not fixed at all. While usually, first the lower, then the upper horizontal was impressed, the small vertical is already discussable. In some cases it was impressed even before the horizontals, sometimes, after them, and there are some cases where it seems that it was impressed as the finalising wedge of the complete sign. Also the Winkelhaken element shows a high variety in stroke order. One possibility is that first the complete upper row, then the bottom wedge was impressed. Another order begins with the bottom one, followed by the upper row. A third option is that first the small Winkelhaken were impressed, followed by the one at the bottom. Finally, another emphasised Winkelhaken follows at the right end of the upper row. Especially here (but also in other cases), this last enlarged Winkelhaken is not on the same axis as the smaller ones, but can be shifted.

A final peculiarity of the sign AM is the change from the two emphasised Winkelhaken at the end to two oblique wedges which are pointing towards each other (see fig. 20, right). In such cases, three small Winkelhaken, or rather tiny oblique wedges, are positioned at the beginning of the lower oblique one and are attached to it (fig. 20, right).

IM

Fig. 21: Three variants of the sign IM.

Another sign that usually contains a Winkelhaken formation is the sign IM. Other readings are *em*, and the name of the storm god Iškur/Adad. It consists of a Winkelhaken formation ("DÍ-element"), followed by a construction consisting of a horizontal wedge, which is placed more or less in the middle of the line. It is crossed by two parallel verticals, their heads placed on, or slightly below the ruling.

The Winkelhaken element of IM can basically have the same shape as the sign DÍ, usually with three or four Winkelhaken in the upper row, and all the varying elements regarding emphasis of single wedges, their arrangement, and their interconnections. Regarding the positioning of this part, mostly the right Winkelhaken of the upper row is placed on the ruling. In some cases, like on Tariša's tablets, it appears that this last Winkelhaken was intentionally emphasised, or reduced, to be impressed on the ruling.

Loosely based on the general shape of DÍ is another variant of the Winkelhaken element. Here, however, the wedge at the bottom is not a Winkelhaken, but an upward oblique wedge, its tail tip ending on the level of the following horizontal. There are at least three variants with such an oblique wedge. In two cases, the upper row consists of either three or four wedges, which can either look like small downward oblique wedges, or have the normal Winkelhaken shape (see fig. 21, middle). The third variant shows a similar formation, but a broken vertical wedge is added in front of the small oblique wedges/Winkelhaken (see fig. 21, right).

Another varying element is the connection of the Winkelhaken element and the following wedge construction, i.e. the position of the head of the horizontal in regard to the leading Winkelhaken element. The head of the horizontal, which in most cases is roughly placed in the middle of the line, is usually on the same level as the upper tip of the wedge at the bottom (be it Winkelhaken or oblique wedge). The difference is the distance between these two parts. They can be completely separated so that a small gap is between both. But their tips can also be connected (like the rightmost example of fig. 21), in such a case, the horizontal might slightly overlap with the rightmost wedge of the upper row. Or the two parts are slightly shifted into each other so that the head of the horizontal is partly impressed on the bottom Winkelhaken (see the leftmost example of fig. 21). For a discrimination of variations, however, the Winkelhaken element is more suitable because its classification is more obvious and consistent, while the connection of first and second part is rather variable.

LI

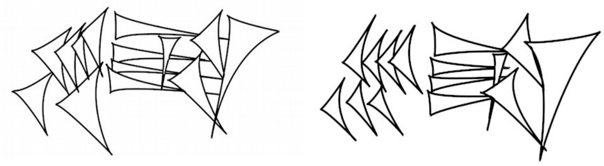


Fig. 22: Two variants of LI.

The sign LI has the readings *li* and *le*. Like the sign IM, it consists of two elements. The first part is a formation of Winkelhaken, the second part is the sign ŠA.

The formation of Winkelhaken can be arranged in different ways. One variant shows two parallel horizontal rows with several Winkelhaken in each row (see fig. 22, right). In the analysed material the most common number of wedges is three or four, but in a few cases the number in one row goes up to six, and there are possibly other examples with even more wedges.[86] The number of Winkelhaken in each of them can be the same; but rather often it differs. In such cases, the number of wedges in the upper row is mostly higher than in the bottom row, but it can also be just the opposite. The consistency strongly depends on the

86 As mentioned before for stacked horizontal wedges, and also the number of Winkelhaken sometimes seem to to be the result of available space and very thin impressions. Thus, the writer impressed very tiny and small wedges and “filled in” as many wedges as possible. This leads to high numbers of wedges.

writer. While some stick to a specific number of Winkelhaken, other persons always impress the same quantity of wedges in the lower row, but changes the number of the upper row, and a third writer may keep the variant with two rows of Winkelhaken, but interchanges the number of wedges frequently. In addition, the two rows can be positioned right upon each other, but often the upper row is slightly shifted to the right so that its first Winkelhaken is placed on top of the second Winkelhaken of the bottom row. Regarding the size of the wedges, it also depends on the individual habits of the writer. In most cases, the wedges of upper and lower row have basically the same size, but there are also individuals with peculiar habits. In such cases, however, not only a specific Winkelhaken is emphasised, but all the wedges of a row.

The other basic form of the Winkelhaken formation is written with two emphasised Winkelhaken in the lower row, and several smaller ones in the upper row (see fig. 22, left). While the typical quantity of the small ones is three or four, some writers write five, six, or even more wedges. But in such cases, the wedges are often so thin and tightly impressed that it is rather difficult to count the exact number (see n. 86).

A feature of this variant is the impression of the first large Winkelhaken. In many examples, the stroke order shows clearly that the left large Winkelhaken was impressed before the right one, followed by the small wedges of the upper row. Thus, the two large Winkelhaken can be combined to one row. However, in regard of the positioning of the first large Winkelhaken, its affiliation is not always entirely clear. As can be seen in fig. 23, it can but does not necessarily have to be on the same horizontal axis as the second large Winkelhaken. Instead, is is often positioned slightly higher, and in some cases even almost on the same level (and/or diagonal axis) as the small wedges of the upper row. In addition, the upper row is usually shifted to the right so that the small wedges begin on top of the second large Winkelhaken. This arrangement adds to the impression, that the first large Winkelhaken rather belongs to the upper row. In several cases, the stroke order, however, cannot be determined because the two larger Winkelhaken are not connected. In such cases, a classification can only be made on the basis of the general arrangement.

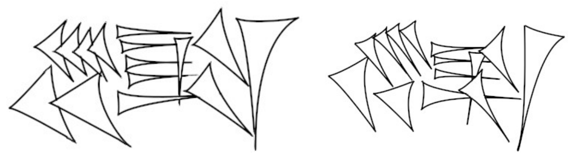


Fig. 23: Two positions of the first lower Winkelhaken.

The second part of LI is the sign ŠA. It consists of at least four to five parallel horizontal wedges, a small vertical crossing them, two Winkelhaken, and a finalising large vertical wedge. The sign ŠA, however, will be discussed in detail below. Another discriminating element of this sign is probably the connection of the two parts, both, the space in-between as well as the positioning. Regarding the latter, for the first part it depends on the formation of the Winkelhaken. In case the upper row is placed on an oblique axis, the last Winkelhaken is mostly impressed on the ruling, or slightly below, but is rarely impressed above. If the axis is horizontal, all of them are placed on the ruling or slightly below. The same applies for the second part. Usually the horizontal wedges are parallel to the ruling, and impressed on or slightly below it. Only in a few cases when either the ruling is crooked, or the signs are inclined, the horizontals are not parallel to the ruling. In such cases, usually the head of the uppermost wedge is impressed on the ruling, and its tail is tilted downwards. Usually the two elements, the Winkelhaken cluster and the ŠA-part are not attached, but both are written closely to each other. In addition, the uppermost horizontal is usually on the same height as the last Winkelhaken of the upper row (or the complete row respectively), and the lowermost horizontal is on the same level as the bottom wedge. Thus, both parts are parallel. In rare cases, the two parts are shifted. Whether this is a slip of the writer, or a habit has to be observed in the respective case.

ZI

Fig. 24: Two variants of ZI.

The last sign of this group is ZI*,* which has the additional readings *ze*, *sé*, *sí*, *ṣé*, and *ṣí*. Its first part consists of a construction similar to the second part of the sign IM: one horizontal is crossed by two parallel vertical wedges. This construction is followed by a formation of Winkelhaken. The latter resembles the Winkelhaken formations of the sign LI with both main variants. Consequently, one basic variant of the Winkelhaken arrangement of the sign ZI consists of two parallel horizontal rows of at least three to five Winkelhaken (see fig. 24, right). As for LI, the number of wedges can be the same, but in many cases the number of the upper row is slightly higher. The opposite with more wedges in the lower row is rather scarce. Regarding the consistency of these patterns, each tablet has to be analysed individually. The upper row can be positioned on top of the bottom row, or slightly shifted to the right so that not all Winkelhaken are on top of each other.

Fig. 25: Rather oblique wedges than Winkelhaken.

Also important for the appearance of the sign is the angle of the Winkelhaken. Their impression and angle depends on the writer's ability, the stylus, and the writing habits. While the right angle of the Winkelhaken often points to the left, the length of the upper and lower side can have the same, or different lengths, with usually the lower side being longer than the upper one. Some writers also tend to rather shape the Winkelhaken – depending on context and position – as a small oblique wedge. Such a habit can strongly shape the appearance of the sign. For example, fig. 25 actually shows the variant with two almost parallel rows of wedges. However, since the writer preferred oblique wedges rather than Winkelhaken, the first impression of the pattern might be a completely different one, i.e. of two oblique rows which are drifting apart. The size of the different wedges is again a matter of individual habits and has to be observed on each tablet.

The other basic variant of the Winkelhaken formation is the variant described earlier with two enlarged Winkelhaken in the bottom row, and usually three to four smaller Winkelhaken in the upper row (see fig. 24, left). Also here, the stroke order indicates that in general, first the two bottom wedges were impressed, followed by the upper row. The first emphasised Winkelhaken, however, is usually positioned on the level of the preceding horizontal, while the second one is on a lower level. The wedges of the upper row are arranged on a horizontal, or slightly upward axis.

Fig. 26: Examples for the first part.

The first part of the sign is the afore-mentioned construction of two verticals and one crossing horizontal. The two parallel verticals are in most cases positioned on the ruling, and only in rare cases placed below. The horizontal wedge is usually placed in the middle or upper part of the line. Individual aspects are the order of the strokes as well as the positioning of the two verticals in regard of the horizontal (see fig. 26). Regarding the construction of this first part, both orders are possible. Either the horizontal was impressed first, followed by the two verticals, or the verticals were impressed before the horizontal. In addition, differences can be observed concerning the position of the verticals on the horizontal. Some writers tend to position them basically in the middle of the horizontals so that the part on the left side of the verticals and the part on the right side of the verticals are of equal length, which gives the construction a balanced impression. Another version is the placing of the verticals on the left side next to the head of the horizontal.

Summary for signs with a Winkelhaken cluster

The signs with Winkelhaken cluster show much variation, and therefore, they are suitable for a comparison. Especially the number and arrangement of the Winkelhaken are imprtant discriminating elements. Furthermore, it could be observed that the signs DÍ and IM frequently show the same formation of Winkelhaken, as well as the signs LI and ZI. Hence, an analysis of these elements could include a comparison of these signs in regard of their similar writing as well. The sign AM can contain a similar Winkelhaken cluster. However, the wedge order seems to be different. Therefore, it should not be included into such a comparison.

Apart from the Winkelhaken cluster, most of these signs, with the exception of DÍ, have additional elements which can be included as discriminating elements. Consequently, all these signs are suitable as diagnostic signs.

2.3.4.3 Signs "with diamonds"

Paola Paoletti refers with this term to sign shapes whose "left side is made up of two slanted wedges" (2015, 53). For Old Assyrian, most variations of the two signs NA and KI fit into this category. Or, to adapt the expression slightly, the main part of both signs is shaped in a slightly rotated diamond (rhombus) form.

KI

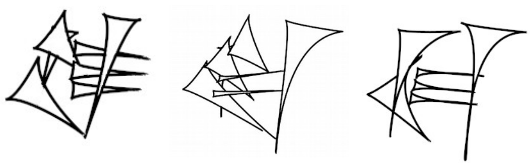


Fig. 27: Three different variants of the sign KI.

The sign KI can be read as *ke*, *qí*, *qé*, *gi*$_5$, and the Sumerogram KI "with" (Akkad. *išti*). It has typically a very compact shape formed with different combinations of Winkelhaken and wedges. Every sign starts with a Winkelhaken, which forms the left corner of the diamond. The following setup, however, can consist of varying elements. A common variant is the formation of two Winkelhaken (including the initial one) and a small vertical wedge (see fig. 22, left). The latter is usually impressed first and the two Winkelhaken are placed on top of it. Thus, the vertical is often hardly visible because the two overlaying Winkelhaken are too large and deeply impressed (a similar case is the example in the middle of fig. 22). The two Winkelhaken can be impressed parallel and with the same angle, which indicates an immediate movement without changing the angel of the hand. In other cases, the writer apparently repositioned the stylus for the second Winkelhaken.

Other variants of the sign are similarly constructed but with different elements. One variant is the same as the one described above, but with three instead of two Winkelhaken (see fig. 22, middle), or there are two Winkelhaken, but no small vertical. The variants mentioned first and last are often not completely distinguishable. As explained above, the two Winkelhaken are sometimes so large that the small vertical is hardly visible, or not at all. Furthermore, the quality of the clay, the stylus, and the handwriting contribute – or counteract – to the legibility of the individual wedge impressions, too. A fourth variant consists of the initial Winkelhaken and a single vertical wedge (see fig. 22, right).

The additional elements, especially the Winkelhaken, are usually positioned on an oblique upward axis of c. 45°, but there are several other possibilities to place the Winkelhaken as well as the small vertical wedge (see fig. 22, left and middle). In general, they are positioned above the first vertical and slightly shifted to the right so that this side of the sign gets its angular form. The highest element, and thereby the second corner of the rotated diamond, is either a Winkelhaken or the head of the small vertical, and it is usually impressed on the ruling, but it can also be slightly moved upwards or downwards.

The right part of the sign consists of a large vertical wedge and several thin horizontal wedges, which fill in the space between the initial construction and the finalising vertical. The latter wedge is, like the highest element of the initial construction, mostly positioned on the ruling, and only rarely below or above. The head of the large vertical forms the third corner of the rotated diamond, and its tail tip the fourth one. This wedge is often inclined to the right, the angle, however, varies. Size and number of the filling horizontals depend on stylus and handwriting style of the writer. Mostly they are neatly and parallel impressed, only rarely a peculiar pressure pattern is observable, where certain wedges are emphasised in size or length. Additionally, these horizontals can cross the finalising vertical, or end on it. This feature, however, is rarely consistently executed on a tablet even though a writer might have a strong tendency doing so.

NA

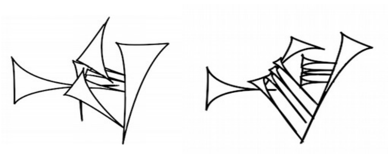


Fig. 28: Variants of the sign NA.

The second sign with a diamond shape is the sign NA. The structure and elements of this sign are almost the same as of the sign KI. The main difference is that the “diamond”-formation of the sign NA is preceded by a horizontal wedge roughly positioned in the middle of the line and on the same level as the first Winkelhaken of the diamond formation. Usually the latter is impressed on the tip of the horizontal. The varying elements of NA are usually the same. Thus, the key part for discrimination is the left part of the diamond, which is usually built with a varying number and combination of

Winkelhaken and vertical wedges (see for a typical example fig. 28, left). However, since the number and arrangement of wedges of the cuneiform signs KI and NA neither limited nor completely fixed as long as the general idea and shape of the sign is still recognizable, the described variants here are only examples of the studied material. The wealth of variants is certainly larger. Hence, for the sign NA an additional variant can be seen on the right of fig. 28. The diamond is not formed with Winkelhaken, but several parallel downward oblique wedges, which are thin and tightly impressed. The upper corner of the diamond is then formed by a vertical wedge, which is inclined to the right and overlaid by the small oblique ones. It indicates that it was impressed before them. The right part of the sign is constructed with the usual components consisting of several filling horizontals and a finalising large vertical wedge.

When comparing the signs KI and NA on a specific tablet, mostly both are constructed in the same way including the number of wedges and their arrangement. Therefore, an analysis of both signs for a handwriting comparison might not be necessary. The sign NA is one of the very few signs that is written on every tablet. In addition, it is also used very frequently. Thus, an accurate analysis of every occurrence can take up a lot of time. On the other hand, the sign KI is not as often used as NA. And even though it should theoretically be written on every letter, at least with its reading *qí* in the introductory phrase *ana* PN *qí-bi-ma* ("speak to PN"), it happens that a writer forgot to write this phrase or it is broken on the tablet (for example on TA564). Therefore, it is not in the list of signs used on every tablet.

While it might not be necessary to include both signs into a handwriting analysis, a study of the construction, the number of wedges and their arrangement of both signs could certainly be an interesting addition.

2.3.4.4 Block-shaped signs

This group comprises the three signs BA, KU, and MA which show a very similar pattern of wedges and form a kind of block.

BA

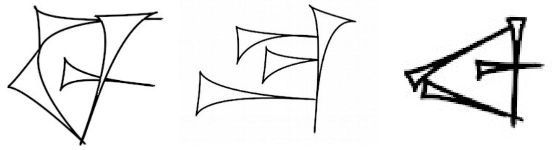


Fig. 29: The variations of BA *and an archaic form of the sign.*

The sign BA consists of three stacked wedges and a finalising vertical one. The stacked elements are an upper and a middle horizontal wedge. The third wedge at the bottom can be horizontal as well, or downward oblique. According to Labat (2011, 42-43) the archaic sign BA consisted of two oblique wedges, striving apart (see fig. 29, right). The shape, however, changed and during the Old Assyrian period, the upper wedge is already horizontal while the one at the bottom can be impressed either horizontally or oblique (see fig. 29, middle vs. left). The angle of the bottom wedge ranges from zero to approximately 45°. In addition, the head of the oblique wedge can be attached to the head of the upper horizontal (see fig. 29, left), but it can also be placed in front, or underneath the upper one. Weather the head of the bottom wedge reaches the upper one, or not, is hardly consistent, but changes from sign to sign. In case the bottom wedge is horizontal, it can either begin on the same vertical axis as the uppermost wedge, or its head is shifted to the left (see fig. 29, middle).

The horizontal in the middle is usually shorter than the outer pair. While the latter usually do not cross the finalising vertical, in many cases, the horizontal in the middle does (which might be a reminder of the archaic variant of the sign). This feature is written consistently on most tablets. This wedge was also usually impressed after the two outer wedges, but not after the finalising vertical wedge.

KU

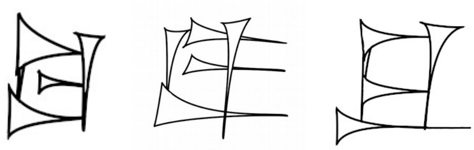


Fig. 30: Three variations of KU.

This sign KU can be read as *ku*, *qú*, and *gu*$_5$. It has a fixed construction and is built of three parallel horizontals and two verticals, of which one is positioned at the beginning of the horizontals and the other at their end. While this construct appears rather simple, a closer look reveals several varying details. A comparable element are the two verticals, even though their analysis is partly very problematic. A reason therefore is that the first one is not always clearly visible because its head, middle part and tip can be overlaid by the impressions of the horizontal wedges (see fig. 30). That, on the other hand, makes it often almost impossible to determine the stroke order of the sign. However, if discernible, both verticals are usually parallel impressed on the ruling, and in most cases they seem to have the same length and size. Another version is that the first one might have a similar length as the second one, but the latter is more strongly impressed and therefore slightly bigger.

Other discriminating elements are the length and positioning of the three horizontal wedges. One variation is that all of them begin on the same horizontal axis, which is usually marked by the first vertical. In such a case, it appears, however, that often the one at the bottom is far longer than the upper ones. While these two end more or less on the second vertical, the one at the bottom crosses the second vertical (see fig. 30, right). A possible reason might be the stroke order. Even though it is often very difficult to determine the stroke order, especially for the first vertical and the uppermost horizontal, in several cases it seems that the bottom horizontal was impressed at the very end, even after the second vertical.

For another variation, the upper and the lower horizontal begin on the first vertical wedge, the horizontal in the middle, however, is shifted to the right so that its head is positioned somewhere in the middle of the box formed by the other wedges (see fig. 30, left). Another possibility is that only the wedge at the bottom begins on the first vertical wedge while the two upper ones are both shifted to the right, either on the same vertical axis, or slightly staggered, too (see fig. 30, middle). Lastly, the head of the lowermost horizontal can also be placed before the first vertical, e.g. to its left, while the two upper wedges begin on the vertical, or the wedge in the middle is shifted to the right. In regard of the length of the horizontals, here, the lowest one usually crosses the finalising vertical wedge as well. The upper ones may or may not cross. But as mentioned before, the consistency of this phenomenon has to be observed on the respective tablets.

Problematic is the consistency of the different manifestations of this sign, or their distinguishability respectively. In regard of the two upper horizontals, very often it is hardly discernible whether they are shifted to the right, or whether they are only overlaid by the first vertical, especially when the stylus impression is somewhat blurry. In addition, in some cases, the lowermost horizontal is undoubtedly shifted to the left of the vertical. However, in other cases, the tip of stylus was directly impressed on the tail of the vertical. In such a case, the upper part of the head protrudes on the left side of the vertical wedge as well. Thus, it appears that the lowest horizontal was slightly shifted to the left, but this is actually not the case. Furthermore, such specific and small details are often not consistently executed in a very exact and therefore discriminating way. Thus, this sign is certainly suitable for a general and individual analysis, but any results has to be treated with caution.

MA

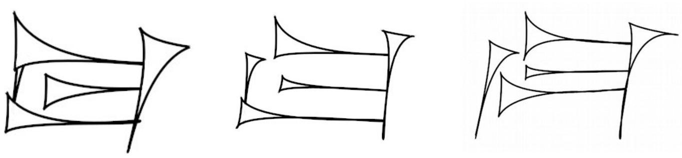


Fig. 31: Different variations of the sign MA.

MA is one of the signs written on every tablet. It shows basically the same shape as the sign KU but with longer horizontals. The discriminating elements are therefore the same as for KU, i.e. the length of the wedges or the positioning of their heads. While the variants observed for KU can be found for MA as well, it appears that the writers developed even more individual variations for MA. For example the first vertical is not attached to the horizontals at all but moved further to the left. In addition, the heads of the two upper horizontals are shifted to the right (see fig. 31, right).

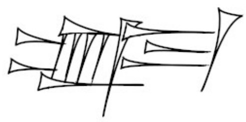


Fig. 32: The ligature of um-ma.

Furthermore, MA is one of the few signs that can be connected to another sign with a ligature. The usual sign combination is *um-ma* ("thus, as follows"), a standard phrase of the letterhead (see also above). The sign UM ends with several parallel vertical wedges, and the last of these wedges is sometimes used as the first vertical wedge of the following sign MA (see fig. 32).

Summary of the block-shaped signs

The three signs BA, KU, and MA show several variations even though they consist of a rather small number of wedges. Because it "lacks" one vertical wedge, the sign BA is incomparable with the two others signs. KU and MA on the other hand have the same wedge number and structure. Regarding the variations, both show basically the same features and peculiarities as well. The only general difference is the length of the horizontals, which is an advantage for the study of ma because the differences are more discernible, and therefore better to distinguish. Because of their similarities, the two signs are suitable for a comparison with each other like LI and ZI (and DÍ and IM).

2.3.4.5 Signs with stacked horizontals

This group comprises the signs ÁŠ, E, ŠA, and ŠU. These four signs begin with several stacked horizontal wedges. Not included is the sign KÀ. Even though it contains several horizontals as well, usually a vertical is impressed on the heads of these horizontals. Thus, it is not open as the other signs belonging to this group. Other signs like DA, or GAL are not written often enough on the tablets to include them into a comprehensive comparison.

ÁŠ

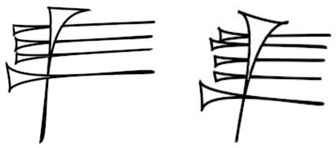


Fig. 33: Two variations of the sign ÁŠ.

The sign ÁŠ consists of several stacked horizontal wedges and one large crossing vertical with its head impressed on the ruling. It is crossing the horizontals somewhere in their middle, but its exact position is not determined and depends on the writing habits of the writer. Some individuals rather impress it closer to the heads of the horizontals so that the latter's tails are much longer than the part before the vertical (see fig. 33, left). From there, the vertical can be moved as far as to the middle of the horizontals, but usually not further. The number of horizontals amounts from three or four to seven and more. Stacks of many wedges are usually impressed very tightly, while between the horizontals of stacks with few wedges, there is usually more space. The horizontals in most cases begin on the ruling or slightly underneath. The lowest one, however, is not positioned at the tail tip of the vertical, but somewhere in its middle. Thus, a large part of the vertical protrudes underneath.

The horizontals are parallel arranged, and depending on the scribe, they begin on they same vertical axis, or all of them are slightly shifted into different directions (see fig. 33, right). In addition, some writers arrange the horizontals in a certain pattern by varying space between the wedges, and their size. The left example of fig. 33, for example, shows a specific pattern. The three upper wedges begin on the same axis and are impressed with the same space in-between. The lowermost one is moved further away from the upper ones, and also slightly shifted to the right. In addition, it is enlarged and bigger than the other ones.

Another possibility of such a pattern is basically the opposite of the one described above. Thus, not the lowermost wedge is emphasised and prolonged, but the uppermost one. Another possibility is that the uppermost one and the lowest one are both emphasised, and either one, or both are shifted to the left. Such specific patterns are usually consistently written on a tablet and display a writing habit of the respective writer.

E

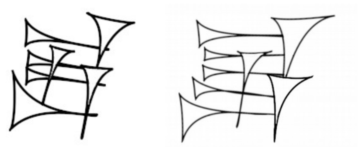


Fig. 34: Two variations of E.

The sign of the vowel E consists of two interlocking elements. Several parallel horizontal wedges are finalised by the sign A. The number of wedges lies between four and five, and is usually consistent on the respective tablet. In addition, their length, or their starting point respectively varies as well as their relative size. Probably the most common arrangement of the horizontals shows the upper wedges with the same length, and an enlarged one at the bottom. The head of the latter can be impressed further on the left, or on the same vertical axis like the others (see fig. 34, left). This vertical axis, however, is not always kept up, and the heads of the horizontals form a rather crooked line (see fig. 34, right). An additional feature is the highest horizontal, usually impressed on the ruling, which is sometimes emphasised, maybe to distinguish it from the ruling.

The second element of E is the sign A, which is attached to the horizontals, or rather, interlocked with them. The main difference to a solitary A is, apart from the attachment to the horizontals, the size of the normal and the broken wedge. For a normal A, both have often the same length. The element of the sign E shows a difference. Here, the broken wedge is impressed on the ruling and shows the length and size of a typical finalising vertical wedge. The normal one in front of it, however, is in most cases shorter and thinner. It can be placed on the ruling as well, but then it ends rather in the middle of the sign, or its head is shifted downwards, for example to the second horizontal. Its tip can, but does not necessarily has to, reach the bottom horizontal. In addition, in some cases, the A-element is only attached to the horizontals, thus, the horizontals end on or shortly after the first vertical. In other cases, the A-element is impressed on the horizontal wedges. The broken wedge shows the same mutability as the one of the sign A.

IŠ

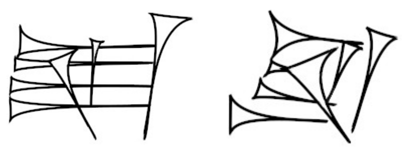


Fig. 35: Two variations of the sign IŠ.

The number of stacked horizontals of the sign IŠ amounts to at least four or five wedges. On these horizontals, a Winkelhaken and a small vertical are impressed, and the sign is finalised by a large vertical usually impressed on the tips of the horizontals (see fig. 35). Like other signs with stacked horizontals, they can change in length and size, and display different variations of the same variant. Thus, the wedges can have the same size and length. Or the one at the bottom can be emphasised, and/or prolonged so that its head is positioned further to the left. Another possibility is that the wedges are shifted further to the right from the bottom to the top (see fig. 35, right). In regard of the enlargement of a wedge, also the uppermost one can be enlarged, usually when it is impressed on the ruling, possibly to set it apart from the ruling. However, this emphasis is not always the case and therefore a habit of the respective writer.

Another element is the combination of Winkelhaken and small vertical wedge impressed on the tails of the horizontals. In many cases they are basically positioned in the middle of the structure. However, the combination can also be moved into another direction, e.g. to the right so that the small vertical is next to the large finalising one (see fig. 35, right). Or it is shifted upwards so that the centre of the Winkelhaken is positioned on the uppermost horizontal.

The Winkelhaken itself is often impressed with a very long lower tail, so that it actually rather reminds of a steep oblique wedge. Winkelhaken and small vertical can be impressed closely together, so the Winkelhaken overlays the small vertical. But both can also be completely separated and on different levels.

A problem is that the sign is very often written only once or twice. Since there are no different sign variants, but only changing details, a clear differentiation and classification is therefore hardly possible.

ŠA

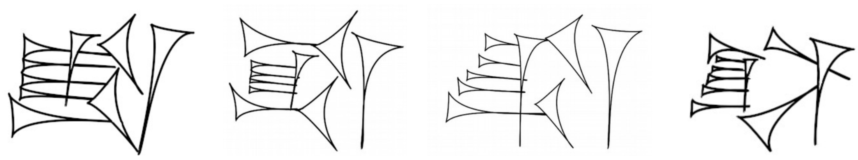


Fig. 36: Different variations and variants of the sign ŠA.

There are only very few tablets on which the sign ŠA is not written (in the analysed corpus two tablets). It is used for the relative marker and the conjunction ŠA.[87] The first part of the sign consists of four to six stacked horizontals. Like for the sign E their length and size can vary. Presumably the most common variant shows the upper wedges with the same length and starting point on a vertical axis while the one at the bottom is emphasised, and often with its head shifted to the left (see fig. 36, leftmost). In some cases, also the highest horizontal is emphasised, maybe to distinguish it from the ruling on which it is impressed. Or the horizontal wedges are shifted to the right from the bottom to the top, and are thereby getting shorter (see fig. 36, centre-right). Such a phenomenon has to be observed in the context of the script because some writers tend to write with a strong inclination to the right which can affect the appearance of the signs and their formation. In such a case, however, not only the horizontals have to be shifted, but also the other parts of the sign, especially the finalising vertical has to be inclined. In addition, some writers tend to have a peculiar pressure pattern, e.g. their outer horizontals are larger and deeper impressed, while the ones in the middle are

87 See Kouwenberg (2017, 779, 808).

rather thin and short (see fig. 36, centre-left). Most commonly the wedges are impressed with roughly the same distance. However, exceptions can mostly be observed in case that the writer tends to differentiate the depth of the wedges (like the example on the left of the centre of fig. 36).

The horizontals are followed by a short vertical. It is placed on or near the uppermost horizontal and mostly reaches, or even crosses, the wedge at the bottom. Only in few cases it ends somewhere in the middle of the sign.

The next part of the sign consists of two Winkelhaken on top of each other, the upper one usually slightly further to the right and impressed on or below the ruling. The lower one, certainly impressed first, is placed somewhere between the middle of the line and the bottom of the sign. While these are usually Winkelhaken, they can also be altered to two oblique wedges with their tips pointing towards each other (see fig. 36, rightmost). According to Labat (2011, 162-163), this sign variant was also used in the contemporary Old Babylonian period as well as in the preceding Ur III-period. In most cases when the version with oblique wedges is written, it is not the only variation on the tablet, but interchanges with the variation with Winkelhaken. Apart from the shape of the Winkelhaken/oblique wedges, however, the sign variation on that tablet is – in regard of the length of horizontals and other elements – usually the same.[88]

The sign is finalised by a large vertical wedge impressed on the ruling and at least reaching the bottom wedge.

Both the number of wedges as well as the general arrangement of this sign seems often to be executed consistently on a tablet. Only in very few cases, a writer did not stick to one variant, but changed small details from sign to sign. However, even though the described variations seem rather easily to distinguish, there are also several cases where the discriminating elements are not clearly visible. Therefore, the sign is problematic for a comparison.

ŠU

Another sign which can be found on almost every tablet is the sign ŠU. It consists of four to six or more stacked horizontal wedges usually ending on a large vertical.

88 For the Old Assyrian texts, there is hardly a consistent reason for the different use noticeable (see below). Mathilde Touillon-Ricci observed a similar alteration on Ur III tablets. However, in these cases, the use of normal Winkelhaken or the long oblique wedges was dependent on the available space in the line (presented in her contribution at the 64th *Rencontre Assyriologique Internationale* 2018).

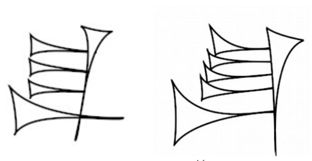


Fig. 37: The sign ŠU, written with two variants.

The uppermost horizontal as well as the head of the vertical are usually impressed on the ruling. While the upper horizontals rarely cross the vertical, the wedge at the bottom crosses it frequently. The varying element of this sign are the length and pressure patterns of the horizontals which are basically the same as of ŠA. All wedges can have the same length and size and be impressed with the same space in-between. In such a case, the lowermost horizontal can be emphasised and/or be longer than the upper ones (see fig. 37, left), or the pressure pattern is very peculiar so that the wedge ate the bottom and the highest horizontal are stronger impressed and enlarged. Some writers tend to position the heads of the horizontals on a crooked axis, or they become shorter from the bottom to the top (see fig. 37, right).

Summary for the signs with stacked horizontals

Especially in regard of their main component, the stacked horizontal wedges, the three signs do not show much difference. The other elements which define the respective signs, like the A-part of the sign E, or the combination of Winkelhaken and small vertical of the sign IŠ, do not show enough differences to classify them into different variationss. The only sign with more complexity is the sign ŠA. In addition to the stacked horizontals, it consists of several wedges supporting a discrimination. While it is probably not necessary to include all of these signs into a comparison, the sign ŠA, even though it is problematic, seems to be the most suitable sign of this group.

2.3.4.6 Additional signs

DU

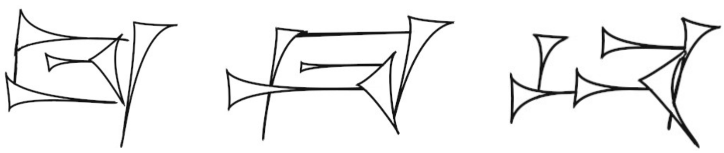


Fig. 38: Three variants of the sign DU.

The sign DU can also be read as *tù* and *ṭù*. One of its standard forms consists of a rectangular box formed of two parallel horizontals, and verticals, one at each end of the horizontals. In the middle of this frame, another short horizontal is impressed with a Winkelhaken at the tip of its tail (see fig. 38, left). The first vertical is often smaller than the last one. Its head begins on the same level as the upper horizontal, and it ends on the lower horizontal, or crosses it. In addition, it can be connected with both horizontals, but it can also be shifted to the left so that it is separated from one or both horizontals (depending on whether both have the same length, or one sticks out).

The last vertical is large. While the upper horizontal can be placed on the ruling or underneath it, the head of the large vertical is usually placed on the ruling and its tail protrudes below the lower horizontal. In most cases, the Winkelhaken in the middle is positioned at the tip of the short horizontal. Its position, however, can also vary depending on the habits of the writer. Therefore, it can be be placed somewhere else, for instance on the tip or slightly above the lower horizontal (see fig. 38, middle), or closer to the upper one.

Another varying element is the lower horizontal. It can be parallel with the upper one, but its head can also be shifted to the left (see fig. 38, middle). The first vertical can then either stick to the upper horizontal (as seen in fig. 38, middle), or it is positioned on top of the head of the lower horizontal, and separated from the upper one.

For another variant, the number of wedges remains the same, but the basic frame changes by shifting the short horizontal wedge and the Winkelhaken from the middle of the box downwards so that it is positioned between the lower horizontal and the final vertical (see fig. 38, right).

Especially in regard of the position of the horizontal wedges and Winkelhaken combination, but also the position of the small vertical, and the other elements, the sign DU seems suitable for a comparison.

HI

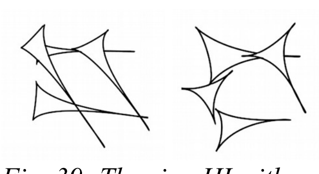


Fig. 39: The sign HI with different forms of Winkelhaken/oblique wedges.

This sign HI has several readings like *hi*, *he*, the Sumerogram DÙG/ DU10 for *ṭābum* "to be good", and the Sumerian plural affix HI(.A). It consists of the rather simple construction of two parallel horizontals and two Winkelhaken, or steeply downward pointing oblique wedges. The upper horizontal is either placed on the ruling, or slightly below. The lower wedge can be positioned directly under the upper one, or it can be shifted to the left. In some cases, it also seems to be slightly shifted to the right, mostly when its tip is pointing a bit upwards.

The differentiation between Winkelhaken and oblique wedges is not always clear, the latter could also be classified as Winkelhaken with prolonged lower sides. In some cases, both types are represented, first the Winkelhaken, then the oblique wedge (see fig. 39, right). The first wedge is mostly positioned between the heads of the verticals, but it can also be placed on the same level as the second one, which is usually on the upper horizontal (see fig. 39, left).

The second Winkelhaken/oblique wedge is impressed on the tip of the upper horizontal's tail. Its lower tip is pointing to the tail tip of the lower horizontal and it is either reaching, or crossing it. Thus, the sign forms, similar to the signs NA and KI, the shape of a rotated diamond. Regarding the stroke order, it seems that first the horizontals were impressed, followed by the two Winkelhaken/oblique wedges.

Even though the sign shows some small changing elements, they are too insignificant to clearly classify them. In addition, it is a sign that is often only written once or twice on a tablet. Therefore, is is difficult to decide whether a detail could be considered a habit or whether a specific form happened only by chance.

I

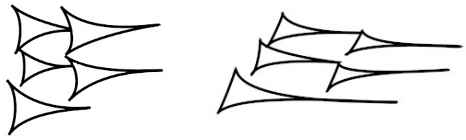


Fig. 40: The vowel I.

As expected for one of the few vowels, the sign I is represented on almost every tablet. It consists of five horizontal wedges. Four of them build a kind of rectangle. Two pairs of parallel horizontals are positioned one after another. The second pair can be placed on the same horizontal axis as the first couple, or slightly shifted downwards. In addition, the heads of the second pair are usually impressed on the tips of the tails of the first ones. The length of the four wedges is roughly the same, the second pair may be slightly longer since they are not ended by following wedges. A large difference in length, however, is very rare.

The fifth wedge is positioned below the rectangle, its head mostly impressed further to the left than the upper ones, its tail ending somewhere between the head of the second pair and its middle. In rather rare cases, the head of the bottom wedge is positioned on the same vertical axis as of the first pair.

The slant of the sign is also noticeable. The wedges are often not parallel to the ruling. The head of the upper first horizontal is impressed on the ruling, but its tip – and all the other wedges of the sign – are usually pointing slightly downwards. One reason is certainly the angle of the hand impressing the wedges. Regarding the movement of the hand, such slightly oblique wedges are easier to impress than truly horizontal ones. In addition, it is easier to distinguish them from the ruling. While the slant usually does not affect the rectangular form of the sign, in some cases, however, the whole sign seems to be deformed (see fig. 40, right). In such cases, the complete tablet should be observed in regard of the general tendency of the writer.

While there are certainly some differences notable, in general, it is hard to pinpoint them. So, the sign is rather not suitable for a comparison.

KÀ

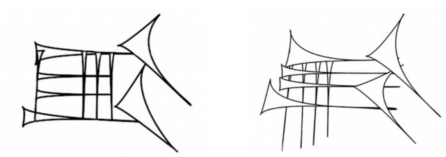


Fig. 41: Two variants of the sign KÀ, the difference is the position of the small verticals.

This very frequently used sign can be read as *kà*, *qá*, and *ga* with the first reading as the most common one. It consists of several discriminating elements. Its main body is built of usually four to six and more stacked horizontal wedges. Like the other signs with the stacked horizontals, the horizontals of KÀ can have the same length and begin on the same vertical axis. Or specific wedges, e.g. the one at the bottom and sometimes the uppermost one as well, are emphasised and prolonged. In another version, the wedges are shifted to the right from the bottom to the top. This variant, however, has to be observed in regard of the general slant and tendencies on the respective tablet. The uppermost wedge may be impressed on the ruling, or slightly below. In none of the examples, however, the slightly oblique impression can be observed which is very common for the horizontal wedges of the sign I.

Another varying element are the small vertical wedges impressed on the horizontals. Usually, one of them is impressed at the beginning of the sign, on the heads of the horizontals (in case the bottom one is sticking out, the vertical is impressed on the heads of the upper horizontals). In addition to this first one, two to five small vertical wedges are impressed on the tail tips of the horizontals. The heads of the verticals are either impressed on the uppermost horizontal wedge, or, if it is not impressed on the ruling, on the latter. The vertical wedges can end on the bottom horizontal, or cross it. Only in a few cases, they are shorter so that they don't reach the horizontal at the bottom. While the small verticals are mostly divided like this, a not so common habit seems to either place all of them at the beginning of the sign (see fig. 41, right), or to evenly distribute them on the horizontals.

The third element of the sign KÀ are two Winkelhaken at the end of the sign. The upper one is usually positioned on the ruling, the bottom one on the level of the bottom horizontal, or slightly above. The upper Winkelhaken is usually slightly shifted to the right, implying that it was impressed last. KÀ is another sign where the two Winkelhaken are sometimes replaced by two oblique intersecting wedges. This variant with oblique wedges and several small verticals is according to Labat (2011, 144-145) only common for the Old Assyrian period. But similar versions with oblique wedges but different arrangements of verticals are also known from the Ur III and Old Babylonian period.

The sign consists of several discriminating elements making it a suitable candidate for a diagnostic sign. A problem, however, is the rather inconsistent number of wedges, both the small verticals as well as the horizontals. If this is a writer's habit or a typical issue of this type of sign (is also occurs in the other signs with stacked horizontals), has to be analysed from tablet to tablet.

KÙ

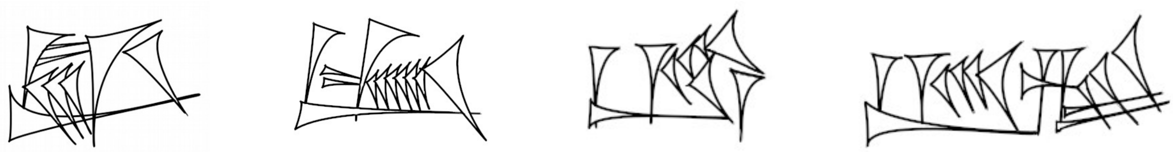


Fig. 42: The left, and centre-left example display two variants of the sign KÙ, the centre-right example shows the sign combination KÙ.BABBAR, the right example shows the sign combination KÙ.GI.

The sign KÙ is one of the few logograms which is very frequently written in the Old Assyrian texts. In most cases, it is combined with the sign UT[89] to express the Sumerian term KÙ.BABBAR, in Akkadian *kaspum*, "silver"(fig. 42, centre-right). Another frequent sign combination is KÙ.GI. This logogram is the Sumerian expression for the Akkadian *hurāṣum,* "gold" (fig. 42, right).

The general frame of the sign is build by two verticals, both usually positioned on or slightly below the ruling, and with some space between them (in terms of cuneiform wedges one might speak of the space of one vertical in-between). At the bottom of the construction, a long horizontal wedge is placed, its head on, or slightly before the first vertical, its tail reaches further to the right than the second vertical. In addition, there are usually several thin verticals impressed in the upper part of the space between the two verticals. They usually end on the second one, and are faintly impressed so that they are sometimes hardly visible. This frame of the sign KÙ does not show much variation.

89 As mentioned above, in combination with KÙ, UT is to be read as BABBAR.

However, the signs contains also several Winkelhaken varying in number, size, and arrangement. For the most common variant, some Winkelhaken, usually one to three, are impressed between the two verticals, mostly in the lower part so that their tips reach or cross the bottom horizontal. Since there is not too much space between the verticals, these Winkelhaken are usually rather thin and small. In addition, one Winkelhaken is following the second vertical (see fig. 42, left). It is usually larger than the ones between the verticals, and its position varies. It can be placed very closely to the second vertical and on the same height as the small Winkelhaken. But it can also be placed further away and with a different distance to the bottom horizontals.

Fig. 43: On the left is a variant of KÙ.BABBAR where both signs are closely linked together. The middle and right example show the term with and without ligature.

Furthermore, since the sign KÙ is often written together with the sign UT/BABBAR which contains two Winkelhaken at the beginning, in some cases, the last Winkelhaken of the sign KÙ is positioned underneath the lower Winkelhaken of UT/BABBAR which gives the impression that it rather belongs to the latter sign. Thus, it builds a kind of link to imply their affiliation (see fig. 43, left). Another habit is to connect these two signs KÙ and UT with a ligature. In fig. 43 in the middle and on the right, the sign combinations KÙ.BABBAR and KÙ.GI can be seen (both examples from tablet AT527: 5, 30). On the right, the sign is written with three smaller and one larger Winkelhaken. There is no connection to the following sign GI. The example in the middle shows the same version, however, the last emphasised Winkelhaken is not written, or rather also a part of the following UT (both examples are also above in fig. 42, at the centre-right, and at the right).

Furthermore, the last example shows that the Winkelhaken do not have to be placed between the verticals, but can also follow after the second one. Another possibility is that some of them are between the verticals and some are written afterwards, especially when the number of Winkelhaken is higher than three (see fig. 42, centre-left). Independent from the number of Winkelhaken is their general arrangement, which is always on a horizontal or slightly oblique upward axis.

The sign KÙ can clearly be considered a diagnostic sign. It it frequently written in Old Assyrian letters, and several consistently written variants can be observed.

NI

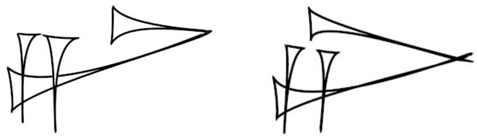


Fig. 44: Two possible variations of the sign NI.

The frequently used sign NI has several additional readings, i.e. *né*, *lí*, *lé*, *ì*, *zal*, and *ṣal*. Most of these readings, however, are very rare, or non-existent on the analysed material. Only *lí* and *ì* can be found more often, especially in names with the form Ilī-like Ilī-ālum (*Ì-lí-a-lu-um*).

The sign consists of two oblique intersecting wedges. In addition, two parallel, short verticals are positioned at the head of the lower oblique wedge. Their heads can be impressed on the ruling, or underneath it with some space in-between, and they can end on the oblique wedge, or cross it.

The oblique wedges show some varying elements as well. Regarding the upper one, a common variation is that its head is placed on the ruling or slightly underneath, while its tail is pointing downwards (see fig. 44, right). Another possibility is that the upper wedge is rather horizontal and parallel to the ruling (see fig. 44, left). In addition, the upper one is usually much shorter than the lower one. The length, however, differs from tablet to tablet. A good indication for a classification here are the small verticals. The head of the upper oblique can be positioned above one or both of them, it can reach them, or its head is placed somewhere on their right side. The tips of their tails can be attached to each other, and even cross. Or they are not connected at all. This shape can often be found in case that NI is attached to a following sign or word divider which is impressed on its tail tips.

The consistency of these elements depends on the writer. Problematic with this sign is that most of the elements refer to length and space. An exact execution of such elements is rather difficult.

RA

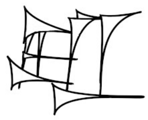


Fig. 45: The sign RA.

The typical form of the sign RA consists of two parallel horizontals and two parallel verticals which form a square that is filled with a cross, build with another horizontal and vertical wedge. Two further horizontals are attached, the upper one is on the same height as the first upper one, which is usually on the ruling. The second one is accordingly attached to the first lower horizontal, but one level below and only with the upper corner of its head. The sign is finalised by a vertical. It is, however, not impressed at the end of the second pair of long horizontals, but somewhere in the middle so that it doesn't form another square, but rather an upright rectangle.

This frame shows little variation, for example the first vertical may be impressed in front of the horizontal's heads, or on them, as well as crossing the lower, or ending on it.

The only wedge that is frequently changing its position, is the vertical in the square forming a cross. It actually does not always show this form but may also be written closer to the first left vertical. In rare cases, there are even two verticals impressed in the middle of the square. This element, however, is not enough to qualify RA as a useful diagnostic sign.

RI

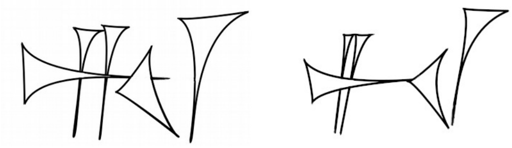


Fig. 46: The main difference of the sign RI is the position of the two parallel verticals.

Another sign with a rather simple structure is the sign RI which can be read as *re*, and *tal*. Two parallel vertical wedges are crossed by a long horizontal wedge. At the end of the latter, a Winkelhaken is placed followed by a finalising vertical, which is usually larger and impressed on a higher level than the two preceding ones.

Fig. 47: An example of RI on AT482:2, the deformation of the two parallel verticals by the horizontal is clearly visible.

In regard of the stroke order it has to be noticed that on the analysed material, it was mostly as described above. Thus, first the two parallel verticals were impressed, followed by the horizontal wedge. The order of the Winkelhaken and the finalising vertical are not always clear to establish since they are not always connected. However, some examples indicate that often the Winkelhaken was the last wedge to be impressed. In his study on the wedge order, Taylor (2015, 8, 15) observed another order. He points out that usually the two parallel vertical wedges were impressed after the horizontal, and the final large vertical was impressed at the very end, i.e. presumably after the Winkelhaken. Whether the two different orders present maybe different schools has to be analysed elsewhere.

The position of the two parallel verticals can change depending on the habits of the writer. First of all they can be placed very close to each other, or with more space in-between. In addition, their position on the horizontal varies from almost on the head of the horizontal (see fig. 46, right) to somewhere in the middle (see fig. 46, left) to its end and next to the

Winkelhaken. The latter can be placed around the tail tip of the horizontal, e.g. on, above, or below it. And in some cases, it is not connected at all.

A close observations reveals that there are actually several consistent tendencies from letter writer to letter writer of how to place the verticals on the horizontal, and how to position the Winkelhaken. One writer might tend to place the verticals close to the horizontal's head so the latter's tail appears rather long (see fig. 46, right). Another writer might tend to leave more space between both verticals and impress one on the head of the horizontal and the other on its middle. Again, the varying elements are not clearly measurable, but the tablets show usually a certain consistency and tendencies. Thus, RI is nevertheless a suitable diagnostic sign.

ŠÍ

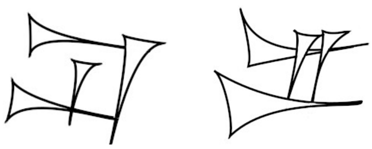


Fig. 48: Two variations of the sign ŠÍ.

The sign ŠÍ, or *šé*, shows a very simple structure as well. Two horizontal wedges, the upper one is usually positioned on or slightly below the ruling, the lower one is impressed underneath the centre line. Both wedges are commonly parallel. Only rarely does the upper or the lower one shift to the left, which might be caused by the writing slant, or accidentally, and has to be analysed individually. Both wedges usually have the same length.

In addition, two vertical wedges are impressed, which are probably the main discriminating element of the sign. One is positioned in the middle of the horizontals, the other one at the end. In some cases, however, the second vertical is not positioned at the very end so that the horizontals protrude. Also height and size of the verticals vary. The latter one seems to be always impressed on the ruling, which means that in case the upper horizontal is positioned underneath the ruling, the vertical protrudes (see fig. 48, right). The first one can be impressed on the ruling, or somewhere between the two horizontals (see fig. 48, left). In the latter case, the difference in size is very apparent. While the first one is mostly short and thin, the latter is long and strongly impressed. When the two verticals have the same length, they are usually impressed with the same strength.

The stroke order here is difficult to determine and seems to vary from writer to writer. The second vertical always seems to be the finalising wedge, the order of the other three wedges seems to differ. Thus, either the horizontals, or the first vertical is impressed first. In some cases it even seems that first the upper horizontal was impressed, followed by the first vertical, and only then, the lower horizontal was placed. Such an order, however, seems unreasonable because it is quite complicated and would require a lot of hand movement.

Even though the sign ŠÍ shows some significant discriminating elements, their consistency, and their exact classification are problematic.

TA

Fig. 49: The sign TA.

This sign TA has the additional readings *ṭá*, and *dá*. It consists of two parallel horizontals, which are crossed by two small verticals. At the end of the horizontals, two Winkelhaken are positioned on the two respective tips. The sign is finalised by a long detached vertical.

As already observed on others signs, the two horizontal wedges can be completely parallel, or the lower one is slightly shifted to the left so that its head is protruding. The upper horizontal may be impressed on the ruling, or underneath.

The two verticals are positioned at the beginning of the horizontals. The first one is usually impressed on the upper horizontal's head, and depending on the bottom one's position, on its head as well, or slightly behind (see fig. 49). In addition, the second one can be placed on the vertical, but also underneath it. Another possibility is that one or both verticals are impressed above, or below the upper horizontal. One, or both can also cross the lower horizontal.

The two Winkelhaken are positioned at the end of the horizontals. The upper one can be impressed around the ruling, or the upper horizontal. The position of the lower Winkelhaken is not fixed either. It can be placed on the lower horizontal, but also shifted upwards between the two horizontals. The upper Winkelhaken is usually positioned slightly further to the right, which indicates that it was impressed after the lower one.

Like for the sign ŠA[90], the Winkelhaken can be replaced by two oblique wedges pointing towards each other. In these cases, the heads of the oblique wedges are positioned above and below the second small vertical.

The finalising vertical is positioned on the ruling, and is, depending on the slant of the hand, upright or inclined to the right.

90 There are actually several signs where the Winkelhaken can be replaced by oblique wedges. These are for example BI, KÀ, LI, ŠA, and TA.

Even though the signs, especially the small vertical wedges, and to some extent also the horizontals, show some variance, all in all, there are no clear and distinguishable differences observable.

TIM

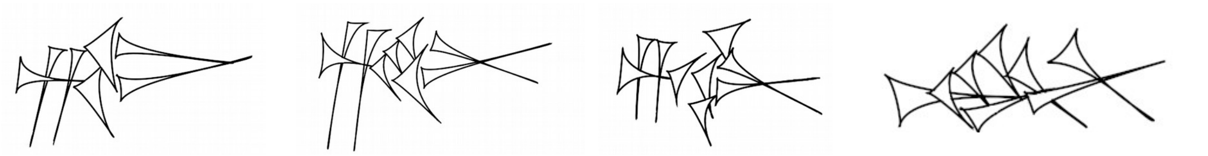


Fig. 50: The diversity of the sign TIM is mostly visible in regard of the Winkelhaken formation.

The sign TIM can be written in several variants which do not only differ in regard of wedge number and small changes in their arrangement, but also general changes of structure and setup. One construction which can possibly be called a standard structure begins with the already described combination of a horizontal wedge positioned in the middle of the line which is crossed by two parallel large verticals. This part is followed by a small Winkelhaken cluster, and finalised by two oblique intersecting wedges. Depending on length and angle, the tips of the latter can meet, and even cross. The number and arrangement of the Winkelhaken cluster varies. A very common variation consists of two Winkelhaken above each other (or slightly offset, as usual, the upper one further to the right). The position of the following oblique wedges varies. The upper one is usually on the same level as the upper Winkelhaken. The lower oblique can be on the same level as the lower Winkelhaken (see fig. 50, left), or even underneath. Another possible formation of the Winkelhaken is the arrangement of the DÍ-sign with either three or four wedges in the upper row (see fig. 50, centre-left). A rather complex construction consists of four Winkelhaken, two of them positioned on a horizontal axis on the same level as the horizontal wedge. In addition, one Winkelhaken each is positioned above the pair, and one underneath (see fig. 50, centre-right).

While the above described variants differ in regard of the Winkelhaken cluster in the middle, their general setup is the same. However, there are a few other variants which only faintly resemble the introduced TIM-shape (see fig. 50, right): Here, the standard form begins with a horizontal wedge as well, but the two verticals are omitted. Instead, three Winkelhaken, or short oblique wedges respectively, follow. They are framed by a pair of long oblique intersecting wedges. While the lower one already begins underneath the Winkelhaken the upper one, is positioned after them (like the oblique wedge combination of the sign NI). This construction is then followed by another pair of oblique wedges, running towards, and eventually crossing each other. The second lower oblique is usually impressed on the crossing of the first oblique couple.[91]

This variant can be changed to other variants. One possibility is to omit the second pair of oblique wedges. This variant then consists only of the horizontal wedge, the three Winkelhaken, and a pair of oblique wedges. Another variant mixes both standard variants by using the horizontal-vertical-construction and adds the arrangement of two oblique pairs.

The observations show that these diverse shapes are usually consistently executed, and therefore, the sign TIM is certainly a diagnostic sign, and suitable for further comparisons.

Ú

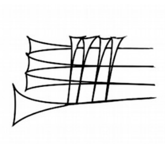


Fig. 51: The sign Ú.

This sign Ú has the shape of a net, consisting of several horizontals and crossing verticals. Three to five parallel verticals are placed either on the ruling or the uppermost horizontal. They usually make an even impression with their heads on the same horizontal axis, unlike the horizontals. Three to six long horizontals are stacked with the formation of verticals in their approximate middle. In contrast to the latter, the horizontals do not have a boundary like a ruling or another vertical wedge. Thus, the positioning of their heads varies greatly. Like ŠU or ŠA, all of them can be positioned on the same vertical axis, but the lowest wedge can also be emphasised with its head shifted to the left. In addition, all the horizontals can be positioned on an oblique axis and therewith shifted to the right from the bottom to the top, or from the top to the bottom; here, the bottom wedge is not impressed on the same oblique axis, but still shifted further to the left. In addition, verticals and horizontals can protrude on the other side of the respective other wedge type, or end on the last wedge of the respective other type.

Ú is one of the signs that show some variation, but they are hardly consistently written, or clearly classifiable. Therefore, it is rather not suited for a comparison.

91 Kryszat (2008, 233 and n. 8) noticed a similar variant but without the second pair of intersecting oblique wedges (with reference to the drawing of Sydney Smith in CCT 1, plate A). He suggests to refer to this second type without verticals as TIM_B while the "standard type" of the sign with two verticals at the beginning is TIM_A. In this research work, however, his system is not applied because for both "types" there are several additional variations and mixed "types". Hence, a differentiation would probably more confuse than support an analysis.

Ù

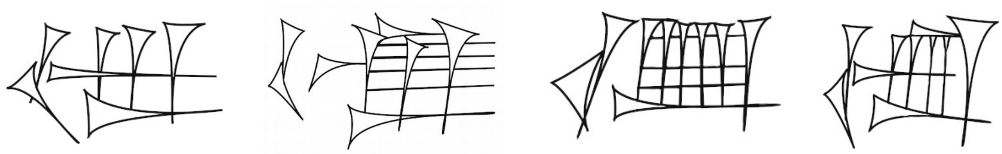


Fig. 52: Different variants of the sign Ù.

The sign Ù is another example for a cuneiform character with a defined exterior which can be formed in several ways. In the Old Assyrian period, the sign usually begins with a combination of a Winkelhaken and a vertical. The former can be impressed as a normal triangle, or the lower side is strongly prolonged. It can be positioned in the middle of the line and in front of the vertical. It can also be impressed partially or completely on the vertical, and shifted downwards (see fig. 52). This part is followed by a construction consisting of a horizontal positioned in the middle of the line, and a connected box formed of wedges. Its setup, however, can vary strongly in regard of the number of wedges as well as their combination. The salient horizontal can be a kind of spine of the box, beginning in front and drawn through the complete box (see fig. 52, left). But it can also be an individual wedge which is impressed in front of the box construction (see fig. 52, centre-left). Another variant omits the salient horizontal (see fig. 52, centre-right). The box itself consists of several vertical and horizontal wedges. All the variants have in common that the horizontal at the bottom is prolonged and emphasised, its head is placed in front of the first vertical, its tail usually crosses the final vertical. The number of vertical wedges differs from three to six and possibly more. The number of horizontals differs greatly, too. As shown in fig. 52 on the left, in case of a horizontal "spine", there may be only the bottom horizontal. Another possibility is that this construction is also closed with a third horizontal at the top, impressed on the heads of the verticals. Or that thin horizontals are impressed in the interspace between the large wedges. In case, there is no spine, the box can also be filled with several horizontals, usually thin and faintly impressed (fig. 52, centre-left and centre-right).

Also for this sign, certain writers develop a particular pressure pattern, for example by emphasising the first two, and the last verticals while the other verticals in-between are thin and weekly impressed (see fig. 52, right).

All in all, the sign Ù shows a wide range of variety which is suitable for an analysis. However, it is problematic that certain details are often hardly discernable.

UM

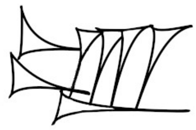


Fig. 53: The sign UM.

This signs begins with two short parallel horizontals which are positioned in the middle of the line. They are followed by four to eight or more large vertical wedges. Their high number results from the preference of some writers to fill in space with many thin wedges instead of a clearly defined number of bigger ones. The finalising wedge of this sign is a large horizontal which is impressed on the tips of the verticals. It usually begins somewhere at the end of the horizontal couple and ends after the verticals.

This common Old Assyrian variant hardly shows any particular discriminating element except the number of verticals which is, taken on its own, a questionable identifier. Only on a few tablets, a different variant can be found, which is, according to Labat (20111, 98-99), typical for the Old Babylonian period. Here, an additional long vertical is positioned above the verticals. In addition, the last vertical may be emphasised and prolonged, and thus possibly cross the bottom horizontal. This feature, however, might be an individual habit of the respective writer.

All in all, the sign does not show enough consistent or peculiar elements to consider it for a comparison.

Summary

The analysis of the 33 potential diagnostic signs has shown that 16 of these signs are suitable for a comparison, and that are:

AM, BA, DÍ, DU, IM, KÀ, KI, KU, KÙ, LI, MA, RI, ŠA, TIM, Ù, ZI

Important discriminating elements supporting a classification are a consistent execution of a fixed sign arrangement, and – at least mostly – a constant number of wedges which distinguishes the different variants.

Huber and Headrick wrote that "individuality is probably more often exhibited by writers in the execution of the more complex letters forms. Some letters of our alphabet require complex movements (…). As a result copybook, or model letter forms, are often slightly altered by the individual to a structure more conveniently performed" (1999, 46). The observation of the cuneiform signs confirms this statement. Especially the simpler signs with only a few wedges might show small differences, but they are usually neither consistently executed nor significant enough for a classification. But also signs with many wedges, but simple structures like ÁŠ or Ú cannot be distinguished in different variants and are therefore not very suitable for a comparison.

On the other hand, also the selected diagnostic signs show a wide range of complexity and wedge number. Outstanding in regard of of both criteria are especially signs with a Winkelhaken cluster, like LI and TIM. These signs show a wide range of diversity. But surprisingly also signs with a fixed number and arrangement of wedges like the block-shaped signs BA, KU, and MA, as well as the sign RI show clear and consistently executed discriminating elements which mark them as useful diagnostic signs.

To summarise, the 16 selected diagnostic signs consist of sufficient peculiarities to group them into different and distinguishable sign variants and variations. The discriminating elements refer to the number of wedges, and their arrangement. Accordingly, the selection of signs can be divided into two groups. One group comprises signs with changing numbers of wedges, a phenomenon which can mostly be observed in stacks or clusters of the same wedge type, be it Winkelhaken, horizontals, or verticals. Here, it seems that the signs had a general formation, but neither the number of wedges nor their definite arrangement was fixed. Therefore, both number and positioning vary. This group includes the signs AM, DÍ, IM, KÀ, KI, KÙ, LI, ŠA, TIM, Ù, and ZI.

The second group contains signs which do not vary in number of wedges, but a comparison of different writers and hands has shown that nevertheless their formations can vary greatly and distinguishably. Therefore, these signs rather display very peculiar and individual traits of hands, which are very important for an identification as well. The signs BA, DU, KU, MA, and RI belong to this group belong.

2.3.4.7 Excursus: Stroke Order

The construction of a letter, or a sign, is a consistent habit of a writer. By learning how to write, he develops his individual style: "They start their letters in approximately the same place whether on the baseline, above, or below it. They move the writing instrument in the same direction and join strokes at a similar location each time" (Koppenhaver 2007, 21). By applying this theory on cuneiform script, one can assume that the stroke order of the wedges is another possible identifier for individual hands.

In 2015, John Taylor published a paper on the wedge order of cuneiform signs. He observed that specific signs in texts from the first millennium BC show a surprisingly consistent order of strokes, while texts from the third millennium show different sequences. He assumed that a changing stroke order might be useful for dating texts, determining their provenance as well as probably support the characterisation of different hands. His study revealed that the stroke order of the cuneiform signs followed guiding principles consistently over the course of the millennia. Thus, he suggests that "these principles must have been taught as a fundamental part of cuneiform education, whatever form that took at any given point, and wherever the student was learning the script" (Taylor 2015, 22). Additionally, he noticed that on the one hand, Old Assyrian texts show a great variation of sign forms, which might point to the literacy of the merchants. On the other hand, the stroke order mainly complies with the sequences found in Old Babylonian and earlier corpora (Taylor 2015, 16).

Fig. 54: One example of sign RI written on AT516 and SI737.

Based on the material of this study, Taylor's observation of the sequence consistency of the stroke order on a particular tablet can be confirmed. Like the shape consistency of a cuneiform sign, also its stroke order is usually the same. However, from tablet to tablet, it can vary. An element which can be found as part of several cuneiform signs is the combination of one horizontal crossed by two parallel verticals (discussed above for e.g. IM, RI, TIM, ZI). In fig. 54 two examples of the sign RI are shown. The left example was written on tablet AT516. The horizontal is clearly squeezed together at the two points where the verticals are crossing it. It is a strong indication that the horizontal was impressed as the first wedge, followed by the two verticals. The second example is from tablet SI737. Here, the impression of the horizontal pushed clay into the triangular notch of the vertical wedges. It shows that the horizontal was impressed after the verticals. The order of the following Winkelhaken and final vertical is discussable. While these two examples are not entirely clear, other examples show that often the Winkelhaken was impressed after the vertical at the end, while some examples show a reversed order.

Fig. 55: Examples of the sign ZI written on AA189 and TA143.

Another example is the order of the Winkelhaken cluster. Regarding the studied material, the most common variant in case of the signs LI and ZI seems to be that the lower row of these wedges was impressed first, followed by the wedges of the upper row (see fig. 55, left; an example from tablet AA189). However, there are also cases where first the upper row of Winkelhaken was written followed by the lower row (see fig. 55, on the right an example of tablet TA143).

In general, however, it is rather difficult to establish the stroke order. Possible indications like the depth of the different wedge impressions are not necessarily decisive (Taylor 2011, 14), with reference to Livingstone *et al*. 2004). A better approach might be the observation of details like squeezed clay at the wedge-edges, or wedges which are not fully depicted. It indicates that their form might have been influenced by the later impressed wedge next to them. But if wedges are too far apart from each other is is almost impossible to figure out their order. In addition, the readability of the wedge and its details is greatly depending on light incidence and shadow, and of course the viewing angle of the reader. While a 3D scan is adjustable in this regard, a 2D picture is unchangeable, and therefore, its use for the study of wedge orders is limited.

The present study was mainly conducted with 2D images of the material. Because of their limitation, a study of the stroke order was only possible in a limited way. Therefore, the stroke order is not playing a decisive part in the identification of handwriting, and is only mentioned in peculiar cases, i.e. when it is very obvious or seems to influence the apperance of a wedge or sign composition.

2.3.5 The Use of Signs

The identification of handwriting does not rely on the shape of the signs alone. Other elements, connected to document and script, can support an identification.

During each and every period of cuneiform writing, a specific corpus of signs and readings was preferred. In the Old Assyrian period, for example the syllable /ti/ was hardly written with the sign that was commonly used for TI, but with the sign TÍ instead. While certain signs were almost entirely omitted, other signs with the same sound value were used simultaneously, or in their place. As mentioned above, Guido Kryszat (2015, 112) published a preliminary list of these phonetic values and their writings, including the different signs for the phonetic values /ab/p/ (AB, ÁB), /b/pi/e/ (BI, BÍ, BI_4), /di/ (TI, DÍ), /e/iš/ (EŠ, IŠ), /la/ (LA, LÁ), and /šur/ (ŠUR, ŠÙR).

The study and comparison of the use of signs should be a part of a palaeographic handwriting analysis. It might give hints about the writer, and, if Kryszat's assumption about the development of Old Assyrian script is correct, the writer's educational background and lifetime[92]. In contrast to the sign variants described above, the discriminating element regarding the use of signs would simply be their actual existence on the respective tablets. On the observed material, the sound value /ti/ is exclusively written with TÍ (DÍ). Therefore, a comparison of both is impossible. A similar result can be observed with the two phonetic segments /ab/p/, and /e/iš/. The writing variants defined as old writings by Kryszat are extremely rare on the material of this study. Therefore, they are not included. The sound values /la/ and /bi/ are very often used, and frequently written with different signs. Thus, both are suitable for a comparison, especially for a statistical approach. /Puzur/ and /šur/ are common elements of personal names. But while the latter is also a syllable of the frequently written name of the city (and god) Aššur, the former is comparatively rare.

Another phenomenon is the writing of oblique wedges instead of Winkelhaken. This can be observed on several signs like BI, IM, KÀ, LI, ŠA, and TA. These variants, however, are usually not written consistently, but interchangeably with variants with normal Winkelhaken. When compared to other examples of the respective sign on the same tablet, the versions with oblique wedges usually have the same shape apart from the altered Winkelhaken.

A difference in use is not apparent. On tablet TA143 (see fig. 56), the sign BI is written in both variants several times, and in different contexts. In two consecutive lines (l.27-28), the expression *a-bi-kà* “your father” is written. While in the first one, BI is written with Winkelhaken and KÀ ends with two oblique wedges. However, in the next line, the same expression written with the same signs shows BI with two oblique wedges and KÀ with two normal Winkelhaken. Thus, both forms appear to be interchangeable. In addition, the different versions are not restricted to a particular phonetic value. On tablet TA543 both versions of BI are written, too. Here, one occurrence of BI with oblique wedges is to be read as *pí*.

Fig. 56: TA143, a-bi-kà in line 27 and 28.

The use of oblique wedges instead of Winkelhaken cannot be explained yet, and mostly both variants are alternately written. However, it is not a frequent phenomenon. It clearly depends on the preferences of the writer; not only for the general use, but also in regard of which sign

92 And vice versa, if the chronological relations of individuals are known (like the generations of a family), such a study of the use of signs could also proof Kryszat's thesis.

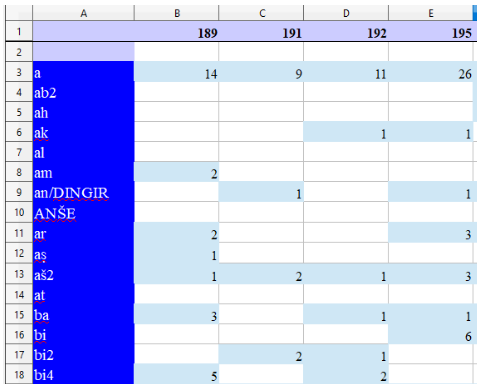
is written with the two variants. Thus, the observation of these "special forms" might give hints about the education and background of the respective writers as well.

Another peculiarity, which can be identified as a writer's habit, is the writing of ligatures. In the Old Assyrian texts, the ligature used most oftten is the combination of UM and MA. In letters, this sign combination is usually represented in the quotative particle *umma*[93]. In case of a ligature, the last vertical wedge of the sign UM is likewise the introducing vertical of the sign MA. This sign combination is not restricted to the partical *umma*, as can be seen on several letters of Ali-ahum, because letters sent by him begin with the wording *um-ma A-lá-hu-um-ma* („Ali-ahum spoke as follows"). The sign combination *um-ma* can be found in the introducing particle as well as at the end of his name. Usually both occurrences are written in the same way. However, not every writer wrote this sign combination as a ligature. On the tablets of Ali-ahum's daughter Tariša, both signs are preferrably written with a clear gap in-between. Thus, the observation of this detail is suitable for a comparison.

2.4 The Approach and Procedure of the following Analysis

As mentioned before, this study focuses mainly on a selection of letters from the family archive excavated in 1993. The main questions in regard of the corpora of the family members is, whether it is possible to identify the handwriting on these tablets. Furthermore, can the identity of the writer be inferred, and does a palaeographic study give sufficient evidence, or are further investigations necessary?

The analysis focuses on the private letter corpora of family members, which are introduced in the following chapter. In the individual case study (ch. 3), the corpora of the family members were hardly compared with each other. Instead, the focus is on the analysis of the individuals (and their corpora). Each tablet was examined on the basis of the above listed factors and discriminating elements, including movement, spatial relationships, form, and individual characteristics. These elements, however, were rearranged for a more logical approach of a cuneiform tablet examiner. Hence, the clay tablets and the layout of the script are described first, followed by an overview of the



	A	B	C	D	E
1		189	191	192	195
2					
3	a	14	9	11	26
4	ab2				
5	ah				
6	ak			1	1
7	al				
8	am	2			
9	an/DINGIR		1		1
10	ANŠE				
11	ar	2			3
12	aṣ	1			
13	aš2	1	2	1	3
14	at				
15	ba	3		1	1
16	bi				6
17	bi2		2	1	
18	bi4	5		2	

Fig. 57: An excerpt of the table use of signs.

93 This particle is followed by a name, noun, or independent personal pronoun plus -*ma*; it introduces verbatim quotations of direct speech (Kouwenberg 2017, 827).

use of signs and a detailed discussion on the individual sign forms on the respective tablets. An analysis of the movement and the spatial relationships completes the examination of the individual corpora. The results are summarised and evaluated at the end of each corpus.

The study was mainly conducted on the basis of 2D photographs of the tablets. Thus, for the analysis of tablet shape and layout, images are compared with each other. The study's main focus lies on the general tablet shape, i.e. mainly their obverse (or reverse) are observed, a side-view is usually not included.[94]

For a comprehensive analysis of the Use of Signs section, every sign on each tablet was counted and recorded in an excel chart. Two tables are created for each sender, the first one is always named with the abbreviation of the respective letter sender (e.g. Ali-ahum = AA), the second chart is named with the name abbreviation + ed (= edited → AA-ed).

Each chart is structured in the same way (see for an excerpt of the table fig. 57): Each row contains the different sign readings which can be found on the respective tablet. Each column represents one letter. Their excavation, or publication number is written in the first line. Each number in the columns represents the number of occurrences of the sign on the respective tablet. Accordingly, the first chart named with the abbreviation of the sender (e.g. AA) contains all the different readings written on his or her tablets. Because of the polyphone character of cuneiform script, each sign can represent different phonetic values on one tablet. On this chart, all the sound values are recorded. In addition, the number of word dividers and personal name markers[95] used in a text are also noted down. At the end of each row, the general number of different readings on each tablet was recorded.

The second chart for each sender (abbreviation-ed → AA-ed) is structured in the same way, but here, only the different signs on each tablet are recorded, i.e. the multiple phonetic values represented by one sign are summarised. Consequently, this chart represents the range of different signs on each tablet. At the end of each column, the total of signs on the respective tablet is summarised as well as the number of different signs.

94 The tablets of the 93/k-archive are unpublished. Therefore, no pictures of those tablets are published in this thesis.

95 Personal name markers are small vertical wedges which are placed in front of a personal name to mark it as such. In Old Assyrian texts they are hardly used, therefore, they are not mentioned otherwise.

Accordingly, these tables give information about the total of signs on each tablet, as well as the range of used signs and their readings. In addition, the use and the number of occurrences of each individual sign on all the analysed material can be observed here.[96]

For the analysis and comparison of the sign forms, individual occurrences of the diagnostic signs were extracted from the photographs of the whole tablets and arranged in a document. Each of these documents contains the images of one particular diagnostic sign, arranged according to the tablet on which the examples can be found, and the line in which they are written.

Fig. 58: An example for an image table.

Fig. 58 shows an excerpt of one of these image tables, containing the occurrences of the sign AM on Tariša's tablets. At the beginning the name of the tablet author is written, followed by the sign. Each tablet is named with the abbreviation of the sender and the respective excavation/publication number. After the tablet designation, several numbers follow. They are the line numbers in which the signs are written that are represented by the following images. In case that more than one example of the respective sign is written in one line, their position is marked with a Latin letter (e.g. a sign is written three times in line 5, the occurrences would be named as "5a, 5b, 5c").

Ideally, all the occurrences of one sign are extracted, but this is not always possible, or necessary. As written above, some signs are very frequently written on tablets, like the sign MA. On some tablets of Aššur-taklāku, son of Ali-ahum, the sign is written more than 50 times. To extract them for a comparison is unnecessary, because its aim is to detect the main tendencies and habits of a writer. Thus, in case of the sign MA*,* for example, not all the occurrences have to be observed, just enough of them to determine the discriminating elements. The number which needs to be compared, however, actually depends on the handwriting. If it is very consistent, then only a few signs are needed. In case of great variation, more occurrences of the sign have to be observed.

96 Because of their size, the charts are saved with the name Appendix_Use_of_Signs on the attached CD-ROM. The file contains the tables of all the senders included into this study.

Another reason for the omitting of some sign occurrences is the illegibility on a tablet. Especially when a sign is written on an edge or at a verge, it is not clearly visible (or not at all) on the photos. Therefore, they should not be used for the analysis.[97]

In the following case studies, the sign tables are evaluated in regard of their peculiarities, and the used sign versions are recorded in tables for an objective statistical comparison.

Furthermore, the movement and spatial relationships on the tablets are analysed and discussed, as well as individual peculiarities. These observations are, however, mostly subjective observations, and in addition, a clear distinction between habit and singular occurrence usually cannot be made. And they can hardly be included into a statistical analysis.

97 All the image tables are saved on the attached CD-ROM and named after the chapter and the respective sender.

Chapter 3: The Family of the 93/k-Archive

3.1 Archive and Family[98]

In 1993, during an archaeological excavation under the current excavator T. Özgüç, the foundations of – most likely – two small neighbouring residential buildings[99] were excavated in grid LVII/127 and LVIII/127-128 in the lower town of the ancient city of Kaneš. These two buildings were badly damaged, but inside the rooms, almost thousand tablets, fragments, and envelopes were discovered,[100] the private archive of a family of the Old Assyrian period. According to Michel it is composed of letters (40%), contracts (20%), legal proceedings (7%), personal accounts (15%), and some unidentified texts (18%) (Michel 2018b, 58).

The owners of the houses were identified by studying the "recipients of letters, providers of loans and persons involved in the other legal texts" (Michel 2018, 57). The individuals mentioned the most were the three merchants Iddin-Suen, Ali-ahum, and Aššur-taklāku as well as the woman Tariša. Cecile Michel, working on this family archive, identified these four persons as members of a larger family:

> "While I was working in Ankara in May 2006 on the 1993 tablets, Klaas Veenhof was studying the 1991 tablets belonging to Elamma's family; exchanging our data we discovered that Alāhum [Ali-ahum] and Elamma were brothers" (Michel 2008, 61).

On the basis of the available material, Michel and Veenhof[101] were able to reconstruct five generations of this family. In the 93/k-archive, no letters of Aššur-nimrī, the father of Iddin-Suen, remained. From Iddin-Suen himself several documents, letters sent to and by him and legal documents were kept,[102] separated from the other tablets of the archive (Michel 2008, 62). He had at least three sons, called Ali-ahum, Amur-Ištar, and Elamma. Veenhof assumes that Ali-ahum must have been the oldest brother since he inherited the house from his father (Veenhof 2017, xxx-xxxi, 2-3). Based on the texts of the two family archives, even children and grandchildren of Elamma and Ali-ahum are known (see fig. 59).

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98 The main information on this archive can be read in detail in Michel 2008a, 2015b, and 2018.

99 The foundations of these buildings are badly damaged so it can not be excluded that it was, at least at a certain point, one building (Michel 2015b, 85, and n.1).

100 Michel (2015b, 85, and n.1) writes that a total of 926 tablets, fragments and envelopes were excavated, scattered in the two buildings. Most of these tablets were found in 1993, and 61 additional tablets were excavated one year later in 1994 in the house in grid LVIII/128, belonging to the archive from 1993 (Michel 2008a, 55, and n.12).

101 For more information about the archive excavated in 1991 see Veenhof 2017.

102 The assignment of these texts to Iddin-Suen is partly difficult because in the texts, his name is mentioned several times with different filiations (see Michel, 2008a, 58, and Veenhof, 2017, xxxi).

Concerning the dating of Ali-ahum's family, Michel points out that the few available dates are written on loan contracts and cover a period of 34 years. Ali-ahum seems to have been active in Kaneš for at least 15 years between c. 1893 and 1878 BC, only one loan contract is dated to 1874 BC. The records of his son Aššur-taklāku point to a period of 18 years of active trade in Kaneš from c. 1877 to 1859 BC (Michel 2018, 60).

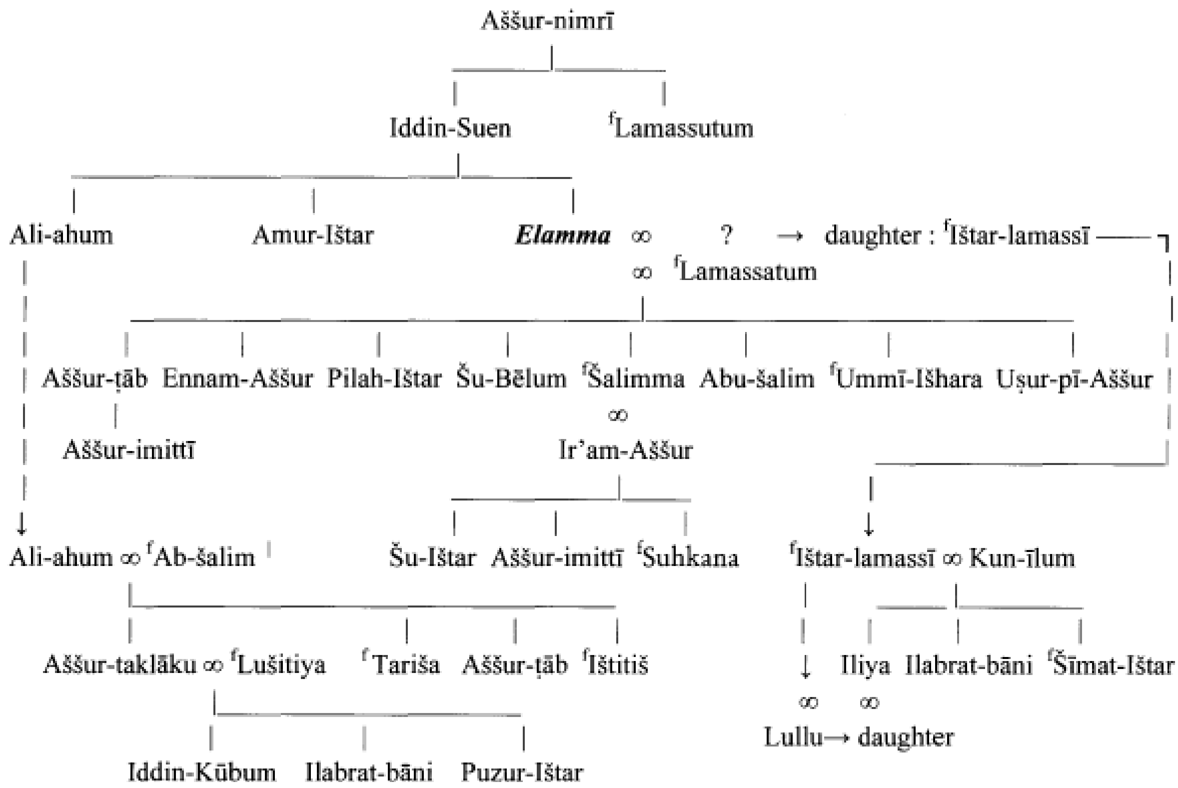


Fig. 59: The family tree of Iddin -Suen's family, including both family branches of his two sons Ali-ahum and Elamma. The image is taken from Veenhof (2017, xxxii).

In the following, the letter corpora of three family members, Ali-ahum, Aššur-taklāku and Tariša, are analysed and discussed. The size of these corpora differs greatly from only seven letters authored by Tariša to 30 selected texts sent by her brother. For an easier first introduction of the material and the application of the method, the corpora are arranged according to their size. Consequently, Tariša's letters are discussed first, followed by the corpora of her father Ali-ahum, and finally her brother Aššur-taklāku.

3.2 Tariša

Tariša was one of the daughters of Ali-ahum, and a sister of Aššur-taklāku. In the family archive, according to Michel (2015b, 89), at least 15 letters sent by her (and others) were found. However, while seven of them are complete or only slightly broken, from the rest only small fragments and pieces remained. On some envelope fragments, she is written with filiation as daughter of Ali-ahum.[103] In addition, the fragment kt 93/k 372+380 implies that she is the sister of Aššur-taklāku: [1]*a-na A-šùr-t*[*ák-lá-ku* (*x*)] [2]KIŠIB *Ta-ri-ša a-ha-tí* (erasure of *šu*?) "To Aššur-taklāku, seal of Tariša, (his?) sister".

Michel (2015b, 89-91) summarises that Tariša was first living in Aššur and later, at a certain point after the death of her father, she moved to Kaneš where she probably lived together with the family of her brother in one of the two houses in which the 93/k-archive[104] was found. From the sources nothing is known about her private status, and whether she was married or not. But from her letters, sent or received by her, and texts in which she is mentioned, she was engaged in the textile production and was, after Ali-ahum's death, an important contact for her brother in financial operations.[105]

3.2.1 The Sources

As mentioned above, only seven tablets are left from Tariša's correspondence. For a comparison of handwriting such a small number is on one hand convenient because many details can be observed in a short amount of time, and the collected data is easier to analyse. On the other hand, one has to keep in mind that any observation on such a small corpus could be coincidence, and every peculiarity an intention.

Only three letters were sent by Tariša, the other four were authored by her and other individuals together, possibly family members or representatives of the family in Aššur.[106] The recipient of the letters is always Aššur-taklāku. In the three letters sent by Tariša only (see table 2), and in another one in which she is mentioned as the first of the group, the senders are mentioned after the addressee. This positioning indicates the relative hierarchical relationship between them.[107] The latter is also formulated in two of Tariša's texts. While she refers to

103 Kt 93/k 143a: [2][*ù T*]*a-ri-ša* DUMU-MUNUS *A-lá-hi-im* "and Tariša the daughter of Ali-ahum". A similar expression can be found on kt 93/k 209 (see also Michel 2015b, 89 and n. 30).

104 This term refers to the year of the excavation, 1993, and the "k" signifies *kārum*, referring to the settlement of the Assyrian merchants in the lower town of Kaneš where the archive was excavated.

105 See for further information Michel (2015b, 92).

106 See also Michel 2015b, 89-90.

107 See Larsen (2002, xxxviii-xl), Michel (2008c, 126-127).

Aššur-taklāku in kt 93/k 198:23 only as her brother, and therefore as kind of equal, in another letter, kt 93/k 301:26, she refers to him as *a-hi a-ta : be-lí a-ta* “you are my brother and lord”. Thus, she puts him in a superior position.

Three other letters were authored by a group of people, mentioned before the addressee. In two of them, Tariša is mentioned at the end after the other addressees, and in one letter, another individual follows after her name. In these three texts Tariša’s name is only mentioned before Aššur-taklāku because she is included into a group of individuals socially superior to her brother.

Tablet	**Abbr.**	**Sender + Tariša’s position**	**Position of the addressee(s)**
kt 93/k 143b	TA143b	Tariša and others, she is mentioned last	Mentioned after the senders
kt 93/k 198	TA198	Tariša	Mentioned before the sender
kt 93/k 301	TA301	Tariša	Mentioned before the sender
kt 93/k 352	TA352	Tariša and others, she is mentioned in-between	Mentioned after the senders
kt 93/k 543	TA543	Tariša and others, she is mentioned last	Mentioned after the senders
kt 93/k 564	TA564	Tariša	Mentioned before the sender
kt 93/k 722	TA722	Tariša and others, she is mentioned first	Mentioned before the senders

Table 2: The seven letters of Tariša.

3.2.2 Form

One group of discriminating elements concerns the form and construction of the individual characters, and their consistency.[108] As it is relevant for the study of cuneiform script, the use of signs is included, as well as the tablet shape and connected elements like layout and ruling.

Tablet shape and layout

Out of the seven tablets, two are badly broken. From TA352 only the left half of the obverse remains, the other half as well as the reverse are completely lost. The fragment TA564 represents the left lower corner of a tablet. Furthermore, from TA301, the right upper corner, is missing. The four remaining tablets partly show some cracks, but the text is hardly influenced and well readable and understandable.

108 Another discriminating element is the legibility of the handwriting. However, this was already discussed above.

Michel describes the letters of Tariša as tablets with "the same regular shape; signs are clear, small and elegant" (2015b, 89). And indeed, the appearance of the tablets, including shape and type face, is very similar. All the tablets are in portrait format. Their dimensions, apart from the broken ones, vary between 5,3 to 9 cm height and 4,4 to 6 cm width. The tablets are fully inscribed, including the left edge (see for numbers and dimensions table 3). Noticeable about the shape of the tablets is that all seven tablets have pointy, and mainly straight corners. The two tablets TA143 and TA543 attract attention because of their length (9 cm and 8,2 cm) and their very straight edges.[109] The five other tablets are 1 to 3 cm smaller and have slightly convex edges (for a comparison of the size, see fig. 60, TA143b and TA722).

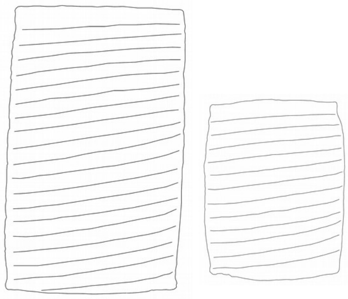


Fig. 60: Drawings from the obverse of TA143b and TA722, the proportions of both to each other are kept.

The ruling on the tablets is either very straight at the beginning, but curves upwards after a few lines (fig. 60), or it is slightly oblique from the beginning. On the two fragments of the corpus, the ruling is hardly determinable. On fragment TA352 the ruling starts very straight, but since the right part is completely broken, it cannot be observed whether the ruling is curved as well. On the other fragment TA564 the ruling seems to be straight until the last line at the bottom.

In table 3, an overview of the average number of signs per line is included. The original idea for this aspect was a study of the size of the handwriting, and possible relationships between the size of the writing and the tablet. However, the numbers average over the total of signs and the number of lines, but they do not represent the actual values on the tablets. When working with quantities of cuneiform signs, one has to keep in mind that in several cases, the clay tablets are not complete but parts can be broken and therefore signs are missing. In case of Tariša's corpus, the only complete tablet is TA722. The other six tablets are at least partly broken, and therefore, all the numbers mentioned above are only approximations. Furthermore, the size of a sign can differ greatly. Some signs consist, as depicted above, only of a few wedges while other form complex structures. Hence, they take far more space in a line. In regard of the average number of signs per line, Tariša's tablets show that the signs per line can differ greatly. For example on TA722, the quantity of signs per line of the reverse ranges between six and 13, while the average of this tablet is 9,1.

109 The shape of these two tablets strongly resembles the typical tablet shape of Aššur-taklāku (below, ch. 3).

Tablet	Total of signs[110]	Different readings[111]	Number of different signs[112]	Number of lines	Average of signs per line[113]	Dimensions (in cm)
TA143b	442	94	75	49 (obv. 19)	9	5,6 x 9
TA198	388	89	72	42 (obv. 17)	9,2	5,1 x 6,3
TA301	254	71	63	38 (obv. 15)	6,7	4,7 x 5,3
TA352	148	62	57	20 (only obv.)	-	6 x 7,6
TA543	615	112	80	54 (obv. 20)	11,3	5,2 x 8,2
TA564	130	54	48	(fragment)	-	(4,4 x 5,3)
TA722	292	72	58	32 (obv. 14)	9,1	4,4 x 5,7

Table 3: An overview of the use of signs on Tariša's tablets.

Use of Signs

On Tariša's seven tablets, a total of 110 different signs[114] with 165 different readings are used. In her longest text, TA543, 80 signs with 112 readings can be found. Thus, there are at least 30 other signs which are only written on specific tablets.

While on the whole material of this study, only four different signs were used on every tablet, in case of Tariša's corpus, 22 signs can be determined: A, AM, BA, BU, E, IM, KU, LU, MA, MÌ, NA, NI, RA, SÚ, ŠA, ŠU, ŠÙR, TA, Ú, Ù, UM and UT.[115] Most of these signs are part of the group which can be found on at least 2/3 of the studied material (see ch. 2), thus, their frequent appearance is not surprising. Additional signs are BU, SÚ, and ŠÙR. Especially the phonetic value /šur/ is very common since it is a part of the name Aššur which denotes the main god of the Assyrians, their home country, and its capital. Therefore, it is quite often used, also and especially as an element of theophoric names like Aššur-taklāku, Aššur-ilī, Aššur-nādā, etc. While there are two different cuneiform signs used for this sound value during the Old Assyrian period, ŠUR and ŠÙR, the writer of Tariša's letters preferred the sign ŠÙR. Its frequent use in the texts can be explained in different ways: All her letters are

110 Both word dividers and numbers are included here. Regarding numbers, every unit more than ten, and every decimal digit was counted individually. The total of signs is especially important for the average of signs per line. However, while some numbers do not need much space in the line, others can be very long. Therefore, this solution of counting seemed like a reasonable middle course.
111 Here, numbers and word dividers were excluded because this study is mainly interested in the study of literacy.
112 See n. 110.
113 The average is calculated from the total number of signs, including word dividers and numbers. This sum is divided by the number of lines.
114 Excluding numbers.
115 Surprisingly, the sign RI is not in this list even though is used in Tariša's name (Ta-ri-ša). The reason is that tablet TA543 is partly broken, and Tariša's name and therewith the sign RI is not completely visible anymore.

addressed to her brother Aššur-taklāku, and even though most of the tablets are somehow broken, his name, or at least this element, is always complete. Furthermore, several other individuals with this theophoric element are mentioned, thus, the sign is written on every tablet at least once and up to eight times.

While there are 22 signs written on every tablet, there are also 22 signs which are only written on one tablet of Tariša's corpus. 18 of these signs[116] are only written once on the respective tablet, four (AH, AP, IS, ŠÁL) are written two to five times. Interestingly, in several cases they are used for the same expression or term. For example, on TA543, the sign AH is used four times, thereof three times (l.12, 17, 18) for the noun *ta-ah-si-is-tum* (a kind of memorandum or document). Amongst the single attested signs, six are logograms of materials or fixed expressions (e.g. TA198:7 GÌR "dagger"; TA543:27 GÁN "field"; TA352:18 URUDU "copper"). Five other signs are elements of names of gods or individuals (e.g. TA198:25 NIN.ŠUBUR (Ilabrat); TA143b:8 MUR in *A-mur-A-šùr*). The rest of these signs are parts of verbs, nouns, or pronouns. Noticeably, eight out of these 22 signs are to be found on the largest tablet of the corpus, TA543.

As mentioned before, in the Old Assyrian period, some phonetic values can be written with more than one cuneiform sign.[117] On Tariša's tablets, these are /ap/, /bi/, /di/, /la/, /šur/[118], /u/, /ur/.

The sound /ap/ can be written with the sign AP, which is rare, or the common sign ÁP. The sound /di/ can be written with either the common DÍ, or the very rare DÌ. In both cases, the common version is generally preferred in the corpus, the two rare signs can only be found on tablet TA543, and here together with the common signs. The sign ÚR is very uncommon, and mostly used in personal names like on TA543:24 *Nu-úr-ì-lí-šu*.[119]

The sound value /bi/ is written in this corpus with either BI or BI_4. On four tablets (TA143b, TA198, TA543, TA564) both signs are written, but usually BI is preferred. On TA301 and TA352 only BI_4 can be found, and on TA722, only BI is written. A peculiarity on these tablets is that – as long it is not broken off – the imperative *qibi-ma* of the letterhead is written with

116 These are AṢ, DAN, DÌ, GÁN, GÌR, IK, KUM, MUNUS, MUR, NA_4, NIN.ŠUBUR, SIG_5, ŠÀ, $ṬUR_4$, UK, UN, ÚR, URUDU.

117 This study's focus lies on signs which are read as a syllable, not as a logogram like SÀ or signs which have another far more common value like the sign NI which can also be read as *ì* or *lì*.

118 This sound value was already mentioned before. It can be written with either ŠUR or ŠÙR. The writer of Tariša's texts, however, is always using ŠÙR, ŠUR is not written at all.

119 This finding confirms a comment about the use of this sign on the Old Assyrian sign list by Veenhof *et al.* which states that the sign is especially used in personal names including *Nu-úr*-X.

BI (on TA301, TA352, and TA564 it is broken). On the tablets on which both signs are written, the use cannot be classified. On TA143, for instance, both signs are only used with their first reading, i.e. BI as *bi*, and BE as *be* (and not bi_4). Furthermore, the latter is only used for the elements of personal names (*be-lum*), while the former is used for nouns, verbs, and personal names. On other tablets, different readings of both can be found as well as alternating use of them. On TA198, BI can be found for *qibi-ma*, every expression connected with *a-bi* ("father"), but also with its reading *pí* as a syllable of a noun. On the other hand, BE is only used with its reading *pì* in different nouns, verbs, and personal names. A similar situation can be observed on the other tablets as well. However, in case a specific word is used several times in a text, it is always written with the same sign. For example *a-bi-ni* ("our father") on TA198, and *ra-bi-ṣum* ("attorney") on TA543.

The phonetic value /la/ is used on most of the tablets except TA564. On two tablets, TA301 and TA352, it is written with LÁ only. On the other four tablets it is written with either LA or LÁ, with preference for the latter. In regard of LA it is noticeable that it is mostly used for the spelling of the particle *ma-la*[120] (TA143b:24, 33, TA198:3, TA722), or verbal forms in the first person plural (TA543:46 and 49, TA722:23). However, on some of these tablets, LÁ is used for the same words as well. For example on TA198, *mala* is written once with LA (l. 3), and once with LÁ (l. 11). The same goes for TA722 (l. 16 LA vs. l. 4 LÁ). In addition, here, a verbal form in the first person plural is written once with LÁ (l. 21 *ni-lá-ak-ma* "we go"), and another one is written with LA (l. 23 *ni-la-qé-ma* "we take").

The phonetic value /u/ is written with *Ú* and Ù[121]. On Tariša's tablets both signs are frequent and with a specific use: The sign Ú is exclusively used in its function as a vowel, and therewith as part of a word (verb, noun, particle, name). The sign Ù, on the other hand, is only used for the conjunction *u* ("and/also/or"[122]).[123]

Another use of signs that should be discussed, is not about two signs with the same phonetic value, but about a sound written with either one sign, or a combination of two signs. The sound /tak/ is relevant for the studied material because it is a syllable of the name Aššur-taklāku, which is a common name, and also the name of the owner of the 93/k-archive. On

120 See also Kouwenberg (2017, 365). However, the particle can also be written with LÁ e.g. TA198:33, or TA301:28.

121 A third sign with the reading u_4 is the sign UT, but this reading of the sign is "restricted to temporal nouns" (Old Assyrian Sign List, Veenhof *et al*.) and is therefore irrelevant for this study.

122 For the translation and use of the conjunction see Kouwenberg (2017, 749-752, 756-758).

123 This distinguished use of the two signs was also noted by Huehnergard for the Old Babylonian texts (2011, 70).

Tariša's text, the name is written on every tablet in the letterhead. On TA301 and TA543 it is written with the sign TÁK. On the other five letters, it is written with the sign combination *ta-ak*.

On Tariša's tablets, it is obvious that the writer followed in some cases certain conventions, e.g. the distinctive use of the signs Ú and Ù, or BI for the imperative *qibi-ma* (instead of BI_4). In other cases, his choice of signs seems rather to be based on his own preferences like the use of TÁK and *ta-ak*, or LA and LÁ, which is in several cases not very consistent. Another interpretation could also be that with the alteration of signs (and sign variants and variations), the writer wanted to visually emphasise a word or phrase. But a specific pattern coud not be noted.

In the following table 4 the data of the use of signs is summarised. It includes the use of the different signs for the sound values /bi/, /la/, and /šur/, marked with an "x". The use of the two signs Ú and Ù is recorded in regard of their various applications. And the writing of the sound value /tak/ is noted. The three tablets emphasised with bold script are the ones sent by Tariša alone.

The table shows that there is a great consistency regarding the use of signs on Tariša's tablets. In case of the use of /u/ and the choice of signs for /šur/, there is an absolute consensus. Regarding the use of BI, it is unfortunate that on TA301 and TA352 the heading is partly broken so that *qibi-ma* is not preserved (and with it a possible BI). Apart from that, the tablets also show a great consensus. The diverse use of the /bi/-signs and the /la/-signs is not explainable.

Tablet	BI	BE (*bi₄*)	LA	LÁ	ŠUR	ŠÙR	*u*[124]	/tak/
TA143	x	x	x	x	-	x	corr.	ta-ak
TA198	x	x	x	x	-	x	corr.	ta-ak
TA301	-	x	-	x	-	x	corr.	ták
TA352	-	x	-	x	-	x	corr.	ta-ak
TA543	x	x	x	x	-	x	corr.	ták
TA564	x	x	-	-	-	x	corr.	ta-ak
TA722	x	-	x	x	-	x	corr.	ta-ak

Table 4: The use of signs.

124 Four classifications are used for the sound *u*: "corr." refers to the consistent distinction of Ú as a vowel and Ù as a conjunction, "Ù-incorr." denotes the use of Ù as a vowel as well, while "Ú-incorr." names tablets on which Ú is used as a conjunction, too. The expression "mixed" marks tablets on which both signs are used for the other function.

Form and Construction[125]

An important part of the handwriting identification is the study and analysis of the sign variants and individual variations. Michel (2015b, 89) compared the signs TA, TÙ (DU), NU, NA, and BI and concluded that the letters TA198, TA301, TA564, TA722, the letters sent only by Tariša or by multiple senders where she is mentioned first, "have been written by the same person, either a member of the family or herself".

For the present study, all seven letters of Tariša are included, and the diagnostic signs discussed in chapter 2 will be the fundament for the following comparison.

AM

Fig. 61: The example AA198:38 shows the stroke order of the vertical wedge.

The sign AM is written on every tablet of Tariša at least once. All of these tablets basically show the same variant with little variation: The two horizontal wedges are usually parallel impressed, but in some cases, the upper one is slightly shifted to the right. This indicates that it was impressed after the lower one (see fig. 61, TA198:38). This phenomenon, however, is not a constant on the tablets, therefore it can't be considered a habit. The same applies to the general positioning of the wedges (and the sign) in the line. The upper horizontal can be impressed on the ruling or slightly below. In some cases, probably depending on whether the ruling is straight or curved, only the head of the upper horizontal wedge is impressed on the ruling while the tail is slightly underneath.

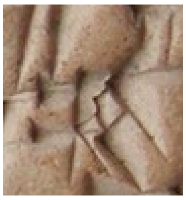


Fig. 62: The example TA301:27 with two small Winkelhaken.

The next discriminating element is the vertical wedge. It is crossing both horizontal wedges at their end, and directly in front of the following Winkelhaken cluster. In some cases, it actually overlaps the latter (e.g. some examples on TA143b, TA198 (fig. 61), and TA543). On none of these tablets, however, this is a constant, and therefore, it should rather be considered a slip of the writer. Its head is always positioned above the upper horizontal wedge and can be placed on the ruling, or even above. Its tail tip crosses the lower horizontal. The stroke order of this wedge is often difficult to determine. Nevertheless, in some cases, its head is deforming some of the Winkelhaken (especially visible on TA143b:47, TA198:38, TA301:27, TA543:37, and 45) indicating that the vertical wedge was actually impressed last.

125 For the image tables of the diagnostic signs see the file Appendix_ch3_Tarisha on the attached CD-ROM.

The Winkelhaken formation has basically the shape of the sign DÍ: On an upward oblique row, two to three small Winkelhaken are impressed, followed by a large one. On the tips of the small ones' tails, a second large Winkelhaken is impressed. However, the stroke order of this element is quite different to the sign DÍ. Here, it seems that first, the small Winkelhaken were impressed, followed by the large one at the tip of their tails. The second large one which is positioned roughly on the same axis as the small ones seems to have been the last wedge to be impressed into the clay. The first small Winkelhaken is often impressed on the upper horizontal wedge, but it can actually vary from there to the lower horizontal. Therefore, their positioning is no consistent writing habit. The upper large Winkelhaken is mostly impressed on the ruling. Thus, it can be positioned on the same axis as the small ones, or slightly shifted. Its exact position in regard to the small Winkelhaken is not fixed and therefore not a habit (see for example TA198: In the three examples the last upper wedge is always in a slightly different position with regard to the small Winkelhaken).

Fig. 63: The example TA143b:40 shows most likely three small Winkelhaken.

Another varying element is the number of small Winkelhaken in the upper row. In most cases there are only two small Winkelhaken visible (see fig. 62). Nevertheless, on a few tablets like TA198:5 and TA564:13', clearly three wedges are visible. On TA143b, in l.32 and 40, it seems that the upper large Winkelhaken is covering another smaller third Winkelhaken (see fig. 63). However, apart from TA564 on which it is the only occurrence of AM, on TA198 and TA143b, there are also several examples with two small Winkelhaken. Therefore, the examples with three will be considered as natural variations, and not as specific writing habits of the respective writer.

BA

Fig. 64: The typical version of BA, *TA143b:25.*

The sign BA is written on each of Tariša's tablets. As described above, the main discriminating element of this sign is probably the wedge at the bottom, which can be horizontal like the two wedges above, or it can be an oblique wedge. On most of Tariša's tablets, the wedge at the bottom is an oblique one (TA143, TA198, TA301, TA352, TA543, TA722). Its head is usually positioned underneath the uppermost wedge and in a certain angle so that the right tip of its head is touching the lower tip of the head of the uppermost horizontal. This point can also reveal the stroke order. Especially on TA143b:25 (fig. 64), TA301:15, and

TA543:41, the lower head seems to “cut off” the tip of the upper head. Consequently, it must have been impressed afterwards.

However, there are few variations in regard of the lowest wedge. On TA143b:29 and TA301:29, at least one example of BA is written with a horizontal lower wedge as well. Both cases can probably be considered as natural variations. Another case is TA722. Even though the lowest wedge is always oblique, its angle and position varies. In several cases (l.5, 10, 19a), there is a gap between the uppermost horizontal and the oblique one, while the other examples show the same version as described above. Reasons therefore can be various. The writer might have been distracted and did not pay much attention to his writing, or he was rather careless in general.

Fig. 65: The second variation of BA, *TA564:19'.*

The other elements of the sign do not show much variation. As already observed for the sign AM, the writer(s) do not pay special attention to the exact positioning of the wedges and signs in regard of ruling and line. Thus, both, the head of the uppermost horizontal, or the complete wedge and the head of the vertical can be placed on the ruling, or underneath. In addition, the vertical can also be placed above. The exact positioning is usually not consistent on a tablet. The small horizontal in the middle was certainly impressed after the two other horizontal/oblique wedges, and some examples like TA143b:29, 32, TA543:11, and TA564:19’ (fig. 65) indicate that it was impressed even after the vertical wedge.

The only exception regarding the version of BA is TA564. Here, all three instances of the sign are written with a horizontal wedge at the bottom.

DÍ

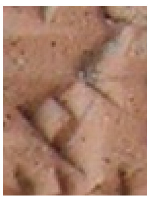


Fig. 66: The first variation on TA143b:24.

The sign DÍ is written on most of Tariša’s tablets except TA564. On the tablets, the same sign variant with three wedges in the upper row is written. While there is only one variant, several variations of this variant can be observed on these tablets. Here, the discriminating element is the position of the bottom wedge, which can be either impressed underneath the left, the middle, or the right Winkelhaken of the upper row. Furthermore, the size of the lower one’s head influences the appearance of the sign.

On Tariša's tablets, the lower Winkelhaken is either positioned under the left Winkelhaken of the upper row, or under the middle one. On none of the tablets, one version is executed consistently, but on three tablets, a clear tendency can be noted. On TA143b the bottom wedge is mostly placed underneath the left, and partly the middle one of the upper row, the tail of the right upper Winkelhaken is protruding beyond the lower one. Nevertheless, it is not the only version, but several times, the Winkelhaken at the bottom can also be placed in the middle so that the left and the right upper wedge protrude beyond it (fig. 66 and 67).

Fig. 67: The second variation on TA543:34.

This second variation is preferably written on TA543 and TA722. The writer tends to position the bottom wedge underneath the middle Winkelhaken of the upper row. Thus, either the left or the right, or in most cases both upper wedges protrude beyond the bottom one. Or the tips of the three upper ones touch the bottom wedge. However, also here, this variation is not written constantly, but in a few cases replaced by the first variation.

On the three tablets TA198, TA301, and TA352, both variations are used just as often so that no clear tendency of the writer can be noted.

DU

Fig. 68: The prolonged variant on TA198:7.

The sign DU is written on every tablet except TA301. On TA143b and TA543 it is written several times, on the other tablets only once. Thus, regarding consistency and individual habit, most of the observations have to be treated carefully. The most common variant on Tariša's tablets is an elongated form. Here, the combination of a short horizontal wedge and a following Winkelhaken on the tip of its tail, which is usually positioned in the middle of the box, is shifted downwards and placed behind the lower horizontal (fig. 68). Thus, the rectangle is built by a vertical at the beginning and the end, which are connected by an upper long horizontal, and two short lower horizontal wedges behind one another and followed by a Winkelhaken. The two short horizontals are not necessarily on the same level, but the second one can be slightly shifted upwards. This variant can be found on TA143b, TA198, and TA543. Another variation is probably displayed on TA564. Here, the second horizontal is not shifted downwards, but upwards so that it is positioned behind the upper horizontal. However, this is the only example on the respective tablet. Therefore, it could also be a slip of the writer.

The second variant of the sign is the short form of DU. Here, the combination of the short horizontal and a Winkelhaken is positioned in the middle of the box, between the upper and the lower horizontal. It is written on TA352 and TA722 (fig. 69).


Fig. 69: The short variant on TA722:29.

On TA543, both variants can be found, but with a preference for the long variant. On this tablet, the use of both can probably be explained with the particular position on the tablet. The two short examples are both placed at the end of the respective line (l. 13 and 31), while the long instances are somewhere in the middle (l. 10, 21, 36). Therefore, the choice of the writer for one or the other variant was probably depending on the available space in the line. A similar explanation, however, cannot be given for TA352 and TA722. In both cases, these are the only examples of the sign on the respective tablets, so they cannot be compared to other instances. And both are located in the middle of the line, thus, the chosen variant cannot be the result of little space.

IM


Fig. 70: The first variation on TA198:29.

The sign IM is written on every tablet, and like most of the signs described so far, it is written with the same variant and only little variation. The Winkelhaken formation is written with three Winkelhaken in the upper row and one at the bottom. Like the sign DÍ, for IM, there are two variations as well, based on the position of the Winkelhaken at the bottom. Both correspond to the variations of DÍ. On TA143b, TA198, TA301, and TA352, the bottom wedge is positioned underneath the left upper one, extending to the middle one. The right upper one is often a bit separated from the two other upper wedges. Additionally, it can be slightly enlarged, and shifted so that it is not on the same oblique axis as the two others (fig. 70).


Fig. 71: The second variation on TA543:42.

The second variation is mainly written on TA543, TA564, and TA722. Here, the Winkelhaken at the bottom is placed underneath the upper mid-Winkelhaken, and the left and right ones usually protrude (see fig. 71). On all the tablets, both variations are represented. However, in contrast to the sign DÍ, the writer shows clear tendencies towards one version on these three tablets.

The second element of the sign, the formation of two verticals crossing one horizontal, is attached to the Winkelhaken cluster by the head of the horizontal. It is usually positioned next to the upper right edge of the lower Winkelhaken. Both can be attached, while the tail of the upper right Winkelhaken is partly covered by the horizontal (e.g. TA543:22, fig. 72). Or in some cases, especially when there is a gap between the middle and the right upper Winkelhaken, the horizontal can also be impressed on the tail of the right one without being attached to the bottom Winkelhaken (e.g. TA198:8 (fig. 72), TA564:3'). This detail, however, is not consistently written and therefore not a writing habit.

Fig. 72: The position of the horizontal, on TA543:22, and TA198:8.

The two verticals usually have the same length and are impressed on the ruling, or sometimes above or underneath. As before, the writer does not seem to have an exact position for his writing. On all the tablets, first the two vertical wedges were impressed followed by the finalising horizontal.

KÀ

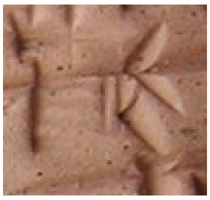


Fig. 73: An example with four horizontals on TA143b:28.

The sign KÀ is written on most tablets except AT564. Based on the numbers of stacked horizontals, the signs on Tariša's tablets can be divided into two variants. The most common one consists of five horizontals (TA143b, TA301, TA352, TA543, TA722). The second variant contains four stacked horizontals (fig. 73), and is mainly written on TA198. On some tablets, both variants can be found, but in general, there are clear tendencies towards one or the other variant. Both variants have, apart from the number of horizontals, the same structure and characteristics. Therefore, they will be discussed together.

The horizontals have mainly the same length, but the one at the bottom is frequently emphasised by being deeper impressed, and therefore slightly increased in size (see for example TA143b:26, or TA198:19). In some cases, especially on TA543 and TA722, the horizontal at the bottom even protrudes slightly on the left. This feature, however, is not consistently executed, and it can be questioned whether the lengthening is, at least in most cases, rather a result of the general enlargement of the bottom horizontal (see e.g. TA543:20a and b, TA722:5 (fig. 74), and TA722:17).

Fig. 74: An example for the variation of the lowest horizontal on TA722:5.

Several vertical wedges are placed on the horizontals. The first one is impressed on the horizontals' heads. In addition, two to three verticals are placed at the end of the horizontals. Generally, they are impressed on the uppermost horizontal or slightly above. Their tails end mostly somewhere between the horizontal at the bottom and the one next to it. Their length and positioning, however, vary greatly from example to example. Regarding the quantity of wedges, the typical number seems to be two verticals at the end. However, like the number of the horizontals, the number of the verticals does not seem to be fixed completely on Tariša's tablets. For instance on TA143b, four examples of KÀ clearly show two verticals, while two additional examples are written with three verticals. The same phenomenon can be observed on almost all other tablets as well. Thus, while there are mostly two verticals, more wedges will be considered as natural variations. A special case is TA352. There is only one example of KÀ written with three verticals at the end. However, because of the general similarity of this example and the ones on other tablets, it won't be classified as another version, but as a natural variant.

The sign is finalised with to Winkelhaken on top of each other, the lower one is placed on the level of the bottom horizontal or slightly higher, the upper Winkelhaken is usually placed on the tip of the uppermost horizontal. In addition, it is frequently impressed on the tip of the lower Winkelhaken as well. Therefore, it must have been impressed after the lower one.

Fig. 75: The expression a-bi-kà "your father" on TA143b l. 27 and 28.

One peculiar phenomenon can be observed in some cases: The Winkelhaken are substituted by two intersecting oblique wedges. This variant can only be observed on TA143b (l.24 and 27) and TA722 (l.4). On both tablets, the other elements of this sign do not change. An analysis of the three occurrences shows that two of them (TA143b:27 and TA722:4) are used in the same phrase, i.e. "in accordance with your message"[126]. However, the same phrase is written for a second time on TA722:16-17[127], but there, KÀ is written with normal Winkelhaken. A similar case can be observed in case of TA143b:27. Here, it is a part of the expression "your father" (*a-bi-kà*) which is repeated in two consecutive lines. In line 27, KÀ is written with two intersecting oblique wedges, and the sign BI ends with two normal Winkelhaken. In the following line 28, in the same expression the sign BI is written

126 TA143:24 is spelled *a-na ma-la na-áš-pár-tí-kà*, noteable here is the use of LA in *mala*; a slightly different spelling can be found on TA722:4 *a-na ma-lá na-áš-pé-er-tí-kà*, here, *mala* is spelled with LÁ.

127 Interestingly, the phrase here is spelled *a-ma-la na-áš-pár-tí-kà*, thus, here, *la* was used instead of LÁ.

with two oblique wedges, and KÀ with two Winkelhaken (see fig. 75).[128] Thus, it seems that the two variants with either Winkelhaken or intersecting oblique wedges are interchangeable, and there is presumably no particular reason for the respective usage.

KI

Fig. 76: The first variant on TA543:18.

The sign KI is written on every tablet except TA564. The main discriminating element of this sign is the combination of usually one or two Winkelhaken, and a small vertical wedge at the beginning of the sign. In case of Tariša's tablets, many examples are not clear because of faint impressions and overlapping elements. There seem to be basically two variants of KI. One of them is written with two Winkelhaken on an oblique upward axis, and a short vertical wedge. The latter's head usually overlaps with the upper Winkelhaken while the tip of its tail overlaps with the lower Winkelhaken. This construction is followed by three stacked horizontals crossed by, or end on a large vertical wedge. This variant is mostly written on TA543 and TA722 (fig. 76). A comparison of the sign NA on the same tablets shows the same construction, the small vertical is frequently visible.

The second variant is similar to the first one, but here, the small vertical of the initial construction is omitted (fig. 77). It is mostly written on TA198 and TA301. On the tablets, the respective variants are not exclusively written, but on most of them clear tendencies towards one variant can be noted. Exceptions are the two tablets TA143b and TA352 where both variants seem to be used just as often.

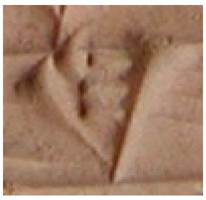


Fig. 77: The second variant on TA301:12.

Problematic for this sign is that the three wedges of the initial construction are usually overlapping. In such a case, it is possible that the small vertical is actually impressed, but completely covered by the two Winkelhaken. On the other hand, on several cases, there is clearly no indication for the vertical, like on TA143b:42 or TA301:12. Thus, presumably both variants are represented on the tablets TA143b, TA198, TA301, TA352, and TA722. Because a clear differentiation is difficult, any preference for one variant or another cannot be determined.

128 The sign BI is one of the signs which will not be studied in detail. Nevertheless, on TA543 both variants of the sign with either Winkelhaken or oblique wedges can be observed as well. Here, one of the latter is read as *pí* (l. 28). Thus, the peculiar writing with two oblique wedges is not restricted to a particular sound value.

Fig. 78: The sign NA *on TA564:1.*

In comparison, the sign NA shows the same two variants, and a similar use on the tablets. In this regard, while KI is not represented on TA564, the sign NA is written several times. Like on the other tablets, here, the sign NA is written with two variants, either with two Winkelhaken and a small vertical wedge, or with two Winkelhaken only.

KU and MA

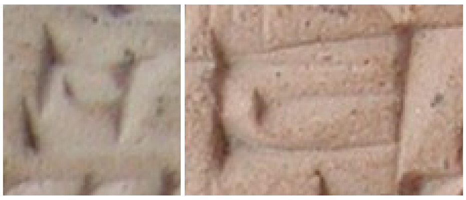


*Fig. 79: The two signs on TA198:1 (*KU*), and 27 (*MA*).*

The signs KU and MA have, as described in chapter 2, a very similar structure, and like the signs NA and KI, one discriminating element might actually be their similar – or different – form. By studying them on Tariša's tablets, it is apparent that both signs are, apart from the length of the horizontals, strikingly similar, and in general unremarkable. The typical box shape of these signs is maintained, the upper and the lower horizontal have usually the same length and form a rectangle together with the two verticals. The horizontal in the middle is slightly shorter. The stroke order is not completely observable, but the lower horizontal (and probably the upper one, too) must have been impressed after the first vertical (fig. 79). Thus, since it was impressed on the vertical, a small part of its head is often sticking out on the left side of the first vertical (fig. 79, left).

Fig. 80: Different positions of the first vertical, on TA301:28 and TA564:7'.

In some cases, the box shape is slightly broken: One reason can be that either the upper or the lower horizontal is considerably longer than the other one. In such a case, the first vertical can stick to the head of the longer horizontal. It is not connected to the respective other, shorter horizontal, but is positioned in front of it. Thus, the rectangular frame of MA is open. Another possibility is that the first vertical is either shorter (fig. 80, MA TA301:28), or separated from the horizontals (fig. 80, MA TA564:7'). These variations, however, are only exceptions and are rarely found on Tariša's tablets.

KÙ

The sign KÙ is written on every tablet except TA722. The main discriminating elements of this sign are the number of Winkelhaken and their arrangement. The latter is very consistent on Tariša's tablets. In general, several smaller Winkelhaken are placed between the two vertical wedges, and a large Winkelhaken follows after the second vertical. The number of small Winkelhaken is mostly two, but several times it increases to three.[129] In addition, the height of the Winkelhaken is hardly consistent. The large one is usually placed in the middle of the vertical, but the small ones are placed in the lower part, or in the middle as well. While these small details point to probably careless, and maybe fast writing, the general similarity of the signs with hardly any variation, and only very few different variations points to an experienced writer who executed his writing in a very habitual manner.

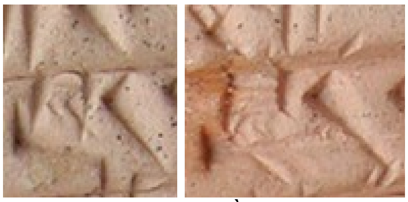


Fig. 81: The sign KÙ with either two or three Winkelhaken between the verticals on TA143b:6, and 9.

LI

Fig. 82: The most common variant on TA143b:28.

The sign LI is written on most of the tablets except TA301 and TA722. The Winkelhaken formation is made of two horizontal rows of wedges, the upper row is usually slightly shifted to the right so that the first Winkelhaken of the upper row is positioned above the second wedge of the lower row. The most common number of Winkelhaken is four wedges in the upper, and three in the lower row. However, on every tablet, there is at least one exception with another number combination: a frequent one is three wedges in both rows (TA143b:46, TA198:17, TA543:40, TA564:19'), another possibility is a higher number than four in the upper row (TA352:18, TA543:12 and 17), or in the lower one (TA143b:43).

Fig. 83: The second most common variant, in these cases rather a natural variant, on TA543:40.

On the basis of the second part of LI which is actually the sign ŠA, Tariša's tablets can probably be divided into two groups. The first group, consisting of TA143b, TA198, and TA352, is characterized by stacked horizontals of the same length. Only in a few cases, the one at the bottom is emphasised by a

129 As for the signs KI and NA one has to keep in mind that sometimes some wedges are simply not visible on the picture, depending on light and quality of the pictures.

deeper impression or slight enlargement. The examples of the second group, TA543 and TA564, mostly show an enlarged horizontal at the bottom. However, it can be questioned whether a distinction into two different version can be made on the basis of the length of the bottom horizontal because the main discriminating element of LI is the Winkelhaken cluster showing overall a consistent form.

RI

Fig. 84: The typical version on TA143b:5.

The sign RI is written on every tablet except TA564. When observing the examples of this sign on Tariša's tablets, it becomes apparent that the two verticals are mainly positioned in the middle of the horizontal. The space between the two is wide enough to squeeze another vertical between them. The parts of the horizontal on their left (including its head) and on their right side have basically the same length. Thus, the sign seems very balanced. The Winkelhaken is placed underneath the horizontal. The lower side points to the tip of the vertical wedge at the end of the sign (fig. 84). An exception seems to be TA352. Here, the Winkelhaken is impressed on the horizontal. Therefore it will be considered as another variations (fig. 85).

Fig. 85: TA352:2 with a differently positioned Winkelhaken.

The final vertical tends to be longer and deeper impressed than the two parallel ones. In addition, its head is placed higher, e.g. in case the two shorter ones are placed on the ruling, the last one is positioned above (TA143b:5, fig. 86). In regard of the general positioning of the wedges, there is no consistency, the first two verticals can be positioned on the ruling, underneath, or even above. The final vertical can be shifted accordingly. However, in a few cases, these proportions vary, and even though the last one is deeper impressed, the two first verticals can be longer (TA543:22, TA722:2), or they have the same length (TA722:28). Apart from TA352, the examples on the different tablets look very similar.

As mentioned before, establishing a stroke order for the cuneiform signs can be very difficult. In case of the sign RI, not many wedges are involved, simplifying the task.

Fig. 86: Indications for the stroke order on TA543:42, TA722:31, and TA143:5.

Regarding the order of the Winkelhaken and the finalising vertical, several examples on Tariša's tablets indicate that the Winkelhaken was impressed after the last vertical (fig. 86, TA543:42). The initial construction of the two parallel verticals and the horizontal wedge were most likely impressed in the same order. An indication is the displaced clay. Obvious examples can be observed on TA722:31 (fig. 86). However, in some cases, the horizontal wedge also displays indentations of displaced clay as on TA143b:5 (fig. 86), and TA198:13. However, these phenoma are not always clearly visible on the pictures.

ŠA

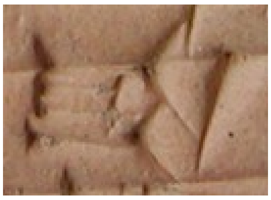


Fig. 87: The variant with four verticals on TA301:11.

The sign ŠA is written on every tablet. According to the average number of the stacked horizontals, the tablets can be distinguished into two groups. The first group, consisting of TA143b, TA352, TA543, TA564, and TA722, features a ŠA with typically five horizontals. The other group, containing TA198 and TA301, displays a ŠA-variant with usually four wedges. On all the tablets, however, there are occasional examples with different numbers of wedges. In a few cases, up to six wedges can be counted (e.g. TA143b:5, TA198:11, TA301:23b, TA543:1). Thus, on every tablet a certain tendency in regard of the average number of stacked horizontals can be noted, but occasional variations are common as well.

Concerning the arrangement of the horizontals, it can be observed that the stacked wedges, without the bottom one, are very evenly positioned on the same vertical axis. Only on very few occasions, this axis is wavy or shifted. One example is TA301:19a, here, the horizontals' heads are shifted to the right from the top to the bottom, and the lowest one is again longer. A possible explanation might be its position at the upper left edge of the reverse. A similar case is TA543:1. Here, the sign is a part of the sign combination PUZUR$_4$ which is written in combination with ŠA[130]. The stacked horizontals are slightly shifted to the right from the bottom to the top.

The horizontal at the bottom is usually enhanced and prolonged, with very few exceptions. In case that it is prolonged, it only sticks out slightly so that the corners of its head protrude beyond the wedges above. While on most of the tablets a clear tendency to an enhanced and prolonged bottom horizontal can be observed, on TA722, the bottom wedge is enhanced, but

130 Being part of this combination, however, is rather no reason for a different writing. In comparison, the same sign combination is also written on TA143b and TA352, but did not influence the appearance of the sign.

rarely prolonged (see fig. 88). And in a few cases, it has the same size and length as the other wedges (e.g. TA143b:15, TA352:16, TA543:3).

Fig. 88: A typical example on TA722:6.

Regarding the first vertical impressed on the horizontals, there is almost no distinct pattern visible: A very general tendency is a long wedge impressed on the uppermost horizontal, and ending between the lowest horizontal, and the one above. However, the actual height of the vertical varies greatly from above the uppermost horizontal to the second wedge from the top on every tablet. Thus, it seems to be an element of the sign which was impressed rather carelessly by the writer. In comparison, the length of the horizontals which is carefully executed.

The upper Winkelhaken is usually impressed on the level of the uppermost horizontal, or slightly above. The lower Winkelhaken is impressed on the same level as the second horizontal from the bottom, or slightly underneath.

Again, the signs show, in general, a consistent shape on each tablet, and from tablet to tablet.

TIM

Fig. 89: The typical variant on TA301:7.

The sign TIM is not one of the signs used very often, but it should be included into an analysis because it shows a wide range of variants proving themselves very useful for the identification of hands. On Tariša's tablets it is not written on the two tablets TA564 and TA722, and on TA352 it is not clearly visible so that a classification is not possible.

The first part of the sign, the combination of two parallel verticals crossing one horizontal, has no particular features. The two verticals are usually placed in the middle of the short horizontal, and both are separated by a gap which is wide enough to squeeze another vertical in-between. Exceptions are TA143b:36 and TA198. In both cases, the verticals are close together. This part is followed by an element consisting of two Winkelhaken on top of each other, and finally a pair of oblique wedges with intersecting tips. The upper Winkelhaken is usually impressed on the ruling, only on TA543 it is slightly underneath. The lower Winkelhaken is impressed on the tip of the horizontal (TA198), or slightly below (TA143b, TA301, and TA543). The upper one is mostly cutting off the upper side of the lower Winkelhaken. Thus, it must have been impressed afterwards.

The following upper oblique wedge is mostly impressed slightly underneath the ruling. The lower one is placed on the same level of the horizontal, or slightly below. In both cases, the height of the oblique wedges does not have to necessarily match with the height of the Winkelhaken. Furthermore, the two oblique wedges are very close to the Winkelhaken, so that the lower one is impressed on the lower tip of the upper one. The examples of TIM on Tariša's tablets show generally the same variant with only a few and small varying elements.

Ù

Fig. 90: The first variant on TA198:28.

Two variants of the sign Ù can be observed on Tariša's tablets. The general setup of the sign is the same, beginning with a Winkelhaken impressed on, or slightly before, a vertical wedge. The following part, the horizontal attached to a rectangular element, is the main discriminating element of the sign. One variant, which can be found on TA198, TA543?, and TA564, is formed with one large horizontal in the middle. It crosses three parallel vertical wedges. And at the tip of their tails, a second large horizontal finalises the sign.

Fig. 91: The second variant on TA722:3.

The second variant which is written on TA143b, TA301, TA352, and TA722, also consists of three parallel verticals and a finalising horizontal at the tail tips. But the first horizontal in the middle ends on the first vertical. And instead, three thin horizontals are impressed into the rectangle, and range roughly from the first to the last vertical (or further). In some cases, the three small horizontals are clearly separately impressed (e.g. TA143b:47, TA301:18), in other cases, it seems that actually one of the thin horizontals is the elongated tail of the first horizontal, which is placed in front of the rectangle (e.g. TA352:22, TA722:3).

Partly the three thin horizontals are hardly visible, therefore the classification is in some cases not very certain (especially TA543).

ZI

The sign ZI is written on most of Tariša's tablets except TA301 and TA722. The first element, the construction of two parallel verticals and a crossing horizontal, is mostly formed in the same way as for the signs RI and TIM. An exception is TA143b. Here, the horizontal wedge is partly deeply emphasised by being strongly impressed into the clay, and the part on the left side of the verticals is much longer.

Fig. 92: The first variant on TA352:12.

The discriminating element of this sign is its second part, the Winkelhaken cluster. Its formation is comparable to the Winkelhaken cluster of the sign LI. Thus, in general, two horizontal rows of Winkelhaken are impressed with a varying number of wedges. There are two main number combinations. The first combines four Winkelhaken in the upper row and three in the lower row. It is mainly written on TA143b, and TA352. The second variant contains three Winkelhaken in both rows. It can be found especially on TA198, and TA564. On these four tablets, even though there is a main variant, occurrences of the other variant can be found, too.

Fig. 93: The variation of TA564:15'.

In addition, there are a few variations. On TA564:15', one example is written with all in all five Winkelhaken, the first one slightly enlarged and followed by two horizontal rows of two Winkelhaken each (fig. 93). On TA543, the first and second variant are written just as often, and in addition, one example of ZI contains five Winkelhaken in the upper row, and three in the lower one.

A comparison with the sign LI shows a remarkable resemblance regarding the diversity of variants. For example, TA143 and TA543 which display both main variants of ZI, display variants with the same number of Winkelhaken for the sign LI. Additionally, TA543:12 and 17 (examples of the sign LI) are also written with five Winkelhaken, which is comparable to ZI in l. 11. On the other hand, even though there are not many examples, but on TA352, LI and ZI are exclusively written with four Winkelhaken in the upper, and three in the lower row. Thus, on many of the tablets consistent writing habits can be found.

Summary

All in all, the sign forms on the tablets authored by Tariša (and other individuals) show a remarkable consistency. Even though there are small differences, they mainly concern the number of wedges, but not their arrangement, which remains basically the same (e.g. KÀ, KÙ, LI, ZI). Regarding the differences, there is no clear pattern notable, neither in regard of the senders (Tariša only, or a group).

3.2.3 Movement

Another category of discriminating elements is the movement including features like line quality, pressure, rhythm and slant. As mentioned before, several of these elements have to be adapted to cuneiform tablets and script. For instance, the line quality is a feature that is not entirely applicable on this script. In modern writing, it refers to the consistency of the drawn line, but cuneiform wedges are not drawn but impressed into the clay. Therefore, the analysis is focusing on the quality of the impression and the recognisability of the wedges. However, these elements certainly do not only depend on the ability of the scribe, but are also influenced, for example, by the moistness of the clay when inscribed, and quality and form of the stylus (see ch. 2).

The wedges on all of Tariša's tablets are very clearly impressed (fig. 94) so that the single wedges of a sign are usually easy to differentiate.

Fig. 94: Examples for NA *on TA143,* NA *on TA198,* BA *on TA352, and* IŠ *on TA564.*

The typical wedge form with the triangular head is clearly recognisable. In regard of pressure pattern and rhythm of the script, Tariša's tablets show in general a very steady handwriting. Usually, the signs fill the height of the lines so that there is no space wasted between script and ruling. But the verticals, instead of being cut off by the ruling underneath, end on it. The different types of wedges (horizontal, vertical, oblique, Winkelhaken) are steadily impressed, filling wedges are not as deeply impressed as the framing wedges, but nevertheless clearly visible. Therefore, the writing gives an accurate impression, and is well readable. However, a closer look at the writing reveals that the writer(s) is frequently inconsistent in terms of the height of the writing in the line. The best indicator here is the position of the head of a normal vertical which is usually placed on, above, or beneath the ruling. It consistently varies between these three positions on all of Tariša's tablets, sometimes from line to line, sometimes from wedge to wedge (a few examples can be observed in fig. 94 and 95).

Fig. 95: Examples for upright (TA198) and inclined writing (TA564).

The three tablets TA143b, TA198, and TA722 show a very similar upright writing. Here, the ruling is oblique or slightly curved upwards. The script, however, is not influenced by the bending, but is orientated to the tablet (fig. 95, top). The writing on the other four tablets shows a bit more of an inclination to the right (fig. 95, bottom). Whether this is an indication of fast writing can be questioned, since the signs are nevertheless accurately impressed and do not show other signs such as abbreviations or illegibility.

3.2.4 Spatial Relationships

The term spatial relationships covers basically all the habits related to spacing between characters, words, and lines. As described above, on Old Assyrian tablets, the script is oriented towards the upper ruling. The uppermost elements like the heads of the vertical wedges, or parts of the uppermost horizontals wedges, are "hanging" from the ruling by being impressed on, or around the ruling, while the rest of the respective sign is positioned underneath the ruling. While obverse and reverse of a completely inscribed tablet are usually fully lined, lower and upper edge can be ruled, too.

Fig. 96: Examples for the alignment of script on the left edge on TA198, and TA143b.

The left edge, however, is hardly ruled even though it was often used for the last few lines of a letter. One discriminating element named by Koppenhaver (ch. 2) is the alignment of text on unruled paper. Thus, the left edge can properly be used as substitute. The script on the left edge is often not completely straight, but rather a bit wavy giving the arrangement on this edge a slightly disarranged appearance. Especially, when several lines are squeezed together on little space. However, on Tariša's tablets, the lines on the left edge are usually carefully inscribed so that every sign is clearly recognisable. Nevertheless, the lines are impressed very tightly, so that the higher elements of the lower lines (like the heads of verticals) are attached to the lower elements of the respective upper line (e.g. the tips of the verticals). A special case is TA143b, even though the two lines on the left edge are tightly written, both are very straight and give a very neat and clear impression (fig. 86, in comparison to another one of Tariša's tablets).

The arrangement of the text ist not particularly noticeable. Usually letters are written without any particular arrangement. Tariša's tablets are fully inscribed with only very few lines on obverse and reverse not completely filled in. Word dividers are used on all of her tablets. While on several tablets their distribution is rather regular with one word divider in almost every line, especially on TA143b and TA543, certain patterns can be observed. On TA143b, only very few word dividers are on the obverse, but on the reverse and further on the last two edges, more and more word dividers are impressed. At the same time it is notable that the script is getting tighter. On TA543, towards the end of both obverse and reverse the number of word dividers rises, and in the last lines usually two or more of them are impressed.

Fig. 97: Examples for the attachment of signs, NI *to* ZI *on TA143b;* IM *to* NI *to* UT *on TA301,* Ú *to* LÁ *on TA198.*

Spacing is another discriminating element. As mentioned above, the height of the lines is basically filled in with the length of the signs, especially the vertical wedges. Thus, in regard of the ruling and lines, usually no space is wasted. Another part of spacing is the space between characters and words. Generally, in Old Assyrian texts words are not specifically separated, but the space between them is the same as between single cuneiform signs. The same observation can be made for Tariša's tablets. In most cases, the space between single signs and words is the same, both on obverse and reverse. However, it can to be observed that even though cuneiform signs are usually not connected, and ligatures are rare, on Tariša's tablets, signs ending with a horizontal (e.g. BAR (½), LIM, MÌ, BU), or two intersecting oblique wedges (e.g. NI, ÁB) are mostly attached to the following sign; the latter is then impressed on the tail tips of the leading sign. In rare cases, even signs with stacked horizontals without a finalising vertical (or any other wedge formation), like Ú or ÁŠ, can be attached to the following sign in this way (fig. 97).[131] This phenomenon can be observed on all of her tablets. However, while most of her tablets (TA143b, TA198, TA301, TA564, TA722) are written with more space between the signs so that the phenomenon is more apparent, TA543 is tightly inscribed so that most of the signs are very close to each other. In addition, while the space between the signs seems very even on most of the tablets, on TA543, and especially on the reverse, some passages are written with wider space, and some with lesser or no space at all. Such a change of space, especially on the reverse, can point to a miscalculation of the writer of text and tablet size, or words and lines.

131 This phenomenon can be found on all of Tariša's tablet, the only exception seems to be TA352 where it can be observed only infrequently. A possible explanation might be that the tablet was probably already very dry when inscribed. The heads of the wedges here are often deeply impressed, but their tails are comparably thin and shallow. And therefore also shorter.

Fig. 98: On TA564 words seems to separated, here line 2-3: um-ma Ta-r[i-ša-ma x x] ša i-na [...].

Another peculiarity can be observed on TA564. Here, it seems that words were actually separated by more space than single characters. Fig. 98 shows a line of the heading as well as the beginning of the text. In the first line, the expression *um-ma Ta-r*[*i-ša*] ("thus (spoke) Tariša") is written, and the space between the second and the third sign is clearly bigger than between the other signs. The same applies to the second line. There, a wider space separates ŠA and the following combination *i-na*. The same phenomenon can be observed several times on the reverse as well. As written above, such a separation of words is rare, and this tablet is the only example in Tariša's corpus.

3.2.5 Statistical Analysis and Summary

The analysis of movement and spacing did not show any particular differences. Instead, the seven tablets give mainly the same impression regarding the neat impression of the wedges as well as the organisation of the signs on the tablet. Problematic about this kind of observation is, however, that it is very subjective and vague. And a clear presentation of the data is not possible.

On the other hand, the discussion of the sign variants is summarised in table 5. Here, only the mainly used variants and variations are recorded. Each column represents one diagnostic sign, each row represents one letter of Tariša. Each number in a column stands for a variant or variation. For example the sign MA is written in the same specific way on every tablet. Therefore, only one variation, represented with the number 1, is noted in the respective column. If several variants or variations are written equally frequently on a tablet, all numbers are recorded in the table.

Tablet	AM	BA	DÍ	DU	IM	KÀ	KI	KU	KÙ	LI	MA	RI	ŠA	TIM	Ù	ZI
TA143b	1	1	1	1	1	1,3	1,2	1	1	1	1	1	1	1	2	1
TA198	1	1	1,2	1	1	2	2	1	1	1	1	1	2	1	1	2
TA301	1	1	1,2	-	1	1	2	1	1	-	1	1	2	1	2	-
TA352	1	1	1,2	3	1	1	1,2	1	1	1	1	2	1	-	2	1,2
TA543	1	1	2	1	2	1	1	1	1	1	1	1	1	1	1	1
TA564	1	2	-	2	2	-	-	1	1	1	1	-	1	-	1	2
TA722	1	1	2	3	2	1,3	1	1	-	-	1	1	1	-	2	-

Table 5: The sign variants on Tariša's tablets.

Analysing the table, seven out of 16 diagnostic signs show basically no variation but are written in the same way on the seven tablets of Tariša. There are hardly more than two different versions of each sign, and in most of the cases, the distinguishing element is the number of wedges or Winkelhaken while the sign shape is the same.

Regarding the distribution of the different variants, there seem to be two groups. The first consists of the four tablets TA143b, TA198, TA301, and TA352, the second contains TA543, TA564, and TA722. The distribution of sign variants is especially obvious for the signs IM, KI, and ŠA. However, the majority of sign variants are the same. And in regard of the different variations, the signs KI and Ù are, as discussed above, difficult to distinguish because the number of wedges and their impressions are often not clearly visible. In case of DÍ, IM, ŠA, and ZI, most of the tablets contain both variations but with preferences for one or the other.

The same result can be drawn from the use of signs and the observations of movement and spatial relationships. On all seven tablets, the script is neatly written with clearly impressed triangular wedges. The lines on the left edge are close, but nevertheless evenly written so that the signs are easily readable. The tablet shape is mostly similar, and the small differences like the very straight edges of TA143b and TA543 in comparison with the rather convex ones of the other tablets might be explainable with their large size.

In conclusion, the seven tablets sent by Tariša and partly by other individuals, to her brother Aššur-taklāku, display a quite consistent handwriting. Several elements like the writing movement, the spatial relations, and form and construction of the script are quite similar, and can therefore most likely be attributed to one writer.

This person seems to have been highly skilled and trained because the script, even though often seemingly carelessly executed, shows a high order of accuracy.

Was Tariša the sender of these letters? - There is actually no definite answer. Regarding the content of the letters, first of all it can be noted that most of them indicate somehow that they were sent from the city of Aššur. All of them are reports about events and tasks, the sender(s) had fulfilled or intended to do. In this context, frequently the City (*ālum*), a reference to the city of Aššur, or some business with an eponym, a high official of Aššur, are mentioned. In TA198, Tariša tells her brother that "the famine of the City fell upon the house of our father and me" (TA198 [13]b*a-bu-bu!-tí* [14][*A*]-*lim*.KI : *i-ṣé-er* É *a-bi-ni ù i-ṣé-ri-a* [15][*i*]*m-qú-ut-ma*).[132] This example contains a specific formulation that can be found on several tablets and divides them into two groups: In this text, she speaks of the house of "our father", so she refers to their common family member. The same formulation can be found on the two other tablets sent only by her (TA301:15, 35, and TA564:16'). On two texts sent by a group of people, the formulation "your father" (TA143b:27, 28,44 *a-bi-kà* (sg.), TA543:35 *a-bi-ku-nu* (pl.)) can be found, which is a clear dissociation. So, these letters were clearly formulated by the group of representatives, not related to the addressee. Tariša was living in Aššur when she sent these letters. There were certainly a number of professional scribes who earned their living in this city who could have been hired by her. On the other hand, she would have been able to learn from such a professional scribe as well. Such an educational advantage would have certainly influenced her writing skills positively. Regarding the formulation "your father" and "our father", in any case, the latter formulation makes sense in the letters sent by her only. However, based on the assumption that the texts were written by one person, and this person was Tariša, the content of the texts would have been dictated by the representatives of her brother. In this case, it can be questioned why she did not continue addressing their father as "our father", but referred to him as "your father".

On most of the tablets, sent by the group of Tariša, the verbal forms referring to the sender are usually conjugated in the first person plural. This observation is especially interesting for the two tablets TA301 and TA564, which were sent only by Tariša. By using the plural form she seems to be writing in the name of several people, which are not identified elsewhere. Another explanation for the plural might be of course that her brother knew which individuals were generally involved in specific affairs, and consequently it was not necessary to mention them by name.

An exception regarding the verbal conjugation is TA198. This tablet was sent by Tariša to her brother, and its text is formulated as a letter from her to him, so the verbal forms she used are conjugated in the first person singular. Another peculiarity can be found on TA722. The initial letterhead mentions Tariša and two other persons as senders. Consequently, the following verbal forms are conjugated in the first person plural. However, in the last lines of the texts (from l. 25 onwards), a second part is introduced by the typical introduction formula *umma Tariša* ("Tariša (said) as follows"), followed by verbal formulations in first person singular.

132 Other instances can be found e.g. in TA143b:17 *a-lu-um i-dí-nu-ni* "the City gave to us"; or in context of a report about events on TA543:12 *um-ma li-mu-u*[*m*] "the eponym (said) as follows".

While the first part of the letter reports of fulfilled tasks, the second part contains information about a private matter concerning the siblings. The handwriting on the tablet does not change and the text must have been written by one person.

Some evidence points to her as the writer of the letters, several other points indicate that someone else was writing her texts. Drawing a conclusion at this point is therefore rather difficult. Further discussions on this topic are following at the end of this chapter.

3.3 Ali-ahum

Ali-ahum was the son of Iddin-Suen, and the brother of Amur-Ištar and Elamma.[133] He was married to Ab-šalim with whom he had at least four children: The two sons Aššur-taklāku and Aššur-ṭāb, and two daughters, Tariša and Ištitiša.[134] In addition to the house in Kaneš, he had at least two houses, one in Burušhattum and one in Aššur where his wife was living. In the 93/k-archive, 31 letters are mentioning him as the addressee, and 17[135] letters were sent by him. He is the creditor of 11 loan contracts, and is mentioned in several juridical documents. This rather small corpus might be explained by the allocation of his archive to his houses in different places. He was engaged in the trade of tin and textiles, and must have dealt with lapis-lazuli as well (Michel 2008a, 58-59, and 2018, 59).

3.3.1 The Sources

From Ali-ahum 17 letters remained in the family archive. On 14 of them he is mentioned as the sole sender. In addition, tablet AA769 was sent by a group of three men of whom Ali-ahum is mentioned first. Letter AA317 was sent by two men with the name Ali-ahum. And on tablet AA195 sender and addressee are broken and cannot be read. Regarding the context, however, it is very likely that Ali-ahum was its sender. Hence, it will be treated like that for the moment.

The letters are addressed to different individuals: Five letters were sent only to Aššur-taklāku, three letters were sent to a group of people including Aššur-taklāku. Another tablet was sent to a group of people, including Ali-ahum's daughter Tariša, the main part of the names here, however, is broken. One tablet is addressed to *kārum* Wahšušana, and the rest of the letters is addressed to different individuals and groups. In most of these texts, including the one sent by a group of men, Ali-ahum is mentioned first, which puts him in the highest position among them. Only in three texts, he is mentioned afterwards. One is the tablet sent to the *kārum*. Another one is tablet AA199, which was sent to two men named Amur-Ištar and Laqepum. The third one is AA770 on which the names of the addressees are broken except for Tariša's

133 For the entire family tree, and more information of the family of Elamma, see Veenhof 2017, xxx-xxxvi.

134 Michel mentions two other female individuals, Šī-Bēlim and Bilulu, which might have been daughters of the couple, but their relationship cannot be fully proven yet (2015b, 85).

135 In Michel 2018, 59, 18 letters are mentioned. The 18th letter, however, was not identifiable among the available material. Therefore, this study includes only 17 letters of Ali-ahum.

name. However, since she seems to be mentioned last, and was at that time still living in Aššur, this letter might have been addressed to Ali-ahum's representatives in the capital.[136]

Tablet	Abbr.	Sender + Ali-ahum's position	Position of the addressee(s)
kt 93/k 189	AA189	Ali-ahum	Aššur-taklāku, mentioned after the sender
kt 93/k 191	AA191	Ali-ahum	Ennānum, Husarum, mentioned after the sender
kt 93/k 192	AA192	Ali-ahum	Aššur-ištikal, mentioned after sender
kt 93/k 195	AA195	(broken)	Aššur-[x]
kt 93/k 199	AA199	Ali-ahum	Amur-Ištar, Laqepum, mentioned before the sender
kt 93/k 303	AA303	Ali-ahum	Aššur-taklāku, Husarum, mentioned after the sender
kt 93/k 317	AA317	Ali-ahum and Ali-ahum	Hinaya, mentioned after the senders
kt 93/k 328	AA328	Ali-ahum	Šamaš-abi, mentioned after the sender
kt 93/k 329	AA329	Ali-ahum	Aššur-taklāku, mentioned after the sender
kt 93/k 332	AA332	Ali-ahum	Aššur-taklāku, mentioned after the sender
kt 93/k 343	AA343	Ali-ahum	Aššur-taklāku, mentioned after the sender
kt 93/k 566	AA566	Ali-ahum	Aššur-taklāku, mentioned after the sender
kt 93/k 769	AA769	Ali-ahum and others, he is mentioned first	Iddin-Suen, mentioned after the senders
kt 93/k 770	AA770	Ali-ahum and others, he is mentioned last (?)	A group, including Tariša, mentioned before the sender
kt 93/k 889	AA889	Ali-ahum	A group of people, including Aššur-taklāku, mentioned after the sender
kt 93/k 936	AA936	Ali-ahum	Kārum Wahšušana, mentioned before the sender
kt 93/k 937	AA937	Ali-ahum	Aššur-taklāku, Belanum, mentioned after the sender

3.3.2 Form

Tablet shape and layout

Seven tablets of Ali-ahum's corpus are basically intact with regard to their shape, edges, and corners (AA189, AA192, AA303, AA317, AA328, AA329, AA343). Six tablets are partly

136 In general it is rather difficult to distinguish an original letter from an archival copy when the latter is not marked as such in any way. On the other hand it seems logical to assume that letters addressed to the archive owner, in this case Aššur-taklāku, are most likely the original tablets, while tablets addressed to other individuals, e.g. representatives and business partners, were presumably archive copies kept to keep track of business and private affairs. For more information on copies see Beyer (*forthcoming*).

broken, but their general shape including the form and diameter of edges and most of the corners can be observed. On AA195, AA332, AA889, and AA937, half of the obverse or reverse respectively is broken, i.e. a part of the clay is chipped of, but it did not damage the shape of the tablet, or only slightly. On the contrary, the two tablets AA191 and AA769 are badly damaged so that only the obverse (and a few lines on the edges) remained while both their reverse is completely broken. On the right side of AA936, a piece of clay broke out of the tablet. AA199 consists nowadays of two pieces glued together. Around the breaking edge and on the left edge, parts are chipped off as well. The two tablets AA566 and AA770 are only fragments.

The two tablets AA303 and AA936 are square, and have dimensions between 4,4 and 5,5 cm. AA303 has slightly convex edges, its corners range from rounded (upper right one) to pointy (upper left one). AA936 on the other hand is an example of a pillow-shaped tablet with convex edges and pointy, squeezed corners. The other tablets, as far as observable, are in portrait format. Their dimensions range from 4,8 to 9,6 cm in height, and 4,1 to 6,9 cm in width. The average number of signs per line ranges from six to nine. However, as demonstrated on the example of Tariša's tablets, these numbers represent only the average (for the exact data see table 6).

The only outstanding tablet is AA199. It has straight edges and straight or roundish corners. In addition, usually, the surface of Old Assyrian clay tablets is slightly convex and inclined towards the edges. Tablet AA199, however, has very flat surfaces, and only the edges are rounded. The other tablets of Ali-ahum have a different shape: In general, they have slightly convex edges and rounded, pointy, or pillow-shaped corners. Especially in regard to the shape of the corners, the tablets show hardly any consistency. For example, AA937 has two pillow-shaped corners on the left and on the right, the upper one is rounded while the lower one is straight. In addition, several tablets seem to be slightly deformed, i.e. one of the edges is somehow dented (e.g. AA328, AA889) or the rectangular shape of the tablet is distorted by a prolonged side (e.g. AA189, AA317, AA937).

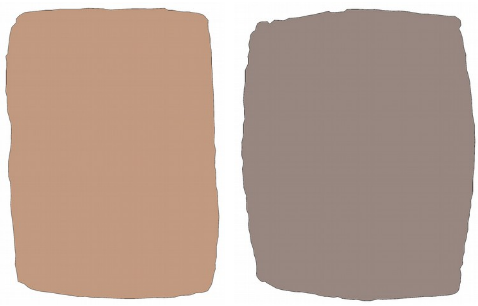


Fig. 99: Two examples for the tablet shape: the exceptional AA199, and AA189.

On six tablets the ruling is very straight so that every line, also at the bottom of a surface, is completely visible (AA189, AA191, AA199, AA317, AA566, AA889). On some tablets, the ruling is generally straight, but a few lines are suddenly curved upwards or slightly oblique (AA195, AA303, AA936). For example, on AA303 especially the ruled lines at the bottom of the reverse are slightly oblique, and the beginning of the bottom line is only partly visible. The reason for this is the deformation of the tablet itself. The ruled lines on the obverse of AA936 are straight. On the reverse, which is not fully inscribed, only the last two or three lines are curved upwards. Finally, on eight tablets, the ruling is mostly oblique or curved upwards (AA192, AA328, AA329, AA332, AA343, AA769, AA770, AA937).

Fig. 100: The ruling on the reverse of AA303.

Tablet[137]	Total of signs	Different readings	Number of different signs	Number of lines	Average of signs per line	Dimensions (in cm)
AA189	242	81	64	33 (obv. 12)	7,3	4,3 x 5,4
AA191	70	26	26	12 (obv. 10)	5,8	4,4 x 4,8
AA192	88	39	36	14 (obv. 10)	6,3	4,1 x 5
AA195	269	68	59	39 (obv. 14)	6,9	5,4 x 6,6
AA199	243	70	56	40 (obv. 16)	6,1	5,3 x 7,4
AA303	189	61	55	26 (obv. 9)	7,3	4,8 x 4,4
AA317	237	64	55	35 (obv. 12)	6,8	4,7 x 6,1
AA328	178	62	56	29 (obv. 11)	6,1	5 x 5,7
AA329	260	89	69	37 (obv. 14)	7,0	5,3 x 6,8
AA332	222	80	66	38 (obv. 14)	5,8	5,3 x 7
AA343	362	73	65	42 (obv. 16)	8,6	6 x 7,8
AA566	71	44	40	8	fragment	4,8 x 3,2
AA769	234	70	60	25 (obv. 21)	9,4	6,9 x 9,6
AA770	191	66	55	42 (obv. 17)	fragment	4,3 x 6,4
AA889	220	57	53	31 (obv. 11)	7,1	6 x 6,5
AA936	153	63	53	19 (obv. 10)	8,1	5,5 x 5,4
AA937	284	81	64	41 (rev. 18)[138]	7,0	6 x 8,5

Table 6: The overview of the use of signs on Ali-ahum's tablets.

137 For this table the same system applies as for the one of Tariša.
138 On tablet AA937 the obverse is badly broken and several lines are not reconstructable. On the other hand, the reverse is complete. Therefore, here, the number of the lines of the reverse was counted).

Use of Signs

On the 17 letters of Ali-ahum, a total of 114 different signs were used with 188 different readings. When analysing Ali-ahum's corpus, one has to keep in mind that only seven texts are complete and (almost) without a missing sign. Out of these seven letters, AA343 has the highest number of written signs (in total 362). However, the highest number of different signs (69) and the highest number of different readings (89) can be found on tablet AA329, which has only 260 sign in total (more than 100 signs less than on AA343). The tablet with the least number of signs in total (88), different signs (36), and readings (39), is AA192. This tablet is complete, however, the text ends on the reverse after two lines.

The comparison of the tablets is interesting in regard of the number of different signs, their readings, and the total of signs. The three complete tablets AA303, AA317, and AA328, contain 55 to 56 different signs each (see table 7). The number of different readings is almost the same for all of them as well and ranges from 61 to 64. On the other hand, the total of written signs shows a larger difference. While on AA303 and AA317 the same number of different signs is written (55), and also the number of different readings is very similar (61 and 64), the total of signs per tablet shows a difference of almost 50 signs (189 vs. 237). The third tablet AA328 has one more different sign (56), but the numbers of different readings (62) and the total of signs (178) are very similar to AA303.

Tablet	total of signs	different readings	number of different signs	number of lines	average of signs per line	dimensions (in cm)
AA303	189	61	55	26 (obv. 9)	7,3	4,8 x 4,4
AA317	237	64	55	35 (obv. 12)	6,8	4,7 x 6,1
AA328	178	62	56	29 (obv. 11)	6,1	5 x 5,7
AA195	269	68	59	39 (obv. 14)	6,9	5,4 x 6,6
AA199	243	70	56	40 (obv. 16)	6,1	5,3 x 7,4
AA889	220	57	53	31 (obv. 11)	7,1	6 x 6,5
AA936	153	63	53	19 (obv. 10)	8,1	5,5 x 5,4

Table 7: An excerpt of the table use of signs above.

Four more tablets can be added to the comparison: AA195, AA199, AA889, and AA936 have broken parts, nevertheless, the remaining texts are all written with a number of different signs between 53 and 59. The number of readings ranges between 57 and 70. The total of written signs on each tablet, however, ranges between 143 and 269. Thus, the number of different signs is probably connected to the number of different readings, but not necessarily to the total of written signs on a tablet.

Seven signs are written on every tablet (A, KI, LÁ, MA, NA, TA, UM). However, as already shown in the general comparison (ch. 2), a single tablet can change such a result. By including signs that are missing on only one of 17 tablets, nine more signs can be added (BA, DÍ, HU, I, KU, NI, NU, ŠA, ŠU). It is notable that seven of these signs are not written on tablet AA191. Most of these 16 signs belong to the group of most common signs. The only exception is the sign HU. An explanation for its frequent use is certainly its use in Ali-ahum's name (*A-li-a-hu-um*). It is missing on AA195 because the right part of the obverse mentioning his name in the letterhead is broken.

On the other hand, 13 signs are written only on one tablet each. Eight of them are Sumerograms and either used as logogram (GÀR in DAM.GÀR, ITI, SIG_5, ŠE, ŠUNIGIN), or as part of a personal name (LUGAL, PUZUR_2, SIPA). The other five signs are used in verbal expressions, adjectives, or names (ÈR, ÌŠ (EŠ), ṬUR_4, ÙH, ÚR). The sign ÌŠ is written six times on AA317. However, it can only be found on the upper and left edge, while the more common IŠ is used on the other sides of the tablet. The sign ÌŠ consists of a horizontal row of three Winkelhaken, the sign IŠ on the other hand is longer and consists of a stack of horizontals, a small vertical and a small Winkelhaken impressed on the horizontals, and it is completed by another large Winkelhaken. It can be questioned whether the writer wanted to save space with the shorter sign (even though the writing is not very squeezed at the edges), or whether it was easier for him to write the sign ÌŠ in regard of the tiny script size on the edge. The sign ÚR is only written once on AA195. As on Tariša's tablets, it is used for the name Nūr-Sîn (l.28, *Nu-úr*-ZU) while UR is used for other expressions.

Fig. 101: The signs IŠ *and* ÌŠ *on AA317:18 and 32.*

Other phonetic values written with different signs on Ali-ahum's tablets are /bi/, /la/, /šur/, and /u/. The sound /bi/ is represented on Ali-ahum's tablets with the signs BI, NE (BÍ)[139], and BE (BI_4). Use and occurrence of the three signs, however, differ greatly. The sign NE is written on eight tablets (AA191, AA192, AA303, AA317, AA328, AA332, AA343, AA769), and is exclusively used for the imperative of *qabā'um* "to speak" in the letterhead, or additional

139 Larsen already mentioned that the sign NE is a very rare sign in Old Assyrian texts, and its use points to a certain conservatism and high level of scribal education (1976, 144), which was confirmed by Kryszat (2015, 112)

specific addresses. On six of these tablets, also the signs BI and BE with their different readings are used: On AA317 and AA769, BI can be found, and on AA192 only BE. On AA303, AA328, and AA332, all three signs are written.

On nine tablets, NE(BÌ) is not written. Instead, on AA195, AA199, and AA566 the sign BI is exclusively used, and on AA189, AA889, and AA936, it is BE. Finally, on AA329, AA770, and AA937, both BI and BE can be found.

Regarding the use of these signs, especially in case that more than one sign is written, an analysis does not give any conclusive result. Observing the individual tablets, it appears that in case of the repetition of a word (independent of declination, conjugation, and reading), the same sign was used. For example on AA303, *libbum* (l. 8, 12: *i-li-bi-kà* "in your heart" (here: in your account)) is written twice with BI. On AA332, *a-bi*$_4$*-ni* "our father" is twice written with BE (reading *bi*$_4$) (l. 33, 35), while the genitive of *ṭuppum* (l. 13: *ṭup-pí-i* "my tablet"; l. 15: *ṭup-pí*-[*x*]) is twice written with *pí* which is a reading of BI.

However, comparing the use of the different signs on all the tablets, no clear pattern or consistency can be found. For example while *libbum* is written with BI on AA303, on the tablets AA189:24 and AA937:41, it is written with BE (BI$_4$). A very common word in the trading context is the verb *wabālum* Š-stem "to carry, to send". On the tablets AA18921, AA192:14, AA303:19, AA332:37, AA937:38 different verb forms are written with BE (*bi*$_4$), but on AA 195:10, 17, 22 and AA769:13 they are written with BI.

Another sound value is /la/. On every tablet of Ali-ahum, it is represented with LÁ, and on AA199 and AA317 additionally with LA. On the latter, LA and LÁ are only written in names. The name Ali-ahum (written as *A-la-hu-um*) can be found three times, once it is written with LA (l.1), twice it is written with LÁ (l.2, 25). A possible explanation could be that the one written with LA is the sender himself and he wanted to point out that the person(s) written with LÁ are other individuals. However, then it could be questioned why another person was written with LA as well (l.18: *A-la-b*[*i-im*]).

On AA199 both signs are represented as well. Here, LÁ is basically used for two words: the verb *šaqālum* Š-stem (l. 10 and 37, "to make s.o. pay"), and the particle *mala* (l.14, 23, 29). On the other hand, the sign LA is used for personal names (l. 2, 3), the negation LA (l. 15), and two different verbs (l. 19: *tù-šé-bi-la-šu-um* "you have sent him s.th."; l. 30: *i-la-qé-ú* "he takes s.th."). And in addition, once for the particle *mala* (l. 32). Again, there seems to be no reason for the diverse use, because *ma-lá* in line 29 and *ma-la* in line 32 are both used as generalizing relative particle.[140]

The phonetic value /*šur*/ is represented on almost every tablet, except AA770. It is either written with ŠUR (AA199, AA317, AA889, AA936), or ŠÙR on the remaining tablets. The clear distinction by using either this or that sign indicates the preference of the respective writer.

The sound /u/ is written with Ú and Ù. On AA189 and AA192 only Ú can be found, and on AA191, AA317, and AA566 only Ù. On the remaining tablets of Ali-ahum's corpus, both signs are written. Regarding the differentiated usage of the two signs based on the observations made on Tariša's tablets, Ali-ahum's tablets can be grouped as follows: On the three tablets on which only the sign Ù is written, it is only used in its function as conjunction. On the two tablets on which only Ú can be found, the sign is used as vowel as well as a conjunction. Five of the tablets containing both signs (AA332, AA769, AA770, AA889, AA936) show the clear distinction of sign and function as it could be seen on Tariša's texts. On five other tablets (AA199, AA303, AA328, AA329, AA343), the distinction can mostly be observed as well. However, in at least one to three instances, Ú is used as conjunction instead of Ù. For example on AA199:32 Ú is first used as a conjunction to introduce a new sentence, and is immediately followed by a second Ú used as a vowel (*ú ú-ṭá-tám* "and the grain"). On another tablet, AA195, it is Ù which replaces Ú in its function as a vowel (16: *ù-na-hi-du-kà* "I instructed you"). On tablet AA937, both signs replace each other and their function once (27: *lu i-na A-lim*$^{\mathrm{KI}}$ *ú i-na* GÁN-*lim* "be it in the City or in the field", 30: *ù-ša-ak-ša-ad-kà* "(if) s.o. approaches you").

The name Aššur-taklāku is not written on every tablet of Ali-ahum. Nevertheless, the ones bearing this name, show a different preference than the tablets sent by Ali-ahum's daughter. On seven letters (AA189, AA195, AA303, AA328, AA332, AA343, AA937) the name Aššur-taklāku is written with the sign TÁK while the sign combination *ta-ak* can only be found on four letters (AA192, AA329, AA566, AA889). On six letters, the name is not written.

In the following table, the data of the use of signs is recorded. Regarding the use of different signs and their application, almost no pattern is recognisable. The two tablets AA199 and AA317 both have the signs LA, and ŠUR instead of ŠÙR. However, on AA889 and AA936,

140 For a definition and explanation of the use of *mala* see Kouwenberg (2017, 367-370).

ŠUR is written, but not LA. Regarding the rest of the tablets, Ali-ahum's tablets do not show such a consistent picture as Tariša's corpus does. Thus, it is rather difficult to determine certain tendencies or even different or similar hands only by an analysis of the use of signs.

Tablet	BI	NE	BE	LA	LÁ	ŠUR	ŠÙR	/u/	/tak/
AA189			x		x		x	u2-incorr.	TÁK
AA191		x			x		x	corr.	
AA192		x	x		x		x	u2-incorr.	ta-ak
AA195	x				x		x	u3-incorr.	TÁK
AA199	x			x	x	x		u2-incorr.	
AA303	x	x	x		x		x	u2-incorr.	TÁK
AA317	x	x		x	x	x		corr.	
AA328	x	x	x		x		x	u2-incorr.	TÁK
AA329	x		x		x		x	u2-incorr.	ta-ak
AA332	x	x	x		x		x	corr.	TÁK
AA343		x			x		x	u2-incorr.	TÁK
AA566	x				x		x	corr.	ta-ak
AA769	x	x			x		x	corr.	
AA770	x		x		x			corr.	
AA889			x		x	x		corr.	ta-ak
AA936			x		x	x		corr.	
AA937	x		x		x		x	mixed	TÁK

Table 8: The data of the use of signs on Ali-ahum's tablets.

Form and construction[141]

AM

Fig. 102: The variant on AA343:15.

The sign AM is written on only nine tablets of Ali-ahum (AA189, AA303, AA317, AA329, AA332, AA343, AA770, AA889, AA937). Compared to letters of other senders, his texts are therefore rather an exception. The sign is mostly written only once, and often on an edge, which can influence the typical shape of the sign. Hence, a determination of the sign variant is sometimes difficult.

A remarkable version of the sign can be observed on tablet 343. Here, three out of four times, the sign is written with two oblique wedges instead of Winkelhaken. Between these

141 For the image tables of the diagnostic signs see the file Appendix_ch3_Ali-ahum on the attached CD-ROM.

intersecting oblique wedges, three small verticals are placed so that this part resembles the sign IR. However, one AM (l.6) on this tablet is written with normal Winkelhaken; it is placed at the end of a line close to the edge while the other examples are located somewhere in the middle of lines with enough space to write them in full length. The writer of this text probably chose the sign variations in regard of the available space.

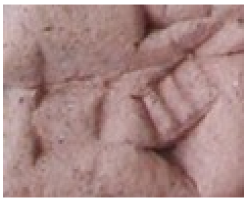


Fig. 103: An example on AA937:31.

On the other tablets, AM is always written with normal Winkelhaken. While the decisive factor is usually the number of Winkelhaken, as well as their position and size, on Ali-ahum's tablets, the number of Winkelhaken is not always clearly countable. The main reason is the quality of the impression. Especially on AA189, AA303, AA317, AA332, the wedges are often blurry and faint so that their number is hardly discernable. On the other hand, their general size is usually clearly visible. On this basis two main types can be distinguished. One type consists of several Winkelhaken of the same size in the upper row, arranged on an oblique upward axis. A larger Winkelhaken is positioned underneath on the tip of their sides. This variant with four wedges in the upper row is written on AA303, AA889, and AA937 (see fig. 103). On AA770:29, a similar variant can be found, but with three instead of four Winkelhaken.

Fig. 104: The second type on AA329:34, and an example with a gap on AA189:6.

The second type shows an emphasised Winkelhaken at the end of the upper row. The smaller wedges are positioned on an oblique upward axis, the tip of their tails pointing to, or are overlaid by the larger Winkelhaken at the bottom of the formation. The upper row is then followed by the afore-mentioned second large Winkelhaken. The number of small Winkelhaken seems to be three on AA329 and AA332. However, on the former, in line 31, there are only two small Winkelhaken visible, but between them and the following large Winkelhaken at the end of the row there is a gap, large enough for a third small Winkelhaken. A similar version can be found on AA189 (see fig. 104). Thus, one might consider that both were written by the same person, and the AM variant on AA189 is – in theory – the same as on AA329 and AA332.

Fig. 105: AA317:19

Another case is AA317. Here, only two small Winkelhaken are in the upper row, followed by a larger one. Between the former and the latter, however, there seems to be no gap. Furthermore, only for the AM sign on this tablet, the small vertical wedge which is impressed on the horizontals, is impressed on the heads of the two horizontals. On all the other tablets sent by Ali-ahum, it is impressed next to the Winkelhaken formation.

BA

The sign BA is written on most of the tablets except AA191. On four tablets (AA192, AA195, AA328, AA566) it is written once, on the other tablets it occurs at least twice or more.


Fig. 106: The three examples on AA769:5, 12a, 12b.

For a classification of this sign on Ali-ahum's tablets, a distinction has to be made between its construction and appearance. When focusing on the latter, the examples seem very inconsistent and show a large range of varying details in regard of the length of the wedges, the angle of the bottom wedge, and their positioning in respect to each other. For example on AA769 the sign is written three times (fig. 106). Each example shows an oblique wedge at the bottom. But the distance between its head and the head of the upper horizontal varies from attached to each other (l. 5) to a wide gap in-between (l. 12a). All of them show the same construction: While the length of the bottom wedge varies, in all three cases it is positioned in a way that its tail points towards the tip of the vertical. In addition, neither the upper horizontal nor the oblique wedge at the bottom cross the vertical wedge, but end on or slightly before it. Only the shorter horizontal in the middle crosses the vertical in some cases. This variation can be found on most of Ali-ahum's tablets (AA192, AA195, AA199, AA303, AA317, AA328, AA329, AA332, AA566, AA769, AA770, AA889, AA937). On most of these tablets it can be noted that the vertical wedge is cut off, or crossed by the ruling underneath. The oblique wedge at the bottom is therefore also cut off or crossed by the ruling as well (see for instance AA329:18, or AA769:12a (fig. 106)). Only in a few cases both wedges end on or above the ruling.


Fig. 107: AA343:18.

On AA189 and AA343, the second variation of BA is written. Here, the three stacked wedges are parallel and horizontal. When observing the bottom one, it might seem slightly oblique. However, the inclination seems to be due more to the general slant of the script. The upper and the bottom horizontal can have the same length, or the bottom one is slightly longer. The horizontal in the middle is slightly shorter than the two others wedges.

On AA936, BA is only written twice, once as the first, and once as the second variation.

DÍ

Fig. 108: The first variant on AA328:14.

The sign DÍ is written on every tablet of Ali-ahum except AA191. Two variants can be identified with different variations each. One variant consists of four Winkelhaken in the upper row, and one Winkelhaken at the bottom. It can be distinguished into two different variations. One consists of four wedges of the same size in the upper row. Their lower tails are overlaid by the Winkelhaken at the bottom. This variation can be observed on AA192, AA328, AA329, AA332, AA343 and AA937. A clear execution is of course not always given. For example on AA329 in l. 15 and 16, the writer prolonged the first Winkelhaken of the upper row so that its head sticks out. On AA343, the writer tends to position the bottom wedge in several cases rather to the right so that the leftmost upper Winkelhaken protrudes (l. 20, 30, 33). These variations, however, are not consistently written.

Fig. 109: AA195:9.

Nevertheless, they differ greatly from the second variation, which is executed on AA195 and AA303. Here, the first Winkelhaken has the same size as the bottom one and protrudes while the other three of the upper row are much smaller and attached to the Winkelhaken at the bottom. On the opposite to the natural variations of the first version, this arrangement is intended and clearly determinable as an individual habit.

The second variant contains three Winkelhaken in the upper row and one at the bottom. As already seen on Tariša's tablets, this variant can be executed in different ways, depending on how the Winkelhaken at the bottom is positioned and how the upper ones are impressed and in what size.

Fig. 110: The three variations of the second variant: AA566:3, AA199:3, and AA936:8a.

One variation shows three Winkelhaken of the same size and on the same oblique axis, their lower tails are overlaid by the bottom wedge (AA566, AA769). In another variation, the left and right Winkelhaken of the upper row are slightly enlarged, the one in the middle is directly positioned above the Winkelhaken at the bottom, and usually the only one attached to the latter (AA199, AA317). In a third variation, the bottom Winkelhaken is placed on the tails of the middle and right Winkelhaken. The one on the left, having the same size as the others, protrudes beyond the bottom one. It is executed on AA189, AA770, and AA936. On AA889, the first and third variations are written equally frequently. On the other tablets, other variations occur as well, but one of them is usually more often written.

DU

Fig. 111: AA195:25.

The sign DU is written on eleven tablets, but missing on AA189, AA191, AA199, AA317, AA328, and AA566. Most of Ali-ahum's tablets show a consistent version of the sign. On all the tablets, the "short" variant is written, i.e. the combination of a short horizontal with an attached Winkelhaken is positioned in the middle of the rectangular box formed by two horizontal and two vertical wedges. Small varying details like the length of the two horizontals, or the size of the Winkelhaken, however, are not consistent on any tablet, therefore, they cannot be evaluated as discriminating elements, or different variations.

Fig. 112: The prolonged variant of DU *on AA889:13.*

A different variation can be found on AA889. The sign seems to be a mix between the short and the long variant of DU. The horizontal with the Winkelhaken is shifted downwards so that it is positioned after the lower horizontal. The first vertical is not positioned on the head of the first lower horizontal, but shifted downwards to its middle, thus forming a kind of cross.

IM

Fig. 113: AA889:18a.

The sign IM can be found on twelve tablets but is not written on AA189, AA195, AA343, AA566, and AA769. It is problematic that on six tablets it is only written once, and in several cases it is located on the edge, or very close to it. Therefore, the examples can be deformed, or their details are difficult to determine.

On Ali-ahum's tablets, the sign can be distinguished into three variants and several variations. A unique variant is written on AA889. Here, the upper row of the Winkelhaken formation is written in the usual way with three Winkelhaken. The lower Winkelhaken is replaced by a slightly oblique wedge pointing upwards. The upper Winkelhaken are placed more or less on a parallel axis. The rightmost one is slightly enlarged in line 11 and 18a.

Fig. 114: AA328:7.

The other two variants of IM are distinguished by the number of Winkelhaken in the upper row of the Winkelhaken formation. One variant contains four Winkelhaken. On AA328 and AA329, the Winkelhaken of the upper row seem to have the same size and are positioned on the same oblique axis. Therewith, this element has the same construction and shape as the sign DÍ on the respective tablets.

Fig. 115: AA332:8.

The other variation of this variant shows a particular pattern and can be found on AA332 and AA770. Here, the leftmost Winkelhaken of the upper row is slightly enlarged, and partly slightly shifted so that it is not on the same axis as the following smaller Winkelhaken, and protrudes beyond the bottom wedge. In addition, the rightmost Winkelhaken of the upper row can also be slightly enlarged. When comparing these Winkelhaken elements with their DÍ counterpart, a certain similarity is again apparent, especially with regard to the emphasis on the very right Winkelhaken.

Fig. 116: The three variations of the third variant on AA192:13, AA936:1, and AA199:24.

The third variant of IM contains three wedges in the upper row. Its versions are categorized according to the execution of the impressions: On AA191, AA192, AA317, and possibly AA937, the three upper Winkelhaken have the same size and length, and the Winkelhaken at the bottom is impressed on the tips of the first and middle upper Winkelhaken. The very right one is not attached to the bottom one and its tail is sometimes protruding. On AA936 the second variation can be found, which is the opposite. Not the rightmost, but the very left upper Winkelhaken is not attached to the bottom wedge, but protrudes. Especially in this case, the similarity to DÍ is clearly visible. The third variation can be found on AA199. Here, the leftmost and rightmost upper Winkelhaken are slightly enlarged, and partly also shifted so that they are not on the same axis as the middle one. The bottom wedge is mainly placed underneath the middle Winkelhaken of the upper row. Its shape equals the shape of DÍ on this tablet as well. The last variation of IM is written on AA303. Here, the three Winkelhaken of the upper row are very small in size. All three are on the same axis, and their tail tips are overlaid by a large Winkelhaken at the bottom. This variant is similar to the peculiar DÍ-variant, but the fourth enlarged left Winkelhaken of the upper row is missing.

An additional characteristic is probably the connection of the DÍ-part with the second part of the signs IM which consists of a horizontal and two crossing vertical wedges. The important detail here is the connection of the two parts due to the head of the horizontal which can be directly attached to either the upper tip of the bottom Winkelhaken, or the tail of the right upper Winkelhaken, or both (see fig. 116). While in most cases on Ali-ahum's tablets the two parts of IM are indeed attached to each other, on tablet 303, 770, and 936 they are disconnected. However, in the two latter cases, there is only one examinable example each, while on the first one, not all the instances are well visible. Therefore, defining this detail as a habit is not advisable since each case could be a scribal slip.

KÀ

The sign KÀ is written on most of the tablets, with the exceptions AA191 and AA566. In addition, on AA192 the sign is not clearly visible, therefore it cannot be classified.

Fig. 117: The first variant of KÀ, here on AA189:7.

There seem to be three variants distinguishable on the basis of the number of wedges as well as on the different execution of specific elements. The first variant consists of five stacked horizontals. The one at the bottom is enlarged, its head is shifted to the left. The other four wedges above begin basically on the same vertical axis. On the heads of the horizontals, a vertical wedge is impressed reaching from the top to the bottom. At the end of the horizontals, three parallel verticals are impressed with their heads either on the ruling, or the uppermost horizontal. They are followed by two Winkelhaken. In several cases the one at the bottom is sometimes impressed on one or two of the parallel verticals (fig. 117). This variation can be found on AA189, AA317, and AA889. Although the main variant on these tablets is consistently used, especially on the first two tablets, the signs are rather sloppily written. For example, the upper four horizontals begin not always on the same vertical axis (AA189:9b, 33; AA317:13), or the first vertical is not accurately positioned (AA189:7, 31, 33; AA317:13). In addition, the wedges are in some cases not deeply impressed, so that they are hardly visible.

Fig. 118: AA199:21.

A very similar variant can be found on AA199. Here, the sign consists of five stacked horizontals, too. The one at the bottom is also prolonged. But not three, but four vertical wedges are positioned at the end. A difference is also their impression. Their heads are not visible at all, but they rather look like four very thin parallel strokes. In addition, while the two Winkelhaken of the first variant have the same size, on AA199, the upper one is larger than the bottom one.

Fig. 119: The third variant, on AA195:29.

The third variant of KÀ consists of four stacked horizontals of the same beginning and length. Partly, the uppermost and lowermost wedges are slightly emphasised by a stronger impression. One vertical is impressed on the head of the horizontals. Three parallel wedges follow. The first of the trio is mostly positioned in the middle of the horizontals, and the following two can be impressed with enough space in-between to reach the end of the horizontals. Or, in some cases, all of them are impressed in the middle of the sign (fig. 119). They are followed by two Winkelhaken clearly positioned after the verticals. This variant seems to be more carefully executed than the first one. It is written on AA195, AA303, AA328, AA329, AA332, AA343, AA769, AA770, AA936, and AA937.

KI

Fig. 120: AA189:6.

The sign KI is written on every tablet of Ali-ahum. Four variants can be distinguished on the basis of number and positioning of two or three wedges on the left side of the sign. The first variant consists of two Winkelhaken usually positioned on a very steep upward axis; the lower Winkelhaken is placed somewhere in the middle of the construction, the second one is placed higher, but on the ruling at the most. This element is followed by a stack of several small horizontal wedges, and finalised with a large vertical wedge (AA191, AA192, AA195, AA936). The latter is usually slightly inclined to the right, independent of the general slant of the individual hand. The number of stacked horizontals might be a discriminating element as well. In case of Ali-ahum's tablets, however, there seem to be mostly four, in a few cases maybe three wedges.

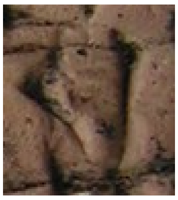


Fig. 121: AA303:3.

The second variant shows a similar construction, but it contains an additional element. Here, a small vertical wedge is combined with the two Winkelhaken at the beginning (AA303, AA317, AA328, AA332, AA343, AA566, AA769, AA770). It can be placed underneath the two Winkelhaken so that it is barely visible, or it is positioned between them like a bridge – both types are alternately written and are therefore be treated as one variant. As mentioned before, an additional discriminating element seems to be the number of small horizontal wedges. On most of the tablets the number seems to be four as well. But on a few tablets, variations with three horizontals can be found, and on AA328, there are clearly five small horizontals impressed. Especially in the last case, the wedges are very thin, thus, the high number of wedges might be a matter of space.

Fig. 122: The third variant on AA199:12.

Problematic in regard of the first and the second variant of KI is that they are often not entirely distinguishable because of the insufficient visibility of the small vertical wedge. On the tablets AA189 and AA937, half of the examples clearly show the small vertical, while for the other half, this wedge is not visible at all.

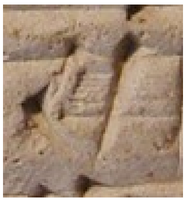


Fig. 123: AA199:12

The third variant of the sign KI is found on the tablets AA199 and AA329. The general shape of the sign is similar to the two variants above, but here, the lower Winkelhaken and the small vertical are written while the upper Winkelhaken is omitted. On these tablets, it is obvious that the head of the first vertical is positioned on the ruling, and its tail pierces the centre of the Winkelhaken. A difference between the variations on both tablets is the number of small horizontal wedges. On AA199, five to seven very thin horizontals are stacked while on AA329 hardly two or three are visible. This difference might be the result from the different qualities of clay and stylus. Especially the stylus used on AA199 must have been very fine because it allowed the writer to impress very thin wedges.

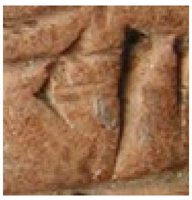


Fig. 124: AA899:21.

The fourth variant of KI is only written on AA889. Here, three Winkelhaken are arranged on an upward oblique axis. They overlap with three small horizontals. The sign is finalised with a slightly inclined vertical wedge.

KU and MA

While on Tariša's tablets KU and MA were very similar on each tablet, on Ali-ahum's tablets they differ. Therefore they will be discussed separately.

KU

The sign KU is written on every tablet except AA769. Here, three variations can be distinguished.

Fig. 125: AA328:22.

The first one consists of three horizontals of the same length, framed at their beginning and end with one vertical wedge each. Both verticals can cross the horizontal at the bottom. The latter can slightly protrude, most likely as a result of the stroke order and rather not as an intended shape: The horizontals were presumably impressed after the first vertical. While the uppermost horizontal is impressed on the wide head of the vertical, the one at the bottom is impressed on the thin tail. Therefore, it can protrude beyond it. This version can be found on AA189, AA191, AA192, AA303, AA328, AA329, AA332, AA770, AA937.

Fig. 126: The second and third variation, on AA566:2 and AA343:25.

The second variation written on AA195, AA199, and AA566, shows a similar shape, however, the horizontal in the middle is slightly shorter, and does not overlap with the first vertical. Slightly different is the third version. Here, the upper and middle horizontal have the same length while the one at the bottom is prolonged. The first vertical is usually placed on the head of the bottom wedge, and therefore, it is in front of the upper and middle horizontal. This version can be found on AA317, AA343, AA889, and AA936.

MA

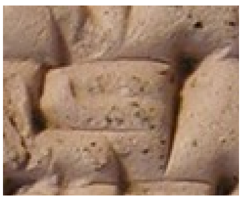


Fig. 127: The first variation on AA195:21b.

Most variations of MA on Ali-ahum's tablets are very similar to KU but with longer horizontals. One difference, however, is that on these tablets the middle horizontal is never as long as the lowermost horizontal as it is the case for KU. Consequently, the first version described for KU does not exist for MA (on Ali-ahum's tablets). Instead the most common variation of MA corresponds to the second variation of KU: The upper and lower horizontal have the same length, and build together with two verticals a rectangular frame.

The horizontal in the middle is slightly shorter, and ends together with the two other horizontals on the second vertical (the horizontals can cross the second vertical, however, on Ali-ahum's tablets it is not a very common, and no consistent trait). This variation is written on AA189, AA191, AA192, AA195, AA303, AA328, AA329, AA332, AA566, AA770, AA889, AA936, and AA937. An irregularity can be noted on some tablets, especially on AA328 and AA889. Here, in several cases the horizontal at the bottom is obviously longer than the one at the top. But the first vertical is impressed on the head of the upper horizontal, so its tail tip is placed behind the head of the lowermost horizontal. This variation, however, is very inconsistently written on these tablets, and the other variation is usually preferred.

Fig. 128: AA199:32.

The second variation of MA can be found on AA199, AA343, and AA769. Here, the lowermost horizontal is clearly longer than the uppermost one. The first vertical is impressed on the head of the lowermost horizontal, and therefore, its head is positioned in front of the head of the uppermost horizontal (fig. 128). The wedge in the middle is typically shorter than the two others.

Fig. 129: AA317:1a.

The third variation corresponds to the third variation of KU, and can be found on AA317. The upper and middle horizontal have the same length while the one at the bottom is longer. The first vertical is placed on the head of the bottom wedge.

KU and MA

Comparing KU and MA, Ali-ahum's tablets show an almost consistent writing style with few exceptions. Compared to Tariša's tablets, however, the two signs are usually not written with corresponding forms on a tablet, but with different ones. On ten tablets, AA189, AA191, AA192, AA303, AA328, AA329, AA332, AA770, AA889, and AA937, the three horizontals of KU have the same length, while the horizontal in the middle of MA is shorter than the two others. On AA343, the two upper horizontals of KU have the same length, while all the three horizontals of MA have different length. Only on the five tablets AA195, AA199, AA317, AA566, and AA936 the corresponding versions of KU and MA can be found.

KÙ

The sign KÙ is written on most of the tablets of Ali-ahum except AA191, AA317, AA328, and AA343. It is usually written in combination with the sign UD for the Sumerian term for silver, KÙ.BABBAR, and on three tablets (AA332:5; 566:7; 769:3) it is additionally used in the term KÙ.GI (Sum. "gold"). On tablet AA189:25 the writer seems to have made a mistake: In the text is written KÙ.KI-*áp*, the grammatical ending -*áp*, however, indicates that the intended word here should be read as *kasap*, the construct state of the Akkadian word for "silver". Therefore, it should have been written KÙ.BABBAR-*áp*. Finally, on AA769:14 KÙ.BI is written.

Fig. 130: The first variant, and its visual connection with the following sign, on AA303:7 and AA303:18.

On Ali-ahum's tablets, there are several variants of the sign KÙ. One of them has three Winkelhaken between the two verticals. They are impressed on a horizontal axis, and usually positioned in the lower part while in the upper part often two to three lightly impressed horizontal filling wedges can be seen. After the second vertical, another Winkelhaken follows, usually larger than the three Winkelhaken before. This variant is written on AA195, AA303, AA332, AA769, AA770, and AA937. Regarding the term KÙ.BABBAR, in some cases the last Winkelhaken of KÙ seems to form a visual connection with the following sign UD (in this combination to be read as BABBAR) by being positioned in one row with the two Winkelhaken of UD (fig. 130, right). This visible connection, however, is not consistently written on these tablets.

Fig. 131: Two rather exceptional variations/slips, on AA189:26 and AA566:7.

On AA189, AA192, AA329, AA566 and AA936 basically the same variant can be found, but with two Winkelhaken between the two verticals instead of three. Notable on AA189:26 and AA936:14 is that the row of two (or sometimes three) Winkelhaken is sometimes shifted to the right so that only one Winkelhaken is actually between the verticals, while the second (and third) one is impressed on the second vertical, or even afterwards, together with the typically following large one (fig. 131). In comparison to the common variants, these two examples seem rather like slips of the writer. The same applies to AA566. Here, the two Winkelhaken between the verticals are so faintly impressed that they are almost not visible. Only their upper edges are visible above the ruling. It also shows that they were not positioned in the lower part of the sign as usual, but almost on the upper ruling.

Fig. 132: AA199:13.

A very different variant is written on tablet AA199. Here, no Winkelhaken is impressed between the verticals, instead a row of approximately six Winkelhaken follows them. While the first several Winkelhaken are very thin and tightly arranged, the finalising one is enlarged and deeply impressed into the clay. Probably a similar version can be seen on AA889:7. Here, no wedge is impressed between the verticals. Instead, three Winkelhaken follow, positioned on an upward axis. However, only the last one is clearly impressed as a wedge while the two others are very thin and rather lines than wedges as if the writer had used only the very edge of the stylus.

LI

The sign LI is on most tablets of Ali-ahum except AA191 and AA566. AA317 is not clearly visible on the photo, therefore, it is not included. On the basis of the key element of this sign, its Winkelhaken formation, several sign variants can be distinguished.

Fig. 133: The first variant, on AA343:29.

One variant shows two rows of Winkelhaken: The upper one contains several Winkelhaken of the same size, the lower row consists of two slightly enlarged Winkelhaken. While this is the basic shape of this variant, it is not consistently written in the same way but details, and even key elements like the number of Winkelhaken can change from case to case. On the tablets A328, AA332, AA769, AA770, AA889[142], and AA936, the number of Winkelhaken of the upper row is consistently four, on AA195, AA303, AA343, and AA937 the typical number seems to be four as well, but all of them have at least one example with only three visible Winkelhaken in the upper row. Different explanations therefore can be natural variations, or the rightmost Winkelhaken is overlaid by the following horizontals of the second part of LI.[143] On AA192 and AA329 only one LI is written, and with only three wedges in the upper row. SinAs no comparison can be made with other examples of the same tablet, they are treated as a different variant.

142 On AA332 and AA889 the variants are hardly determinable because the former is partly broken, the latter is written on an edge and deformed. Nevertheless, in both cases at least three Winkelhaken are visible in the upper row, and there seems enough space between the Winkelhaken formation and the following ŠA-part to add another wedge.

143 Another possibility could certainly be an unfavourable angle of the picture, which does not capture all the necessary shadows that make the respective sign and all details visible.

Fig. 134: The different arrangement of both rows on AA195:25 and 39.

Another varying element is how the two rows are positioned to each other. Both can be horizontal and parallel, but especially the upper one can also be slightly upward oblique (fig. 134, AA195:25 vs. 39). The upper row is usually slightly shifted to the right so that the two rows are not exactly above each other. The two Winkelhaken at the bottom can have the same size and be on the same horizontal axis, but frequently the first one is enlarged and shifted upwards so that it is positioned somewhere between the upper row and the lower wedge (e.g. fig. 134, right). However, the stroke order in some cases indicates that this first large Winkelhaken was impressed before the second wedge at the bottom, while the upper row was impressed after the latter (e.g. 329:7, 937:28).[144]

Fig. 135: AA199:12.

A peculiar version can be observed on tablet AA199. The general shape of LI corresponds to the first variant. But here, at least five thin Winkelhaken are positioned next to each other, and the row is finalised by an enlarged Winkelhaken. Together with the first Winkelhaken of the bottom row the two seem to enframe the smaller Winkelhaken (fig. 135).

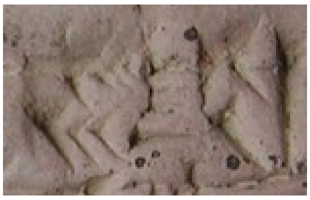


Fig. 136: AA189:17.

An indeed different variant can be found on AA189. Here, the main feature is the bottom row with three Winkelhaken on a horizontal axis.[145] In the parallel upper row, three or four Winkelhaken are positioned, and the row is slightly shifted to the right so that its first wedge is placed above the second wedge of the bottom row. Since the number of Winkelhaken here is very inconsistent, the main discriminating element should rather be the general arrangement of the wedges.

The second part of LI, the element in form of the sign ŠA, shows two additional characteristics. Usually, the bottom horizontal is enlarged and often longer than the ones above. In addition, the head of the small vertical at the end of the horizontals is placed at most on the uppermost horizontal, while its tip often barely reaches the horizontal at the bottom.

144 As mentioned before, the stroke order is often hardly determinable, especially on the basis of pictures. Similar observations can nevertheless be made for Aššur-taklāku's tablets as well (below, ch. 3).

145 In line 19, the second example of LI has four Winkelhaken in the bottom row. However, both are smaller than the others and with a different angle positioned, thus, they were probably added later by the scribe.

Fig. 137: The different position of the second part on AA936:8.

While the attachment – or separation – of the Winkelhaken formation and the ŠA-part is varying, both parts are usually parallel. It means that the centre of the bottom Winkelhaken is on the same axis as the lowest horizontal of the second part. Exceptions are AA936 and AA937. Here, the second part is not always parallel to the first one, but slightly oblique so that the bottom horizontal points to the upper row of Winkelhaken (fig. 137).

Regarding the number of horizontals, which could also be considered a discriminating element, in case of Ali-ahum's tablet it is problematic. In many cases, the number of wedges is hardly determinable because they are either very closely impressed or blurry so that the individual impressions are not clear. In most cases, however, there seem to be four horizontal wedges, and only occasionally five or more (e.g. AA192, AA199, AA770). Hence, this element is not included into the analysis.

RI

The sign RI is only written on eleven tablets. On AA189, AA192, AA317, AA566, AA770, and AA937 it is not written or only partly visible, and therefore not useful for a comparison.

Fig. 138: AA199:8.

On a first glance, the sign looks the same on every tablet of Ali-ahum, especially in regard of the two first verticals. Usually they are positioned in the middle of the horizontal, the first one impressed after the head of the horizontal, the second following, not too close but with comfortable space, i.e. only the tips of their heads may slightly overlap, or even be separated by a tiny gap. The protruding tail of the horizontal is more or less as long as the part in front of the first vertical. Therefore, the signs have a balanced appearance. One exception might be AA191:6, here, the protruding part is prolonged. However, the other example on the tablet rather resembles the normal type. Therefore, the one in l. 6 might be a slip.

A varying element on these tablets is the position of the Winkelhaken following the afore described formation. On most tablets, the Winkelhaken is impressed on the tip of the horizontal, or slightly above. Its lower tip points towards, or even reaches the tail tip of the finalising vertical. Regarding the consistency of the execution, tablets like AA199 and AA343 with four examples of RI each show that the positioning was not a coincidence, but a consistent habit.

Fig. 139: AA889:15.

Therefore, and in comparison with Tariša's version of the sign RI, it has to be noted that on the three tablets AA332, AA889, and AA936, the Winkelhaken is placed underneath the horizontal wedge. Which is consequently considered a second version of RI.

The finalising vertical is larger, and stronger impressed than the two other verticals, and often higher positioned.

ŠA

The very common sign ŠA is written on almost every tablet of Ali-ahum except on tablet AA192. Different variants and variations can be distinguished on the basis of their number of wedges, the varying wedge size and their arrangements. There are two variants and two variations, plus one special element. More important than the variants are here the variations which are distinguished on the basis of the length of the horizontals.

Fig. 140: AA189:21.

The first variation of ŠA consists of four stacked horizontal wedges. The upper three begin on the same vertical axis, the one at the bottom is shifted to the left so that its head somewhat protrudes. It can also be slightly enlarged by being deeper impressed. And in some cases, the gap between the bottom one and the next one above can be wider than between the upper three wedges. This phenomenon, however, is not consistent on the respective tablets, and therefore, it is not considered a discriminating element. The first small vertical is usually impressed on the uppermost horizontal, or even a bit higher, and ends between the bottom horizontal and the next one above. It is followed by two Winkelhaken, the upper one usually on the same level as the uppermost horizontal or even slightly higher, the lower one is positioned on a level somewhere between the lowermost horizontal and the next one above. The sign is finalised by a large vertical. This variation is written on AA189, AA191, AA317, AA566, AA769, AA770, and AA889.

Fig. 141: One example for the irregular length on AA189:20.

While the variant described above is most common on the afore-mentioned tablets, on several of them there are natural variations in regard of wedge size and length, as well as the number of wedges. For instance, the upper horizontals of AA189:20 do not have the same length, but are very irregular in length. On AA769:16, the uppermost horizontal is emphasised and longer than the two wedges in the middle, and on AA189:12 and AA566:7 the horizontal at the bottom has the same length as the other three above it. A high range of variation can also be observed for the first small vertical. Its length does change in several cases. Nevertheless, these varying elements are not consistent.

Fig. 142: The second variation on AA303:20b.

The second variation consists of four stacked horizontal wedges as well, but the one at the bottom has the same length as the three wedges above. Nevertheless, it can be emphasised by being deeper impressed, and therefore, being bigger than the others. The small vertical does not show much consistency. Its head is usually placed between the uppermost horizontal and the next one underneath. Its tail usually ends between the bottom horizontal and the next one above. Apparently, the lower Winkelhaken is very often impressed on the vertical. This variation is written on AA303, AA328, AA329, AA332, AA343, AA936, and AA937. On several tablets, certain irregularities can be observed, too. Especially the length of the bottom wedge varies, and probably because of its emphasis it appears sometimes slightly longer as well (e.g. AA303:20b, AA328:17b). In some cases, also the upper horizontal is slightly emphasised (AA329:34b), or the space between the bottom horizontal and the next one above is bigger than between the other wedges. These elements, however, are not consistently executed.

Fig. 143: AA199:14.

Both variations are usually written with four horizontals. On two other tablets, however, each variation is written with five instead of four horizontals. On AA195, the second variation with horizontals of the same length is displayed, but with five instead of four wedges. On AA199, the first variation is written, but with four to five horizontals of the same length, and an additional wedge at the bottom with its head positioned further to the left. In addition, in a few cases (l. 5, 16), the uppermost wedge is slightly emphasised, and moved away from the smaller horizontals in the middle (fig. 143).

Fig. 144: AA343:8.

A peculiarity can be observed in regard of the Winkelhaken. In case of AA328:7, AA343:4, 7, 8, 16, 17, 23, and AA769:11, the Winkelhaken are replaced by oblique intersecting wedges. The general shape of the sign regarding the number of horizontals and their length remains the same, only the shape of the Winkelhaken changes (which can lead to a very short first vertical, fig. 144). This phenomenon, however, is not carried out consistently, but mixed with normally written signs. Analysing the use of the different variations on the respective tablets, there seems to be no difference. The ŠA with oblique wedges is mostly used as a preposition, connected to personal names and ownership. However, on all these tablets, ŠA with normal Winkelhaken is used for the same purpose as well.

TIM

The sign TIM is written on most of the tablets, except AA191, AA192, AA303, AA328, AA332, and AA566. On five tablets (AA189, AA195, AA770, AA936, AA937) it is only written once, on the other tablets it occurs at least two or three times.

Fig. 145: AA329:5.

This sign can be distinguished into several variants according to different numbers of wedges and their arrangements. The first element of the sign, the two parallel verticals crossed by a horizontal, does not show any peculiarities. The main discriminating elements are the Winkelhaken formation and the following two intersecting oblique wedges. The first variant is written on AA189, AA317, AA329, AA769, and AA889. Here, two Winkelhaken are written, the lower one is either impressed on the tip of the horizontal (AA329, AA769), or below it (AA189, AA317, AA889). The second Winkelhaken is shifted slightly to the right and higher above, but usually not higher than the ruling. The position of the oblique wedges is not very consistent. The upper one is placed more or less on the level of the upper Winkelhaken, the second one mostly on the level of the lower Winkelhaken. In addition, since the bottom Winkelhaken is usually impressed first, and therefore further to the left, the respective oblique wedge is shifted further to the left as well. In some cases, especially on AA769 and AA889, the two wedges are also shifted downwards so that the upper one is placed between the two Winkelhaken, and the lower one is positioned underneath the lower Winkelhaken.

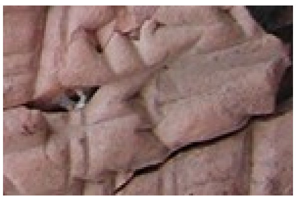


Fig. 146: AA937:34.

The second variant contains three Winkelhaken, and is written on AA195, AA343, AA770, and AA937. The three Winkelhaken are roughly arranged in a triangle. One is usually slightly enlarged and positioned on the tip of the horizontal, or slightly shifted either upwards or downwards. Its positioning is not very consistent. The two other Winkelhaken are a bit smaller, and are impressed somewhere around the tips of the larger Winkelhaken. The following two oblique wedges are usually positioned on the level of the smaller Winkelhaken, but can also be shifted towards the middle.

Fig. 147: AA936:9.

A third variant of the sign can be found on AA199 and AA936. The Winkelhaken formation is arranged like the DÍ-sign with an upper row of several Winkelhaken, and another Winkelhaken which is impressed at their lower tips. On AA199, there are clearly four Winkelhaken in the upper row, on AA936, three Winkelhaken are visible in the upper row (fig. 147).

Ù

The sign Ù is written on most of the tablets except AA189 and AA192. In case of AA770 hardly any detail is visible. On most of the tablets, the variant of Ù is the same. It begins with a vertical, which is overlaid by a Winkelhaken positioned on its lower half. The lower side of the Winkelhaken is usually prolonged so that the wedge rather resembles an oblique wedge than a Winkelhaken. Its exact position varies, it can either be placed on the vertical, or slightly in front of it. In addition, it can also be shifted in height, and its angle can change. The angle of such a central wedge could actually be used as an important discriminating element, and by observing the different examples of Ù on Ali-ahum's tablets, differences can be noted. But to pinpoint these differences without a measurement device or any program to analyse the data is too inaccurate, and depends too much on subjective observation.

Fig. 148: AA195:29.

The second part of the sign consists of a horizontal wedge, which is followed by a rectangular construction. In case of the most common variant of Ali-ahum's corpus, the initial horizontal wedge in front of the rectangular structure ends on the first vertical. It is f^ollowed by three thin parallel horizontals impressed in the space between the first and second vertical, their tails ending or even crossing the third one at the end of the signs. In addition, a large and deeply impressed horizontal is additionally placed on the tail tips of the verticals. This variant is written on AA191, AA195, AA199, AA303, AA317, AA328, AA329, AA332, AA566, AA769, AA889, AA936, and AA937. On several tablets, variations can be observed: While the three thin horizontals are mostly regularly impressed, on some tablets, they are also positioned with irregular gaps in-between (e.g. AA328). Also the number of horizontals changes sometimes. AA328:10 and AA317:23 have four instead of three verticals, and on the latter tablet in l. 2 there seem to be four thin horizontals. Nevertheless, these variations are only isolated occurrences, on all these tablets there is a clear tendency to three thin horizontals.

Fig. 149: AA343:11.

The only exception in this corpus seems to be AA343. Here, the first horizontal does not stop on the first vertical wedge. Instead, it is drawn through the rectangular element until it reaches the third vertical on which it ends. The only additional wedge seems to be the large horizontal wedge at the tail tips of the verticals.

ZI

The sign ZI is regularly used in Ali-ahum's text, but it is not written on AA191, AA192, and AA317. The first part of the sign consists of the typical construction of two parallel verticals, crossed by one horizontal wedge. In most cases, it shows the balanced version where the two verticals are positioned basically in the middle of the horizontal. The only consistent variation can be observed on AA769. Here, the two verticals are shifted to the right so that the first one is impressed on the head of the horizontal.

Fig. 150: AA303:6a.

The main discriminating element of this sign, however, is the following formation of Winkelhaken. Some of the represented variants resemble the respective Winkelhaken elements of the sign LI. As with the other sign, the mainly written type of ZI is written with two parallel rows of Winkelhaken. The lower one consists of two Winkelhaken arranged on a horizontal axis, with the first wedge usually placed on, or slightly below the tip of the horizontal wedge of the first part. The upper row is a bit shifted to the right so that its wedges, usually four by number, are positioned above the second Winkelhaken of the bottom row or further to the right. A difference to the respective variant of the sign LI is that the first Winkelhaken of the bottom row does not change its position but is always written on the same horizontal axis as the second Winkelhaken of the bottom row. This variant is written on AA195, AA303, AA328, AA329, AA332, AA343, AA770, AA889, AA936, and AA937.

Fig. 151: AA199:10.

A similar variant is to be found on tablet AA199 and is arranged like the respective part of the sign LI (fig. 151). While there are also basically two rows of Winkelhaken, the first one of the bottom row is slightly enlarged and placed higher, the last of the upper row is emphasised, too. Both seem to enframe the thin Winkelhaken of the upper row.

Fig. 152: AA189:22.

The third and fourth variant are very similar and are only distinguished by one Winkelhaken in the bottom row. On tablet AA189 and AA769, ZI displays two parallel rows of four Winkelhaken each (fig. 152).[146] The upper one is slightly shifted to the right, the lower one is positioned on or slightly below the axis of the horizontal wedge of the first part. On tablet AA189 it is noticeable that the first Winkelhaken of the bottom row is partly placed higher and on the tip of the horizontal while the other three are positioned slightly below.

Fig. 153: AA566:8.

The fourth variant is represented on tablet AA566 and consists of two parallel rows with four Winkelhaken in the upper, and three in the lower row (fig. 153). Both rows are positioned on top of each other, and to balance the difference in number, the Winkelhaken of the upper row are thinner and closer to each other, while the three at the bottom are broader with more space in-between.

While most of the signs show the same arrangement for both signs, LI and ZI, in a few cases (AA189, AA769, AA936) at least small differences can be noticed. AA189 shows one, and AA769 shows two more Winkelhaken in the bottom row; the arrangement of the two parts (horizontal-vertical-construction and Winkelhaken cluster) of ZI on tablet AA936 are parallel in contrast to the two parts of the sign LI (Winkelhaken cluster and ŠA-element).

3.3.3 Movement

The line quality of Ali-ahum's tablets can probably be distinguished in three groups: The first group of tablets shows a very neat writing. The typical triangular form of the wedges is clearly recognisable. The wedges are not necessarily evenly impressed and with the same depth, but all of them are readily identifiable. In addition, the cuneiform signs are carefully formed by connecting the appertaining strokes. This group consists of AA189, AA303, AA328, AA566, AA769, and AA937.

146 An exception is AA189:21; here, both rows contain only three Winkelhaken each. However, the other examples on this tablet are written with four Winkelhaken each.

The second group also shows a clear script, and the triangular form of the wedges is recognisable. However, the exact execution is lacking. Thus, some lighter impressed wedges are not well visible, the elements of a sign are not properly connected, and some wedges are seemingly crooked and blurred. This kind of line quality can be observed on AA191, AA195, AA199, AA343, AA889, and AA936.

Fig. 154: The different levels of line quality on AA189, AA195, and AA329.

On the tablets AA192, AA329, AA332, and AA770, the script is very blurry. The triangular shape of the wedges is often not clearly shaped, and the spine is hardly visible. Instead, the triangular impression is rather roundish. Lightly impressed wedges are hardly visible. This kind of impression, however, does not entirely depend on the writer, but is also dependent on the clay quality and its condition as well as on the stylus.

A special case is AA317 (fig. 155). Here, the wedges are mostly clearly and deeply impressed. But the used stylus must have been made from another, maybe flexible material, most likely without an angular edge, because the impressions do not have the typical triangular shape.

Fig. 155: The wedge impressions on AA317.

On most tablets, the script is slightly inclined to the right. Only on the three tablets AA189, AA769, and AA889, the script is upright which means the vertical wedges are perpendicular, and independent of any inclination of the ruling or a spoiled tablet shape. On AA317, the script is upright or partly even slightly inclined to the left.

On all the tablets, the heads of the verticals are usually impressed on the upper ruling. Cases where the head is placed above or underneath the ruling can be found on several tablets, however, they are rather exceptions. On twelve tablets, i.e. AA189, AA191, AA195, AA303, AA328, AA329, AA332, AA343, AA566, AA769, AA770, and AA937, the length of the vertical wedges[147] usually extends from the upper ruling to the ruling below. On tablets AA329 and AA937, some verticals even intersect the ruling underneath. On five tablets, the verticals frequently do not reach from ruling to ruling. On AA199 and AA317, this phenomenon can mostly be explained by observing ruling

Fig. 156: An example for a crooked ruling on AA199.

147 Here, only verticals are included which are not restricted by an underlying horizontal wedge.

and script size. While the former is partly crooked and wavy, the script is even in size (fig. 156). For AA192, AA889, AA936, such an explanation cannot be found.

3.3.4 Spatial Relationships

Regarding the alignment of the text, almost all the tablets display several tightly written lines on the left side. Usually, they are not very straight but rather a bit wavy, depending on the shape of the left edge on which they are usually aligned. Only on AA191 the line on the left edge is very straight.[148]

Most of the tablets are fully inscribed with only few gaps on obverse and reverse. Exceptions are AA192 and AA936. On the former, the text ends on the reverse after two lines. In addition, the end of the second line and two following lines are erased with only a few traces left. The last sentence of the text, however, is complete. The letter was not addressed to Aššur-taklāku, the owner of the archive, but to a man called Aššur-ištikal. Therefore, it is most likely an archive copy. Whether the letter is complete or only an excerpt cannot be determined. The other tablet, AA936, is a letter to *kārum* Wahšušana and presumably an archive copy as well. Here, several lines are written on the reverse, but some space is left. After the last line, another ruling is drawn. The text ends with a full sentence as well.

On eleven tablets of Ali-ahum, word dividers can be found. Their numbers, however, differ greatly. On three tablets (AA199, AA769, AA889) only one or two of them are placed, on AA329 are five word dividers, and on six other tablets (AA195, AA303, AA332, AA343, AA770, AA937), there are between 11 and 22 word dividers. Unfortunately several of these tablets are partly broken, often on the obverse. Hence, a study of the distribution of word dividers is incomplete. Especially on the tablets with more than 10 word dividers it is notable that while some of them can also be found on the obverse (usually more in the lower part), most of them are used on the reverse, upper, and left edge, i.e. towards the end of the text (e.g. AA195, AA303, AA343, AA937). On AA329 and AA332, a different pattern can be observed. Here, the word dividers are mostly used at the end of the obverse, lower edge, and beginning of the reverse.

The text on Ali-ahum's tablets is generally tightly written, i.e. hardly a vertical wedge can be inserted between two neighbouring signs. On most of the tablets, this tight positioning of

148 Without a left edge, and therefore excluded from this specific part of the analysis, are the fragments AA566, AA769, and AA770 because here, not every relevant edge can be observed. The tablets AA192 and AA936 are both not fully inscribed, hence, the left edge was not used.

signs is basically regular (AA192, AA195, AA303, AA317, AA329, AA332, AA343, AA566, AA769, AA770, AA889, AA937). On these tablets, in case that a sign ends with a horizontal, or two oblique wedges, the following sign can, but does not necessarily has to be, impressed on their tip. The connecting or separate writing of these signs, however, is irregular. On AA191 and AA936, the script is also written with very small but regular gaps, but almost no signs are connected. On AA189, AA199, AA328, the space between the signs differs from a gap to being attached, even the heads of two verticals of two different signs can be attached. Here, the tips of the horizontals can be overlaid by the following sign, but do not necessarily have to. Compared to Tariša's tablets on which the sign NI is usually connected to the following sign, on Ali-ahum's tablets, this is often not the case. In addition, frequently, the two oblique wedges barely cross. More often, they end with a gap between their tips.

3.3.5 Statistical Analysis and Conclusion

By comparing movement and spatial relationships of Ali-ahum's tablets small differences can be noted. However, in several cases, especially in case of the wedge impressions, these differences are rather due to the quality of the writing material and the writing tool, and not entirely dependent on the writer himself. The same applies to the spatial relationships. Some differences were notable, but none of them actually lead to a different classification of any tablet. The evaluation of the tablet shape showed that especially AA199 shows a very special, and different shape, while most of the other tablets are basically similar. Several of them are slighty deformed at the edges and corners. Differences in layout like on AA317 might again be due to a bad writing tool. The comparison of the diagnostic signs, however, shows a different result:[149]

149 The numbers in the table again represent the different sign variations that are consecutively numbered from Tariša's case study onwards. Thus, the same numbers on the different tables represent the same sign variation.

Tablet	AM	BA	DÍ	DU	IM	KÀ	KI	KU	KÙ	LI	MA	RI	ŠA	TIM	Ù	ZI
AA189	4	2	6	-	-	4	1,2	2	1	1	1	-	2	1	-	5
AA191	-	-	-	-	1	-	2	2	-	-	1	1	2	-	2	-
AA192	-	1	3	3	1	-	2	2	1	3	1	-	-	-	-	-
AA195	-	1	4	3	-	6	2	1	2	2	1	1	4	2	2	3
AA199	-	1	2	-	2	5	3	1	3	4	3	1	1	3	2	4
AA303	2	1	4	3	7	6	1	2	2	2	1	1	3	-	2	3
AA317	1	1	2	-	1	4	1	3	-	-	2	-	2	1	2	-
AA328	-	1	3	-	4	6	1	2	-	2	1	1	3,5	-	2	3
AA329	4	1	3	3	4	6	3	2	1	3	1	1	3	1	2	3
AA332	4	1	3	3	5	6?	1	2	2	2	1	2	3	-	2	3
AA343	5	2	3	3	-	6	1	3	-	2	3	1	3,5	2	1	3
AA566	-	1	5	-	-	-	1	1	4	-	1	-	2	-	2	1
AA769	-	1	5	3	-	6	1	-	2	2	3	1	2,5	1	2	5
AA770	3	1	5,6	3	5	6	1	2	2	2	1	-	2	2	-	3
AA889	2	1	6	1	3	4	4	3	3	2	1	2	2	1	2	3
AA936	-	1,2	5,6	3	6	6	2	3	1	2	1	2	3	3	2	3
AA937	2	1	3	3	1	6	1,2	2	2	2	1	-	3	2	2	3

Table 9: The summary of the sign variations on Ali-ahum's tablets.

The signs sometimes show a wide range of variation. The sign IM for instance is written with seven different variations in total. The signs AM and DÍ have five different variations each. However, the remaining 14 signs show usually between two and four different variations. In general, the comparison shows that on the largest part of the corpus, usually only two, and hardly more variants are written.

Table 10 (see below) contains the same data as the other table above, but here, the most common versions written on the tablets are marked in red, and blue respectively, and a few exceptional versions are coloured in green. In addition, the tablets are rearranged in accordance with their similar versions (regarding the colour code: when possible tablets with red marks together, as well as blue coloured versions, but the green marked versions separated). Accordingly, one large group containing eleven tablets can be formed, and three small groups of two tablets each.

On the eleven tablets of the large group, especially the afore-mentioned two signs AM and DÍ do not support any classification, but the remaining 14 diagnostic signs are rather consistently written with very few exceptions.

For six other tablets (of the three small groups), any classification has to be questioned because of several different sign variants, or lacking comparative material. Two of these tablets, AA191 and AA566 are very problematic because several of the diagnostic signs are not written on them, so the comparison is incomplete. However, the few diagnostic signs that are written on AA191 correspond to the sign variations of the first group. In case of AA566, basically the same pattern applies, but here, especially for DÍ and KU very uncommon sign variants were used, and its ZI-variant is not written on the other tablets at all. Nevertheless, regarding the rest of the signs as well as tablet shape and other factors, these two tablets might have been written by the same person as the tablets of the first group.

On the two tablets AA189 and AA889 sign forms are used which cannot be found on the tablets of the first group (marked in green). In addition, several of the common sign forms written on them can be found in the first group as well, but they are not the mainly used sign variants (marked in blue). Therefore, a clustering of the hand as written by the same person as the other tablets mentioned above is rather questionable.

The two remaining tablets are AA199 and AA317. Especially the former shows the most differences to the main handwriting on Ali-ahum's tablets. At the same time, the shape of this tablet differs from the other tablets of Ali-ahum. Hence, it was certainly written by another person than the rest of the tablets. Observing the script of AA317 it seems very peculiar and different from the other tablets of Ali-ahum. However, a reason for this might have been the writing tool that the scribe used to impress the wedges into the clay, and which made the script seem uneven and clumsy. Half of the sign variants on this tablet, however, correspond to the sign variants of the first group (marked in red and blue), the other half is different (marked in green, or without colour). And additionally, several diagnostic signs are missing. Thus, also here, a classification is very difficult.

Consequently, the largest part of Ali-ahum's corpus seems to have been written by the same person. And in case of AA191 and AA566, it seems likely that the same person might have written them. The four remaining tablets, AA189, AA889 as well as AA317 and AA199 are rather questionable.

Tablet	AM	BA	DÍ	DU	IM	KÀ	KI	KU	KÙ	LI	MA	RI	ŠA	TIM	Ù	ZI
AA303	2	1	4	3	7	6	1	2	2	1	2	1	3	-	2	3
AA328	-	1	3	-	4	6	1	2	-	1	2	1	3,5	-	2	3
AA332	4	1	3	3	5	6?	1	2	2	1	2	2	3	-	2	3
AA937	2	1	3	3	1	6	1,2	2	2	1	2	-	3	2	2	3
AA329	4	1	3	3	4	6	3	2	1	1	3	1	3	1	2	3
AA192	-	1	3	3	1	-	2	2	1	1	3	-	-	-	-	-
AA195	-	1	4	3	-	6	2	1	2	1	2	1	4	2	2	3
AA936	-	1,2	5,6	3	6	6	2	3	1	1	2	2	3	3	2	3
AA343	5	2	3	3	-	6	1	3	-	3	2	1	3,5	2	1	3
AA770	3	1	5,6	3	5	6	1	2	2	1	2	-	2	2	-	3
AA769	-	1	5	3	-	6	1	-	2	3	2	1	2,5	1	2	5
AA191	-	-	-	-	1	-	2	2	-	1	-	1	2	-	2	-
AA566	-	1	5	-	-	-	1	1	4	1	-	-	2	-	2	1
AA189	4	2	6	-	-	4	1,2	2	1	1	1	-	2	1	-	5
AA889	2	1	6	1	3	4	4	3	3	1	2	2	2	1	2	3
AA317	1	1	2	-	1	4	1	3	-	2	-	-	2	1	2	-
AA199	-	1	2	-	2	5	3	1	3	3	4	1	1	3	2	4

Table 10: The rearranged data of the analysis of Ali-ahum's sign forms.

Also in case of Ali-ahum, the identification of the same hand does not mean that the tablets were actually written by himself. The place of sending of the letters is mostly unknown, only the textual content of the two tablets AA189 and AA329 indicates that they were sent from Aššur. Both are addressed to Aššur-taklāku, and therefore it can be assumed that they are the original letters. In AA189, Ali-ahum tells his son of his intention to address the city assembly.[150] In AA329, Ali-ahum reports of a shipment, mainly tin, that he will send to Aššur-taklāku. Such goods were usually bought in Aššur, therefore, Ali-ahum must have been there.[151] The analysis of these two tablets has shown that AA189 shows a different hand than the main corpus of Ali-ahum. The other one, AA329, is written with the same hand as most of his tablets. Furthermore, tablet AA317 was most likely sent from somewhere in Anatolia because the letter senders (Ali-ahum and Ali-ahum) report of the selling of textiles. This

150 AA189:5 *A-lam a-ma-ha-ar-ma* "I will approach the City(-assembly), and...".

151 Especially on the obverse of AA329 (l. 3-19) Ali-ahum lists the goods which he will dispatch to Aššur-taklāku in Anatolia.

tablet, however, shows also a completely different handwriting than the main part of the corpus. On AA770, the addressees are mostly broken, the only readable name is Tar[iša] who was still living in Aššur. Therefore, this tablet could be a copy from a letter sent from somewhere in Anatolia. Like AA329, tablet AA770 belongs to the large group of Ali-ahum's tablets which seems to have been written by the same person. The place of the sending of the remaining tablets can hardly be determined.

Ed Stratford suggested that another possibility for the identification of the writer is the comparison of texts authored by several people. In the corpus of Ali-ahum there is one letter which was sent by multiple authors: AA769. It was sent by three men including Ali-ahum. Their whereabouts are unknown, but the content of the letter begins with a confirmation of the receipt of gold, and later in the text the senders mention a shipment of tin and textiles, so they might have been in Aššur. Regarding the script on the tablet, even though it was authored by several people, the analysed handwriting is comparable to the "standard hand" on Ali-ahum's tablets. According to Stratford's suggestion, the similarity could be an indication that Ali-ahum himself wrote the tablet(s).

For further evidence of Ali-ahum's literacy, five contracts, or to be more precise, copies of contracts (AA161, AA168, AA173, AA454, AA758) were included[152], mainly debt notes with Ali-ahum as creditor. The sign forms were analysed and the results recorded in the following table (table 11). Sign variations which are conform with the versions on the main group of eleven tablets (see above) are also marked in red or blue.

Tablet	am	ba	dí	du	im	kà	ki	ku	KU3	ma	li	ri	ša	tim	ù	zi
AA161	18	2	6	3	8	19	-	-	6	2	2	-	2	2?	2	3
AA168	18?	-	-	3	-	7	3	-	5	3	3	1	3?	1	-	3
AA173	18	2	6	1	3	-	-	3	5	2	2	-	2	2	-	3
AA454	1	1	-	1	6	-	2	-	2	3	2	3	1	2	2	6
AA758	3	1	-	3	1	2	1	2	2	2	3	-	2	2	2	6

Table 11: The sign variaitons used on the copies of debt-notes of Ali-ahum.

First of all, the comparison has shown that the sign corpus of contracts is very different from letters. Signs like DÍ and KU, which are common on letters, are hardly written on the tablets, and MA, one of the mostly written signs in letters, could often found only once or twice on

152 See for the difference of original and copy of debt notes Beyer (*forthecoming*).

the analysed contracts. Consequently, the comparison of sign variations is limited due to the altered sign corpus.

Regarding the sign forms, all five tablets contain sign variations which can be found on Ali-ahum's letters as well. However, in case of the four tablets AA161, AA168, AA173, and AA454, there are only six matches each. In these cases, however, there are also up to five diagnostic signs not written, and therefore not comparable. Only the fifth tablet, AA758, displays eleven sign variants that are also used on Ali-ahum's letters written with the "standard hand". In addition to the sign variations, the tablet shape can also be compared. It is notable that the shape of the three tablets AA161, AA173, and AA454 does not match with Ali-ahum's letters. They have rounded corners while the letters typically have straight or pointy ones. The tablet shape of AA168 is very similar to the one of the letters, but in this case, the sign forms are very different. In case of AA758, both tablet shape and sign forms are very similar to the main corpus of the letters.

To conclude, eleven letters (AA192, AA195, AA303, AA328, AA329, AA332, AA343, AA79, AA770, AA936, AA937) were certainly written by the same person, most likely Ali-ahum himself. Evidence for this assumption are for instance the two letters AA329 and AA770, one of them presumably sent from Aššur, the other one from Anatolia. Furthermore, letter AA769 was authored by two men, but shows the same handwriting as the other letters mentioned above. And finally, the debt note AA758 with Ali-ahum as creditor is written by the same hand as well, and it is also formed in the same way.

3.4 Aššur-taklāku

Aššur-taklāku, the son of Ali-ahum and Ab-šalim, was married to Lušitiya. Three of their children are known by name: Iddin-Kūbum, Ilabrat-bāni, and Puzur-Ištar (Michel 2008, 61 and n. 36). Aššur-taklāku dealt with textiles, and the large amount of 72 letters, which he sent home to his family indicate that he travelled a lot so that he had to inform and instruct them frequently by writing. In addition, the archive contains 72 letters addressed to him, and approximately 30 judicial texts, e.g. lawsuits concerning him somehow. Furthermore, he is the creditor of 48 discovered loan contracts. Especially these texts point to him as the owner of the archive (Michel 2018, 59). He seems to have stayed and worked with his father at the beginning of his career, but built up his own business. He was involved in a legal conflict with Anatolian local rulers and had to go to jail (for detailed information see Michel 2008, 62-66).

3.4.1 Sources

In the archive, 72 letters were sent by Aššur-taklāku, but for the present study, only 30 letters were analysed. The selection of these tablets was based on a few general principles: Even though the analysed materials are private letters, which are not subjected to strong rules of formulation and format, they nevertheless abide certain rules in regard of formula and hierarchy. Whether, and how much these guidelines might have influenced the handwriting, the selection of signs etc. is not studied yet. Therefore, the selection includes a wide range of different letter “types”. One requirement should be that it is always the same sender. In addition, the positioning of sender and addressee in the letterhead reflects their relative social hierarchy. Hence, letters are included in which the sender is mentioned first, as well as texts in which he is mentioned after the addressees. Also the addressees themselves are a criterion in terms that letters were sent to a group, but also to individuals, to business partners as well as to family members. Lastly, a number of tablets are added which have been written under equal conditions, e.g. the same addressee.

Consequently, all the letters were solely sent by Aššur-taklāku. In 15 texts, he is mentioned before the addressees. Four of these tablets are addressed to his sister Tariša, the others were sent to one individual or to small groups of two to three men. Even though some personal names can be found in several letters (e.g. Idī-abim in AT666 and AT708), none of them is addressed more often. Furthermore, in 15 texts, Aššur-taklāku is mentioned after the addressees.[153] This group of letters is always addressed to a group consisting of at least two to ten people. The exact number is not always determinable because several letters were not only sent to named individuals, but also to unspecific groups like the representatives, in Akkadian *ša kima iāti* "who (is) like me", mostly of Aššur-taklāku himself (AT295, AT456, AT489, AT528), and one to the representatives of his father (AT473:1 *a-na ša ki-ma a-bi-ni*). Tariša is the person mentioned most frequently in the texts. In seven texts her name is added to a group of men (AT468, AT473, AT489, AT520, AT526, AT528, AT544), and in four additional texts (AT295, AT514, AT516, AT519), she is mentioned together with Šāt-Aššur[154] and Uṣur-ša-Aššur. A few names, presumably colleagues or partners, appear a few times, like Imdīlum (AT456, AT519, AT520), and Rabi-Aššur (AT514, AT516, AT519, AT544), but non of these people stand out either.

Tablet	**Abbr.**	**Position of the sender**[155]	**Addressee(s)**
kt 93/k 151	AT151	Mentioned first	Two addressees
kt 93/k 176	AT176	Mentioned second	Group of three people (with specification[156] before sender)
kt 93/k 284	AT284	Mentioned first	One person
kt 93/k 295	AT295	Mentioned second	Representatives of AT + Tariša and Uṣur-ša-Aššur
kt 93/k 316	AT316	Mentioned first	Two addressees
kt 93/k 456	AT456	Mentioned second	Imdīlum, AT's representatives, and Puzur-Ištar, with specification Imdīlum (mentioned before the sender)
kt 93/k 468	AT468	Mentioned second	Two men and Tariša, with specification of one man (then written after the sender)
kt 93/k 473	AT473	Mentioned second	Representatives of his father and Tariša
kt 93/k 482	AT482	Mentioned first	Tariša
kt 93/k 489	AT489	Mentioned second	His representatives and Tariša

153 A special case is AT516, here a group of five men is mentioned before the sender, and a group of three different persons, including Tariša, are additionally addressed after the sender. The imperative *qibi-ma*, however, is only written after the second group of addressees.

154 Not much is known about this lady. She appears regularly in the texts of the 93/k-archive, but her relation to the family is unknown (Michel 2015b, 92).

155 All the letters here were sent by Aššur-taklāku alone. This column therefore records the position of him, the sender, i.e. first (before the addressee), or second (after the addressee).

156 In the Old Assyrian corpus, it happens that a letter is first addressed to a group of people, followed by a second addressing to a specific individual of that group, usually initiated with the normal letterhead *ana* PN *qibima*. This specific addressing can refer to only a paragraph, or the complete text. In the mentioned examples in Aššur-taklāku's letters, the specific addressing follows immediately after the main letterhead, but it can also be positioned somewhere else in the letter. If a letter is addressed to one person in such a way, the other addressees of the main letterhead are somehow included into the content of the text. In case of Aššur-taklāku's letters is also notable that the specific addressing is still written before the sender, when the latter has the lower rank (as in AT176). Thus, the relative hierarchy is preserved.

kt 93/k 505	AT505	Mentioned first	Group of three men with specification
kt 93/k 508	AT508	Mentioned first	One person
kt 93/k 509	AT509	Mentioned first	Two men, with specification
kt 93/k 514	AT514	Mentioned second	Group of eight people, including Tariša, Šāt-Aššur, and Uṣur-ša-Aššur
kt 93/k 516	AT516	Mentioned in the middle	First group are the same men as in AT514, they are followed by the sender, and he is followed by an additional addressing of Tariša, Šāt-Aššur, and Uṣur-ša-Aššur
kt 93/k 519	AT519	Mentioned second	Group of ten people, including Tariša, Šāt-Aššur, and Uṣur-ša-Aššur
kt 93/k 520	AT520	Mentioned second	Group of five people, including Tariša
kt 93/k 526	AT526	Mentioned second	Group of eight people, including Tariša
kt 93/k 527	AT527	Mentioned first	Tariša
kt 93/k 528	AT528	Mentioned second	His representatives, Tariša, and Amārum
kt 93/k 537	AT537	Mentioned first	Tariša
kt 93/k 539	AT539	Mentioned first	Tariša
kt 93/k 544	AT544	Mentioned second	Group of seven people, including Tariša
kt 93/k 599	AT599	Mentioned first	Group of three men, with specification
kt 93/k 606	AT606	Mentioned second	Group of three men, including another Aššur-taklāku
kt 93/k 666	AT666	Mentioned first	Two men, with specification
kt 93/k 708	AT708	Mentioned first	Group of three men, with specification
kt 93/k 714	AT714	Mentioned first	Two men, with specification
kt 93/k 736	AT736	Mentioned second	Group of three men
kt 93/k 781	AT781	Mentioned first	Group of three men, with specification

The tablets of Aššur-taklāku.

3.4.2 Form

Tablet Shape and Layout

Most of Aššur-taklāku's tablets included into this study are complete in regard of their general shape. Only on the three tablets AT537, AT606, and AT714, the left lower edge is broken off. On AT509, the lower right edge and reverse are slightly broken. The remaining parts of these tablets are intact so that their shape can be evaluated. From the lower edge of AT544, a part is broken off as well, the general shape of edges and corners can be analysed nevertheless.

A typical tablet shape of Aššur-taklāku's corpus is the portrait format with four slightly convex edges. It can be noted that the upper and lower edge are usually more convex than the left and right one. The corners are a mix of straight pointy tips, and squeezed pillow-shaped corners. Tablets formed like that are AT316, AT482, AT505, AT508, AT509, AT714, AT295, AT473, AT489, AT606, and AT736. Tablet AT151 has a similar shape but with rounded corners.

Several smaller tablets can be found in the selected corpus as well. Their general shape resembles strongly the form described above. One difference, however, is that most of them are wider than high, so that their shape should rather be called a landscape format. Here, the right and left edge are usually more convex than the upper and lower edge. Regarding the corners, the tablets can be distinguished in tablets with squeezed (AT284, AT468), straight (AT599, AT666, AT708), and rounded corners (AT176, AT456).

The third group of tablets is defined by their large size and basically straight edges. Even though some of the other tablets show some irregularities, usually, the upper and lower edge and/or the right and left edge are straight. The corners are mostly straight, or even a bit rounded. Squeezed corners are hardly to be found. In addition, these tablets are characterized by a large size. All of them have a height of at least 6,5 to 9 cm while the other tablets are mostly smaller with approximately 3,5 to 5,5 cm (an exception is AT509, it is as large as the tablets of the third group, but its shape rather reminds of the tablets of the first group). The tablets in this group are AT514, AT516, AT519, AT520, AT526, AT527, AT528, AT537, AT539, AT544, and AT781.

On most of the tablets, the text is arranged on very straight ruled lines. Only on seven tablets the ruling is slightly curved, or oblique. It is particularly notable with regard to the lowermost line on obverse and reverse. Here, the ruling is bend upwards so that only the right part of the lowermost line is visible (AT176, AT519, AT539, AT544, AT599, AT666, AT781), and on the two tablets AT526 and AT736, the ruling is slightly downward oblique, so that only the left part of the lowermost line is visible.

Tablet[157]	Total of signs	Different readings	Number of different signs	Number of lines	Average of signs per line	Dimensions (in cm)
AT151	234	74	61	32 (ob. 12)	7,3	3,9 x 4,8
AT176	243	68	54	27 (obv. 11)	9,0	4,7 x 4,2
AT284	160	57	48	25 (obv. 8)	6,4	4,1 x 3,4
AT295	213	65	54	27 (obv. 14)	7,9	3,9 x 4,7
AT316	275	78	68	37 (obv. 13)	7,4	4,8 x 5,8
AT456	171	63	55	25 (obv. 9)	6,8	4,3 x 3,5
AT468	215	73	61	23 (obv. 9)	9,4	5 x 4,2
AT473	450	85	68	44 (obv. 16)	10,2	4,3 x 4,9
AT482	394	78	65	40 (obv. 15)	9,9	3,9 x 5,3
AT489	295	78	65	36 (obv. 14)	8,1	4,4 x 5
AT505	330	78	67	37 (obv. 14)	8,9	4,9 x 6,3
AT508	213	72	58	31 (obv. 11)	6,9	4,5 x 5,1
AT509	297	80	65	35 (obv. 16)	8,5	5,1 x 6,5
AT514	626	105	79	54 (obv. 20)	11,6	4,7 x 6,6
AT516	565	108	82	51 (obv. 19)	11,1	4,9 x 6,6
AT519	541	91	70	44 (obv. 19)	12,3	5,1 x 6,6
AT520	473	100	72	48 (obv. 19)	9,9	4,8 x 6,7
AT526	603	110	79	53 (obv. 19)	11,3	4,9 x 6,7
AT527	693	98	72	56 (obv. 22)	12,4	5,2 x 7,7
AT528	501	96	78	48 (obv. 20)	10,4	4,9 x 6,7
AT537	658	109	77	57 (obv. 24)	11,5	5,2 x 7,1
AT539	680	94	67	55 (obv. 24)	12,4	5,5 x 9
AT544	965	120	84	65 (obv. 24)	14,8	6,1 x 8,7
AT599	144	55	45	22 (obv. 9)	6,5	3,6 x 3,2
AT606	258	79	65	40 (obv. 16)	6,5	4,8 x 6
AT666	155	59	47	26 (obv. 10)	6,0	3,7 x 3,4
AT708	195	66	55	25 (obv. 8)	7,8	4,5 x 3,9
AT714	184	63	54	30 (obv. 11)	6,1	4,3 x 4,9
AT736	255	73	60	33 (obv. 12)	7,7	4,2 x 4,9
AT781	484	94	83	47 (obv. 18)	10,3	5,4 x 7,4

The signs and their readings on Aššur-taklāku's tablets.

157 For this table the same system applies as for the one of Tariša above.

Use of Signs

Altogether 121 different signs were used on Aššur-taklāku's tablets, with a total of 218 different readings. The number of different signs on one tablet ranges from 45 signs (and 55 different readings) on AT599, to 84 different signs (and 120 readings) on AT544. Both tablets also represent the smallest and largest[158] tablet of the corpus, with the lowest and highest number of lines, and the highest and lowest number of signs in total. Aššur-taklāku's tablets display the typical ratio of the tablet size to the number of signs and readings, i.e. the larger the tablet, the more different signs and different readings are written and used. Thus, the group of the eleven large tablets is also the group with more than 70 different signs and varying readings. The number of different signs on the small and medium-sized tablets ranges between 45 to 68. These two groups, however, cannot be separated by numbers as clearly as it is possible for the group with the large tablets. There is some overlap between the group of small and medium-sized tablets. For example AT708 and AT714 have almost the same number of different signs (55 vs. 54), readings (66 vs. 63), and a similar total of signs (195 vs. 184). However, AT708 has the measures of 4,5 x 3,9 cm, and is therewith almost one centimetre smaller than AT714 with 4,3 x 4,9 cm.

Tablet	Total of signs	Different readings	Number of different signs	Number of lines	Average of signs per line	Dimensions (in cm)
AT708	195	66	55	25 (obv. 8)	7,8	4,5 x 3,9
AT714	184	63	54	30 (obv. 11)	6,1	4,3 x 4,9

18 signs are written on all 30 tablets of Aššur-taklāku (A, BU, DÍ, I, KÀ, KI, KU, LÁ, LI, mA, NA, NI, RA, ŠU, ŠÙR, TA, UM, UT). Four additional signs are used on almost all tablets with one exception each (KAM, ME, ŠA, Ù*)*. Most of these 22 signs belong to the most common ones. The signs BU, KAM, and ŠÙR are exceptions. The latter's consistent use is explainable as being a part of Aššur-taklāku's name. The two signs BU and KAM, are frequently used signs on Ali-ahum's and Tariša's tablets as well.

In contrast to the very common cuneiform signs on the tablets of Aššur-taklāku, there are also seven signs which are only used in one text of the corpus. They are, however, not unusual signs, but signs which are not often used in letters in general. There are the Sumerian logograms DUB.SAR ("scribe") and GIG ("wheat") in AT781, and KIŠIB ("seal") in AT516.

158 The largest tablet in height is actually AT539, but AT544 is wider and therefore in general larger than AT539.

The syllabically used signs are mostly CVC-signs like *kur* (AT544), *mar* (AT526), *qúl* (AT509), and the VC-sign *ùh* (AT528).

The sound value /bi/ is represented with all three signs in Aššur-taklāku's corpus, but not every sign is written on every tablet. On AT544 all three signs were used. On AT295, AT456, and AT599, only BI, and on AT606 and AT714, only BE can be found. On the rest of the tablets, BI and BE are both represented. The use of the different signs, however, is hardly explainable. On AT544, BI, NE (*bí*), and BE are written; NE (*bí*) is only written once for the imperative *qibi-ma* (l. 3), the two other signs are used for all kinds of expression (especially for the term *abini* "our father"). But while there seems to be no difference in use of both signs, there is a spatial segregation, i.e. the sign BI can be found on obverse, lower edge, and reverse, and the sign BE is almost exclusively written on upper and left edge (on the left edge (l. 62) is one exceptional BI). The tablets with both signs can be distinguished as follows: On the 13 tablets AT151, AT176, AT284, AT316, AT473, AT489, AT505, AT508, AT514, AT537, AT666, AT708, and AT736, the two signs are physically separated, so that first one of the two signs is written once or several times, followed by the other sign, also written once or several times.[159] On eleven tablets, AT468, AT482, AT509, AT516, AT519, AT520, AT526, AT527, AT528, AT539, AT781, both signs seem to be written randomly on the tablet. Especially on tablets of the latter group it is possible to analyse the use of the two signs, and whether they are used in special occasion or randomly. Such a comparison is of course impossible if a word, or one of the two signs, is only written once on a tablet. However, some examples indicate that the signs were basically chosen at random. For instance on AT781, the name Aššur-mūtappil is once written with BI (= *pí*: l. 2: *A-šùr-mu-ta-pí-il*), and in the following line with BE (= *pì*: l.3: *A-šùr-mu-ta-pì-il*). On the same tablet, the same phenomenon can be observed with the imperative of *patāum* "to open" (l. 21 vs. l. 31). On AT482, the word *libbum* "heart" is once written with bi_4 (l. 4) and twice with *bi* (l. 23, 24).

The sound value /la/ is written with LÁ on all the tablets, and on six of them additionally with LA (AT473, AT482, AT520, AT526, AT527, AT537). On five of these tablets, LA is only written once, and it occurs somewhere in the text either as a negation or as a syllable of a verb or noun. Its occurrence seems random, and interchangeable. This assumption is supported by AT473 on which LA is written eight times, and LÁ ten times. Both signs are alternately

159 In some of these cases, however, it has to be noted that "separation" is maybe a bit misleading in regard of the number of instances of the respective signs. For example on AT514 the sign BI is written only once, while BE occurs 18 times. Nevertheless, BI is not written somewhere in-between, but at the beginning (*qí-bi-ma*).

written, and represent in parts the same syllable in a word. The negation *la* is several times written with LÁ (e.g. l. 8, 16, 29), but also several times with LA (e.g. l. 10, 14, 28). The particle *mala* is written with both, LA (l. 19) and LÁ (l. 39).

On Aššur-taklāku's tablets both signs PÚZUR (AT516, AT526) and PUZUR$_4$ (AT456, AT468, AT514, AT519, AT520, AT606, AT736) are written. But both signs do not appear on the same tablet.

The sound value /šur/ is written on every tablet with the sign ŠÙR and on the four tablets AT468, AT473, AT516, and AT528 in addition with ŠUR. In each occasion it is part of the name Aššur, and part of a personal name. In most of the cases, the name containing ŠUR is positioned somewhere in the text. Only on AT516, Aššur-taklāku's name in the heading is written with ŠUR. A pattern for its use is not discernible here either.

The vowel /u/ is written on almost every tablet with both Ú and Ù. Exceptions are AT456 and AT714 on which only Ù is used, and AT736, where only Ú is written. On these three tablets, the different u-signs are used accordingly, i.e. Ú is used as vowel, and Ù as a conjunction. The other tablets containing both signs can be differentiated into four groups: On the thirteen tablets AT295, AT468, AT489, AT505, AT509, AT514, AT519, AT520, AT539, AT599, AT606, AT666, and AT708, both signs are exclusively used in the way described above. Thus, a strict distinction is made between the use of the two signs. On the remaining tablets, the use of both signs is inconsistent. On the tablets AT151, AT316, AT482, and AT508 the sign Ú only represents vowels, but Ù is used as a conjunction, and once or twice per tablet as a vowel as well. And on AT544, Ù is used even nine times as vowel. The opposite can be observed on six other tablets (AT176, AT284, AT473, AT516, AT528, AT781). Here, Ù is only used as a conjunction, but Ú is used as a vowel and one to three times as a conjunction as well. On the three tablets AT526, AT527, and AT537, both signs are used once or twice with the opposite function respectively.

The sign TÁK, which is often used on Ali-ahum's tablets, and hardly on Tariša's, is mainly used on Aššur-taklāku's tablets for writing his own name. Only on five tablets, AT151, AT284, AT295, AT316, and AT539, his name is written with the sign combination *ta-ak*. A special case is AT606, here, the name Aššur-taklāku is written twice, the first time as one of the two addressees, and with the sign TÁK. In the second instance, it is the name of the sender, written with the sign combination *ta-ak*. A similar discrimination could be found on one letter of Ali-ahum. There, two senders with the name Ali-ahum are listed, one is written with the sign LA, and the other is written with the sign LÁ. A possible interpretation of this switch could be that the writer intended this change of writing to distinguish between both persons. In any case, Aššur-taklāku's use of signs has shown several times that consistent writing was not his strongest point.

Many of Aššur-taklāku's tablets look pretty much alike. They can be grouped according to their size. But it usually depends on the length of the text and therefore it should not be a criterion. The differences in shape (straight edges vs. convex edges) might actually be a result of the tablet size. As Taylor wrote, especially tablets too large to fit into a hand "show signs of kneading or rolling against a hard surface" (2011, 11). In case of Aššur-taklāku's tablets, they are not too large to still fit into a hand. Nevertheless, to form the large tablets accurately it might have been easier to press them against a flat surface, or to use a tool to form the straight edges. This, however, is only a hypothesis which needs to be analysed elsewhere.

Regarding movement and wedge impression, it can be noted that the clear and thin impression which are typical for Tariša's tablets, cannot be found in this corpus at all. Instead, the signs are frequently written with a probably rather blunt writing tool, and presumably on rather well moistened clay so that the wedge impressions are often a bit blurry and "spineless". Thus, they remind rather of several of Ali-ahum's tablets. Another common point on many of the tablets is the straight ruling and script filling the lines evenly and completely. On the other hand, the use of signs on Aššur-taklāku's tablets is very diverse. The use of different signs for one phonetic value is generally difficult to understand, but on Tariša's tablets as well as on some of Ali-ahum's tablets certain patterns and tendencies can be observed. In case of Aššur-taklāku, on the other hand, the use of different signs for a phonetic value is mainly irregular, even on a single tablet.

In the following, the data of the use of signs is summarised in a table (table 12). Regarding the names of the tablets, some of them are bold. They mark the tablets on which Aššur-taklāku is mentioned before the addressees. In addition, the four tablets sent to his sister Tariša are tagged with "TA". Regarding the use or none-use of specific signs, however, no pattern is discernible. In addition, the table does not contain enough data for such an analysis.

Tablet	BI	NE (*bi*)	BE	LA	LÁ	ŠUR	ŠÙR	/u/	/TAK/
AT151	x		x		x		x	u3-incorr.	*ta-ak*
AT176	x		x		x		x	u2-incorr.	TÁK
AT284	x		x		x		x	u2-incorr.	*ta-ak*
AT295	x				x		x	corr.	*ta-ak*
AT316	x		x		x		x	u3-incorr.	*ta-ak*
AT456	x				x		x	corr.	TÁK
AT468	x		x		x	x	x	corr.	TÁK
AT473	x		x	x	x	x	x	u2-incorr.	TÁK
AT482 (TA)	x		x	x	x		x	u3-incorr.	TÁK
AT489	x		x		x		x	corr.	TÁK
AT505	x		x		x		x	corr.	TÁK
AT508	x		x		x		x	u3-incorr.	TÁK
AT509	x		x		x		x	corr.	TÁK
AT514	x		x		x		x	corr.	TÁK
AT516	x		x		x	x	x	u2-incorr.	TÁK
AT519	x		x		x		x	corr.	TÁK
AT520	x		x	x	x		x	corr.	TÁK
AT526	x		x	x	x		x	mixed	TÁK
AT527 (TA)	x		x	x	x		x	mixed	TÁK
AT528	x		x		x	x	x	u2-incorr.	TÁK
AT537 (TA)	x		x	x	x		x	mixed	TÁK
AT539 (TA)	x		x		x		x	corr.	*ta-ak*
AT544	x	x	x		x		x	u3-incorr.	TÁK
AT599	x				x		x	corr.	TÁK
AT606			x		x		x	corr.	TÁK
AT666	x		x		x		x	corr.	TÁK
AT708	x		x		x		x	corr.	TÁK
AT714			x		x		x	corr.	TÁK
AT736	x		x		x		x	corr.	TÁK
AT781	x		x		x	x	x	u2-incorr.	TÁK

Table 12: The summary of the use of signs of Aššur-taklāku.

Form and construction[160]

AM


Fig. 157: The first variation of the first variant on AT489:24.

The sign AM is written on most of Aššur-taklāku's tablets except on AT468, AT482, and AT508. The sign can be classified into variants and variations on the basis of the number of Winkelhaken, and the position and size of the small vertical wedge. One variant is written with two small, and two large Winkelhaken, one of the latter is impressed on the lower tips of the small Winkelhaken, the other one is positioned more or less on the same oblique axis as the small ones. This variant can be distinguished into two variations according to size and position of the vertical in front of the Winkelhaken formation. The first variation shows a short vertical impressed in the middle of the horizontals, between the latter's heads and the Winkelhaken formation. The vertical's head is usually placed on or underneath the upper horizontal wedge, its tail can cross the lower one (fig. 157). This variation is the most common one on Aššur-taklāku's tablets, and it is written on AT151, AT176, AT284, AT456 AT489, AT505, AT509, AT519, AT520, AT526, AT527, and AT599.


Fig. 158: The second variation on AT544:10.

The second variation of the same variant shows a large vertical with its head positioned above the upper horizontal. Its typical position is more or less in the middle of the horizontals, between their heads and the Winkelhaken formation, with a tendency towards the former. This version is consistently written on AT295, AT537, AT544, AT666, AT708, and AT714.


Fig. 159: The two variations of the second variant, on AT736:17a, and AT316:24a.

Another variant shows basically the same Winkelhaken formation, but with three instead of two small wedges in the upper row. Here, too, the variant can be distinguished into two variations on the basis of the position and size of the vertical. On the tablets AT473, AT539, and AT736, the vertical wedge is large. Its head is impressed above the upper horizontal with its tail crossing the lower one. It is positioned right in front of the Winkelhaken formation. The other variations can be observed on AT316, AT606, and AT781.

160 For the image tables of the diagnostic signs see the file Appendix_ch3_Assur-taklaku on the attached CD-ROM.

Here, the vertical is impressed at the beginning of the horizontals with its head on the upper one, or slightly underneath.

The third variant of AM has four small Winkelhaken in the upper row. It is written on AT514, AT516, and AT528. Here, the vertical is placed right in front of the Winkelhaken formation with its head impressed above the upper horizontal, and its tail crossing the lower one (fig. 160).

Fig. 160: The third variant on AT516:9.

BA

The sign BA is written on most of the tablets except AT176 and AT736. Both main variations of the sign can be observed on Aššur-taklāku's tablets, with either three horizontal wedges, or two upper horizontals and a downward oblique wedge at the bottom.

Fig. 161: The open sign on AT527:37.

The most typical angle of the latter is approximately 40°-50°. Only on a few tablets, e.g. AT473, AT489, and AT516, the angle of the lowermost oblique wedge varies greatly from approximately 45° to almost horizontal. The head of the oblique wedge often touches the head of the uppermost horizontal. This version is consistently (or at least with very few variations) written on AT284, AT295, AT316, AT473, AT482, AT489, AT505, AT509, AT514, AT516, AT519, AT526, AT527, AT528, AT537, AT539, AT544, AT599, AT666, AT708, AT714, and AT781. On these tablets another phenomenon can be observed. As mentioned before, the lines on Aššur-taklāku's tablets are neatly filled by the script, and the vertical wedges usually reach from the upper to the lower ruling, or are even cut off by the latter. This factor leads to "open signs" which means, the tips of the oblique and the vertical wedge which would actually intersect, are both cut off by the ruling, so that the two wedges are not connected as they usually are (fig. 161). This habit could be observed on several tablets of Ali-ahum as well, but hardly on Tariša's.

Fig. 162: The third variation on AT456:10.

The other variation of BA with three parallel horizontals is written on several tablets, too. The only tablet, however, which shows this variation consistently is AT456. The other tablets, AT151, AT468, AT508, AT520, and AT606, have at least one example with a strongly oblique wedge at the bottom. The lowermost wedge of the second variation of BA does not reach or cross the vertical at its tip, but somewhere above.

DÍ

The sign DÍ is written on every tablet of Aššur-taklāku, and with the same variant containing three Winkelhaken in the upper row and one at the bottom. Three different variations of this variant can be noted which are characterised by the position of the lower Winkelhaken and the lateral protruding of the upper wedges.

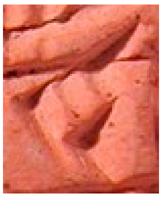


Fig. 163: AT316:7.

In the most common variation, the bottom Winkelhaken is impressed on the tips of the middle and right upper wedge while the one on the left does not touch the one at the bottom. This variation is consistently[161] written on AT316, AT456, AT473, AT482, AT489, AT505, AT509, AT514, AT516, AT520, AT526, AT527, AT599, AT606, and AT666.

The second variation is characterised by the bottom Winkelhaken being positioned under the mid-Winkelhaken of the upper row so that the left and right Winkelhaken of the upper row do not touch it (fig. 164). This variaiton is consistently written on AT151, AT708, AT736, and AT781.

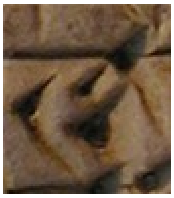


Fig. 164: The second variation on AT151:23.

On the three tablets AT176, AT284, and AT508, the first and second variation of the sign DÍ can be found (on AT176, both are used just as often, on the two other tablets, the first variation is preferred). Interestingly, on all three tablets, both variations are almost completely separated. Thus, on AT176, on the obverse, the second variation, and on the reverse (and following edges, e.g. upper and left edge), the first variation is written (with only one exception in l. 26). On AT284, a similar separation can be found, but beginning with the first variation, followed by the second one on the reverse. On AT508 the switch from the first to the second variation is on the reverse.

Fig. 165: The third variation on AT544:19a.

The third variation of DÍ is characterised by the three upper wedges being equally attached to the one at the bottom. This variation is consistently written on AT295, AT539, AT544, and AT714. On AT528, the third variation of DÍ is preferred as well, but additionally several natural variations can be found. Furthermore, on AT468, AT519, and AT537 the third variation is mainly written, but combined with the first variation. Here, however, there is no separation and both variaitons are alternately written.

161 Consistently doesn't mean that there is no other variation at all, but there are only few natural variations. A clear writing preference is discernible.

A special case is AT528. Here, the three variations described above, and a fourth variation where the bottom Winkelhaken is placed on the tips of the left and the middle upper wedge while the right one is laterally protruding, are alternately used on the entire tablet without any clear preference.

A peculiarity on many of Aššur-taklāku's tablets is the inconsistent size of the wedges, even though the same variation is written. On AT151 the second variation of DÍ is written several times, but the three upper wedges are often impressed with different force, and on different axes. For an instance, in line 8 the right wedge is emphasised and slightly shifted, in line 8 the one in the middle is shifted upwards, and in line 23, the one in the middle is smaller and shifted downwards (fig. 166). Similar phenomena can be observed on most of his tablets.

Fig. 166: The irregular writing on AT151:8, 18, and 23.

DU

The sign DU is written on most of the tablets except AT508, AT519, AT599, and AT714.

Fig. 167: AT544:10.

For this sign, two long and one short variant can be observed on Aššur-taklāku's tablets. The short one is the typical variant consisting of two verticals and two horizontals forming a rectangular box. In the middle of the box, a short horizontal wedge with an attached Winkelhaken is placed. This variant is written on AT295, AT544, and AT666. The details of two examples on AT468 are not clearly visible because of a crust of sand on the wedges, but in both cases there seems to be a rectangle formed by wedges with an additional horizontal in the middle. The Winkelhaken is not clearly recognizable.

Fig. 168: AT151:6.

The typical long variant is formed by an open rectangle, i.e. the short horizontal shifted from the middle of the box downwards and is attached to the lower horizontal. Thus, is prolongs the lower side of the rectangle while the upper one is written with one horizontal. The latter, however, begins in the most common version on Aššur-taklāku's tablets in the middle of the side and ends on the final vertical wedge. Thus, there is an opening between the first vertical at the beginning of the sign and the upper horizontal. The Winkelhaken remains more or less in the middle of the box and very close to the second vertical wedge. This variant can be found on AT151, AT284, AT316, AT456, AT473, AT482, AT489, AT505, AT509, AT520, AT526, AT527, AT606, AT708, AT736, and AT781.

Fig. 169: AT176:6.

On the tablets AT176, AT514, AT516, AT537, and AT539 a long variant of the sign is written as well, but here, the upper horizontal is not attached to the second vertical, but it begins parallel to the first horizontal at the bottom, and is attached to the first vertical. It usually does not reach the second vertical, but ends somewhere in the middle so that there is a gap, too. The Winkelhaken is very close to the second vertical as well, and it can be positioned somewhere between the two horizontals, or it is impressed on the second lower horizontal. Its positioning is not very consistent.

IM

The sign IM is written on most of tablets, except AT151, AT473, AT508, and AT736. Two different variants can be found on the tablets depending on the number of Winkelhaken in the upper row of the Winkelhaken formation.

Fig. 170: AT708:2.

On the tablets AT316, AT489, and AT708, a variant with four Winkelhaken in the upper row is written. The leftmost and the rightmost wedges are usually enlarged and shifted upwards so that they frame the two small Winkelhaken in the middle. In addition, their tails can protrude beyond the upper side of the Winkelhaken at the bottom. The second element of the signs consisting of the two parallel verticals crossed by a horizontal, is closely impressed to the first part so that the head of the horizontal touches the edge of the lower Winkelhaken (and is therewith usually impressed on the tip of the rightmost upper Winkelhaken). While this variant with four Winkelhaken is consistently written on AT316 and AT489, on AT708 the writer suddenly changes from four Winkelhaken to three Winkelhaken in the upper row. The pattern, however, remains.

Fig. 171: AT176:16b.

This variation on AT708 is actually a variation of the variant with three upper Winkelhaken and is also written on AT176, AT509, AT599, and AT781. The bottom wedge is basically positioned underneath the mid-Winkelhaken of the upper row, and the left and right ones are detached, and unconnected to the Winkelhaken at the bottom. Notable is that with the exception on tablet AT781, there is always a small gap between the first and the second part of the sign.

Fig. 172: AT520:1.

There are two other variations of the variant with three Winkelhaken in the upper row. One of them is characterized by the bottom wedge positioned underneath the middle and right upper Winkelhaken, so that the left one is detached, and usually protruding. This variation is written on AT284, AT482, AT505, AT520, AT527, AT606, and AT666.

Fig. 173: AT714:15.

In the third variation, the bottom wedge is positioned basically in the middle, but all the upper Winkelhaken are attached to its upper side. This variation is mainly written on AT295, AT456, AT468, AT514, AT516, AT519, AT526, AT528, AT537, AT539, AT544, AT714.

It is notable for the last two variations that the first and the second part are usually connected via the right edge of the Winkelhaken at the bottom and the head of the following horizontal. In addition, both variations are neither very consistently written, nor very carefully executed. Thus, on many of these tablets, there are certain tendencies for one or the other version, but there are many natural variations as well (e.g. on AT456, AT505, AT516, AT519, AT526, AT527, AT528, AT537, AT714).

By comparing the Winkelhaken formation of IM with the sign DÍ it can be noted that on most tablets the two signs comply with each other in both the mostly written variation as well as the natural variations. An exception is AT514, here the same variant with three Winkelhaken in the upper row is written, but with different variations for DÍ and IM. However, the latter is only written once, and in regard of the high number of natural variations of the Winkelhaken formation, the different versions of both signs should not be taken too seriously. A different observation can be made for the tablets on which IM is written with four Winkelhaken in the upper row, i.e. AT316, AT489, and AT708. Here, different variants for the Winkelhaken formation can be found. However, in case of AT708, the variant of IM changes in-between from four to three Winkelhaken. This variant then corresponds to the DÍ version on the tablet.

KÀ

The sign KÀ is written on every tablet of Aššur-taklāku's corpus. But on AT508, the examples of KÀ are not clearly visible and therefore, a classification is not possible. In general, a differentiation is difficult in regard of often faintly impressed and therefore hardly visible and frequently also overlapping wedges.

Fig. 174: AT708:7.

The most common variant seems to consist of four stacked horizontals. The upper three wedges have the same length, the one at the bottom is prolonged so that its head protrudes. The first vertical is impressed on the heads of the upper three horizontals. Three additional verticals are impressed at the end and on the tips of the horizontals. The verticals are usually impressed on the uppermost horizontals and reach, or even cross the lowermost horizontal. This element is not executed consistently. The horizontals are followed by two Winkelhaken, the upper one is one the same level as the uppermost horizontal or slightly higher, and the lower Winkelhaken is usually impressed between the lowermost horizontal and the next one above. This variant is written on AT176, AT295, AT456, AT468, AT473, AT482, AT489, AT505, AT509, AT514, AT516, AT526, AT527, AT528, AT537, AA599, AT708, AT781.

Fig. 175: AT520:18.

On the four other tablets AT316, AT520, AT606, and AT666, a similar variant can be found. Here, the four horizontals are stacked to the same structure, but at the end, there are not three parallel verticals, but two. On AT151, the first and the second variant are used interchangeably, but with a preference for the second variant. On the two tablets AT284 and AT714, the same variant is written, however, it is mostly sloppily executed. Several times, the four horizontals do not begin on the same vertical axis, but they are shifted to the right and from the bottom to the top. The first vertical is still impressed on all the horizontals' heads, and therefore, it is strongly inclined to the right. At the end, two parallel verticals follow, both Winkelhaken are impressed on the usual level.

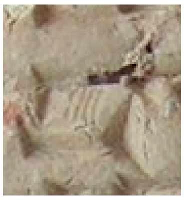


Fig. 176: AT539:4.

On AT539, the horizontals are stacked in the same way as well, but at their end, four parallel verticals are impressed (fig. 539).

Fig. 177: AT519:17.

On the two tablets AT519 and AT736, all four stacked horizontals begin on the same vertical axis, and have the same length. On their heads one vertical is impressed, followed by three parallel verticals at their ends. The Winkelhaken are positioned on the usual level. On AT544 basically the same variant is written, but with two instead of three vertical wedges at the end.

KI

The sign KI is written on every tablet of Aššur-taklāku. Its main characteristic in this corpus is probably its diversity of variants on most of the tablets. On at least eleven tablets more than one variant is written. Also on Aššur-taklāku's tablets, the frequent overlapping of wedges is a problem for the identification of different variants. Regarding the number of small horizontals, there seem to be mainly three wedges, but in rare cases, also four can be impressed. But their number seems to depend at least sometimes on the available space. Since on most of Aššur-taklāku's tablets, the wedges are rather wide, three seems to be the most usual number.

Fig. 178: AT544:47.

In general, the three typical variants can be found on Aššur-taklāku's tablets, i.e. the first variant begins with two Winkelhaken, positioned on an upward oblique axis. Additionally, a thin vertical is impressed which is usually overlaid by the two Winkelhaken and therefore often hardly visible. In some cases, only its tip is actually visible below the lower Winkelhaken (fig. 178). This variant is exclusively written on AT537, AT539, AT544, AT599, and AT781. On eleven other tablets, it is one of two or three written variants (with preference for this variant on AT468, AT519, and AT526).

Fig. 179: AT520:8.

For the second variant, the initial sign combination is reduced by the upper Winkelhaken. Thus, the sign begins with the combination of a Winkelhaken in the middle and an intersecting small vertical wedge. This variant is consistently written on AT284, AT520, and AT714. On seven other tablets, it is combined with at least one other variant (with a preference for the second variant are AT151, AT456, AT482, AT489, AT508, and AT527).

Fig. 180: AT516:12.

For the third variant, the small vertical of the initial construction is dropped, and only the two Winkelhaken remain. A difficulty here is that often the small vertical might have been written, but it is no longer visible due to the two Winkelhaken. This variant is consistently written on AT295, AT316, AT505, AT509, AT516, AT528, AT606, AT666, and AT736. Furthermore, on AT176, ATAT473, AT514, and AT708 several variants are written, but mostly the third variant can be identified.

The following combinations can be found on the tablets: The first and the second variant are written on AT151, AT456, AT468, and AT489. The combination of the first and the third variant can be found on AT473, AT514, AT519, and AT526. The second and third variant are used on AT508 and AT708. And on the three tablets AT176, AT482, and AT527, all three variants are written.

KU and MA

Both signs KU and MA are represented on all the tablets of Aššur-taklāku's corpus.

KU

The differentiation of KU is sometimes difficult because of the stroke order. It appears that the first vertical was usually impressed after the upper and middle horizontal. Therefore, both heads, and sometimes parts of the tail, are cut off, and the exact determination of their impression and length is difficult. Accordingly, for an exact estimation of the impression and length of a wedge only the full impression with a clear triangular head will be evaluated.

Fig. 181: In the right example, AT482:7, the heads of the two upper horizontals are cut off by the first vertical. In the second example, AT539:10, the head of the upper one is partly visible.

There are basically three variations of the sign KU. The first variation is characterised by three horizontals of the same length. Thus, the three heads begin with the first vertical wedge. The difference is, as mentioned above, that the first vertical is usually impressed on the heads of the upper and middle horizontal so that these heads are not visible. The wedge at the bottom is often impressed afterwards. This version is written on AT151, AT316, AT456, AT468, AT473, AT482 (see fig. 181, left), AT489, AT505, AT508, AT509, AT519, AT526, AT606, AT708, AT736, and AT781.

In the second version of KU, written on AT295, AT520, AT537, AT539, and AT544, the horizontal wedge in the middle is shorter, its head is shifted to the right so that it does not overlap with the first vertical, and is therefore completely visible (fig. 181, right).

Fig. 182: AT528:35.

The third variation is characterised by a shortened upper and middle horizontal. Both wedges are usually parallel shifted to the right. Both heads are not overlaid by the first vertical so that their complete triangular is visible. This variation is written on AT514, AT516, AT527 AT528, AT599, and AT666 (fig. 182).

On some tablets few natural variations can be found. On AT284 the first and the third variation are represented, and on AT176 the first and the second one.

MA

The sign MA can be distinguished into two variations (and one tendency) on these tablets. The main discriminating elements are the length of the three horizontal wedges and their arrangement.

Fig. 183: The stroke order of the upper horizontals and the first vertical on AT456:14 and AT482:11a.

The first and main variation builds a rectangular box with two parallel horizontals and two verticals, one at the beginning and one at the end of the horizontals. While the lower horizontal is usually impressed after the first vertical, the stroke order of the upper horizontal and the vertical is mostly hard to differentiate. On AT456:14, the head of the first vertical is dented by the upper horizontal which is a clear indication that the latter was indeed the second wedge. On 482:11a, the head of the upper horizontal is cut off by the vertical while the head of the lower horizontal is clearly visible. This implies that the upper horizontal was impressed first, followed by the vertical, and finally by the lowermost wedge. The horizontal in the middle was presumably impressed after the one at the bottom, and is shorter. Its head is shifted to the right, and its triangular shape is clearly visible, i.e. it is not deformed by the impression of the first vertical. The sign is finalised by a large vertical. This version is written on AT151, AT176, AT284, AT295, AT316, AT456, AT468, AT473, AT482, AT489, AT505, AT520, AT526, AT527, AT539, AT544, AT606, AT708, AT714, and AT736. On several of these tablets, a number of natural variations can be found, especially in regard of the length of the uppermost horizontal and the position of the first vertical which can be shifted to the left, then being positioned in front of the horizontals.

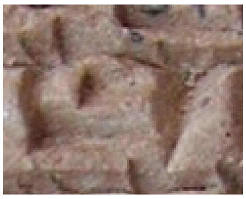


Fig. 184: Rather a tendency than a variation, here on AT514:4b.

On Ali-ahum's tablets, the second variation of MA is written with a prolonged lowermost horizontal. The first vertical, which is impressed on the former's head, is consequently placed in front of the uppermost horizontal. A similar variation can be found on Aššur-taklāku's tablets as well (fig. 184). However, while this variation is mostly consistently written on Ali-ahum's tablets, and executed with a clear difference in length of upper and lower horizontal, on Aššur-taklāku's tablets neither the difference of the length is very obvious nor is a clear preference notable for this signs "variations" on the respective tablets (AT509, AT514, AT516, AT519, AT537, AT666). Instead, it is frequently mixed with the first variation. Furthermore, in several cases, the first vertical wedge is positioned slightly in front of the lowermost horizontal as well. Thus, this "variation" rather points to careless or rushed writing than to an explicit variation. Consequently, on Aššur-taklāku's tablets, it will rather be considered a tendency, but not a variation.

Fig. 185: AT508:15.

The second clearly executed variation of MA is characterised by a shortened upper horizontal. Here, it has the same length as the wedge in the middle; the first vertical is positioned in front of both upper horizontals. It is written on AT508, AT528, and AT599.

Fig. 186: AT781:17b.

AT781 is a special case. It seems that the middle and upper horizontal have the same length as the one at the bottom. However, because of the stroke order, the heads of the two upper wedges were cut off by the first vertical, which is the reason why the upper horizontal seems mostly shorter than the middle one. This variation reminds of the first one of the sign KU.

KÙ

The sign KÙ is written on most of the tablets except AT505, AT539, and AT714. Basically three variants can be found on the remaining tablets, all of them very similar in wedge number or arrangement.

Fig. 187: AT520:5.

The first variant shows the typical frame of two vertical wedges which are mainly connected by a long horizontal at the tips of their tails. Between the two verticals, usually two to three filling horizontals are impressed, often, however, they are rather faint and barely visible. This construction is followed by a row of three closely impressed Winkelhaken, which is usually positioned in the middle of the line, or even slightly higher. This variant is written on AT151, AT284, AT316, AT456, AT473, AT482, AT489, AT508, AT520, AT526, AT527, AT537, AT606, AT708, and AT781.[162]

Fig. 188: AT468:14.

A very similar variant is written on AT468. Here, KÙ has the same setup as the first variant, but four instead of three Winkelhaken are positioned in the row. In addition, the Winkelhaken are placed very high, almost on the ruling, and they are very thin and close to each other.

Fig. 189: AT666:12.

The third variant of KÙ has the typical frame with the two verticals and the horizontal. The Winkelhaken, however, are arranged differently: A row of three is positioned between the two verticals. And another large Winkelhaken follows after the second vertical (AT176, AT295, AT509, AT514, AT516, AT519, AT528, AT544, AT599, AT666, AT736). The height of both elements changes from tablet to tablet, and partly even from example to example: On AT514 the row of three Winkelhaken and the fourth one are basically on the same level in the middle. But on AT544, in most cases the row of three is positioned in the lower half of the sign while the fourth Winkelhaken is placed in the upper part. On AT176, the three Winkelhaken are hardly visible, only the tips of their tails can be seen underneath the horizontal.

There are only very few natural variations on the tablets. One example is AT473:10. Here, a row of three very thin and one large Winkelhaken follow the second vertical. However, the large one almost completely overlays the third thin one. On AT537, the first variant is preferred, but in line 21, the third one is written. On AT666:14, it is vice versa.

LI

The sign LI is written on every tablet of Aššur-taklāku's corpus. Three variants can be distinguished. Their setup and shape is basically the same, but the number of Winkelhaken and wedges differs.

162 This variation is partly connected with the following BABBAR via a ligature (see ch. 2). This phenomenon, however, is hardly provable and rather inconsistent.

Fig. 190: Two examples for the stroke order of the Winkelhaken formation on AT514:29 and AT519:11.

The Winkelhaken formation of LI is probably the main discriminating element. On these tablets, it has the same construction. There is a bottom row, usually consisting of two Winkelhaken, and an upper row, containing several Winkelhaken. Their number determines the different variants. The upper Winkelhaken are usually parallel arranged on a slightly upward axis. The bottom row consists of two larger Winkelhaken. Both can have the same size, or the first one is enlarged. In addition, both wedges are hardly connected, or even arranged on the same axis. More often, the first one is positioned on a higher level, partly on a similar axis like the Winkelhaken of the upper row. Nevertheless, few cases like AT514:29 or AT519:11 (fig. 190) indicate on the basis of squeezed clay that this first large Winkelhaken was written as the first element of the sign, followed by the second Winkelhaken at the bottom, and only then the wedges of the upper row. After the Winkelhaken formation, the element constructed like ŠA follows. Interestingly, on Aššur-taklāku's tablets, it seems that the number of Winkelhaken and the number of horizontals are related, i.e. in case the number of Winkelhaken increase, the number of horizontal wedges increases, too.

Fig. 191: AT468:13.

The first variant of LI contains three Winkelhaken in the upper row of the formation, and the following ŠA-part is written with four horizontals. The one at the bottom is usually stronger impressed and often also slightly enlarged. The three upper ones are frequently getting shorter from the bottom to the top. This variant is mainly written on AT176, AT284, AT456, AT468, AT489, AT599, AT666, and AT708. On the three tablets AT606, AT714, and AT736, the signs are either not clearly visible, or oddly impressed so that a conclusive determination is impossible. Nevertheless, they are most likely examples of this first variant. In general, and in contrast to the typical style on Aššur-taklāku's tablets, there is not much variation on the tablets, only in case of AT176:15 and AT489:35, the number of Winkelhaken is increased, or decreased respectively by one.

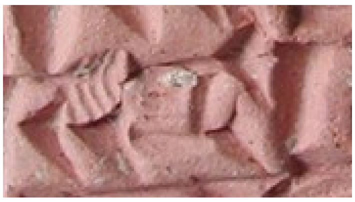


Fig. 192: AT781:15.

The second variant consists of one more Winkelhaken in the upper row so that there are four small Winkelhaken. In addition, the ŠA-part is written with five horizontal wedges. This variant is mainly used on AT151, AT295, AT316, AT473, AT482, AT505, AT508, AT509, AT514, AT516, AT519, AT520, AT526, AT527, AT539, AT544, and AT781. However, on eight of these tablets, AT473, AT482, AT505, AT516, AT519, AT726, AT527, and AT781, the first variant can be found once or more often as well.

On AT537, the first and the second variant are written alternately.


Fig. 193: AT528:22.

Tablet AT528 is a special case. Here, two rows with Winkelhaken are written. The upper one consists of four to five thin and closely impressed wedges. The lower one is written with three Winkelhaken arranged on a horizontal axis as well. But they are stronger impressed than the upper ones, and therefore, they are larger. In addition, they are positioned with more space between them so that basically their complete triangular shape is visible.

In regard of the great similarity of the three variants as well as the frequent interchange on tablets, on which mainly the second variant is written, it should not be too far-fetched to assume a kind of development of one writer.

RI

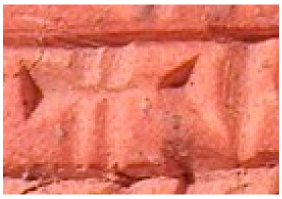


Fig. 194: AT316:5.

The sign RI is written on most of tablets, except AT509, AT666, and AT736. On Aššur-taklāku's tablets, the execution of the sign shows a great consistency; on most of the tablets basically the same variation is written. It is characterised by the two parallel verticals which are positioned in the middle of the horizontal. The first vertical is impressed right after the triangular head of the latter, and the second vertical is impressed with some space in-between, but hardly wide enough to insert another wedge. The following Winkelhaken is impressed on the tip of the horizontal, and rarely beneath or above it. The sign is finalised with a long vertical, which is usually slightly shifted upwards, and enlarged.


Fig. 195: The two exceptions AT714:13, and AT781:6.

Only on two tablets different variations can be noted, and in both cases the height of the Winkelhaken is decisive. On AT714, it is positioned underneath the horizontal so that only its upper tip borders the latter. However, on this tablet there is only one example of RI, and in addition, it is written on an edge. Maybe the writer wanted to save space and positioned the Winkelhaken therefore differently, or it was a slip (as it can be observed on AT527:55 as well). Another variation is written on tablet AT781. Here, the sign RI is written four times. Twice (l. 8 and 14) it is written in the typical way, but in two other instances (l. 6 and 21), the Winkelhaken is positioned in the upper half of the sign and above the horizontal.

ŠA

The sign ŠA is written on most of the tablets, except AT599. In this corpus it is represented with two variants and two variations. The distinction is based on the number of wedges differing between four and five horizontals, and the arrangement, i.e. the length of these wedges.

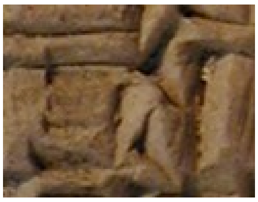


Fig. 196: The first variation with obvious stroke order on AT151:21.

The first variant is written with four horizontals. One variation is characterised by three upper horizontals of the same length which begin on the same vertical axis. The fourth horizontal at the bottom is longer, its head is slightly shifted to the left. At the end of the horizontals a first thin vertical is impressed. It reaches mostly from the uppermost horizontal, or even above, to the bottom one. Its length is not always consistent, thus, it can also be positioned further down between the uppermost and the next horizontal. Its height varies partly from example to example and should therefore not be considered a discriminating element. The two following Winkelhaken are placed on the typical levels. The bottom one is positioned between the lowermost and the next horizontal, and the upper Winkelhaken is usually placed on the same level as the uppermost horizontal, or slightly underneath. The sign is finalised by a large vertical. This variation is written on AT151, AT176, AT284, AT295, AT468, AT509, AT514, AT527, AT708, and AT736.

Fig. 197: An irregularity on AT284:23.

On several of these tablets, however, some irregularities can be found, i.e. the variation is not accurately executed (for example the length of the wedges changes), and some inconsistencies, i.e. natural variations, can be observed. For instance on AT284:23 (fig. 197), the three upper wedges that are usually positioned on the same vertical axis, are shifted to the right from the bottom to the top. In line 1 and 2 on AT468, the uppermost horizontal is strongly impressed to emphasise it while on the other examples on that tablet, all the wedges show the same depth of impression. On AT514, some examples show different numbers of wedges (l. 2a, 6), or an irregular execution (l. 27a).

Fig. 198: AT316:9.

The second variation of the variant with four horizontals is written on AT316, AT519, AT666, and AT714. In general, it has the same setup as the first variation, but here, the lowermost horizontal begins basically on the same vertical axis as the others. In some cases, but not consistently, the uppermost and the lowermost horizontals are deeper impressed, and therefore slightly enlarged.

Fig. 199: AT516:34b.

The other variant of ŠA contains five horizontals. One variation is comparable to the first variation of the other variant. Thus, the four upper horizontals begin on the same vertical axis while the one at the bottom is slightly shifted to the left. The rest of the construction is basically the same. This variation is written on AT516, AT528, AT537, AT539, AT544, and AT781. However, it is hardly consistently or regularly written. Every tablet with the exception of AT781, shows some variations, be it the decrease of horizontals (e.g. AT516, AT528, AT537), or a divergent arrangement (e.g. AT528, AT537).

Fig. 200: AT456:17b.

The second variation of this variant is characterised by the five stacked horizontals getting shorter from the bottom to the top, i.e. their heads are shifted further to the right. This variation, which seems on other tablets like an irregular execution is mostly consistently written on AT456, AT473, AT482, AT489, AT505, AT508, AT520, AT526, and AT606. Some inconsistency regarding the number of wedges can be found on AT482, AT489, 508, and AT526.

For this sign, several variations can be observed as well, but notable are especially the frequent inconsistencies and irregularities on several tablets.

TIM

The sign TIM is not written as often as the other diagnostic signs and missing on the tablets AT151, AT176, AT295, AT489, AT505, AT509, AT599, AT666, and AT714. The examples on the remaining tablets display mainly the same variant, only on two tablets a different variant can be found. The initial element of TIM is rather short here: The two parallel verticals are still in the middle of the horizontal wedge, but because of the shortness of the latter, the first vertical is positioned on its head. And the tail of the horizontal wedge ends right after the second vertical.


Fig. 201: AT456:16.

In the first variant written on Aššur-taklāku's tablets, this structure is followed by two Winkelhaken, the first one is basically at the level of the horizontal, often impressed on its tip. The second one, impressed afterwards, is positioned higher, usually on the ruling or underneath, and slightly shifted to the right. The final part of the sign consists of two oblique wedges that intersect at the end. In general, the upper one begins on the same level as the upper Winkelhaken, the lower one on the same level as the lower Winkelhaken. In addition, its head is shifted further to the left because the lower Winkelhaken is positioned further to the left as well. There are small changes in height and exact position of these four elements, Winkelhaken and oblique wedges, but their relative position is the one described above.


Fig. 202: AT544:48.

The second variant of the sign, written only on AT508 and AT544, contains three instead of two Winkelhaken. Here, the first one is also impressed on the tip of the horizontal wedge. The other two Winkelhaken are positioned on the tips of the first one so that they form a triangular constellation. The upper oblique wedge is on the level of the upper Winkelhaken. The lower oblique is also on the level of the Winkelhaken in the middle, but its head is attached to the upper tip of the lower Winkelhaken.

Ù


Fig. 203: AT519:10.

The signs Ù is written on almost every tablet of Aššur-taklāku, except AT736. Problematic with this sign is that in many cases, the filling wedges providing the basis for a discrimination are hardly visible. For example on AT520, the sign Ù is written four times, but only on the second example of line 9, three small filling wedges are noticeable. Taking this observation into account, the analysis of this sign might lead to very diverse results with a wide range of variation on each tablet. Therefore, the example of each tablet that has the most detail is considered the main variant on that tablet.

The typical shape of Ù remains the same, it begins with a vertical wedge, and a Winkelhaken, which is impressed on the lower part of its tail. In case of Aššur-taklāku's tablets this Winkelhaken is usually impressed on the tail tip of the vertical, and only occasionally it is shifted upwards so that the tip of the vertical is still visible. The following part begins with a horizontal wedge and an attached standardized frame consisting of three parallel verticals and a long horizontal impressed on their tips.

The three variants of the sign can be distinguished on the basis of the first horizontal in front of the construction, and the filling wedges between the verticals. The first variant is characterised by a horizontal which ends usually on the first vertical of the frame. Only in rare cases, it is drawn through the first vertical, or even until the end of the frame. In the intermediate space between the first and second vertical of the frame, three thin horizontals are impressed, their tails end on the third vertical, or cross it. In case that the first horizontal wedge is drawn through, it usually replaces one of the three thin horizontals that follow. This variant seems to be written on AT176, AT295, AT316, AT456, AT473, AT514, AT516, AT519, AT520, AT526, AT528, AT537, AT539, AT544, AT599, AT666, AT708, and AT781. On tablet AT544:11 and 12, and AT666:3, there seem to be sometimes even four thin horizontals.

Fig. 204: AT489:25.

The second variant shows no indication for any small filling wedge, instead the first horizontal in front of the frame is drawn through until the third vertical. This variant seems to be written on AT151, AT468, AT489, AT505, AT509, AT606, and AT714.

Fig. 205: AT482:12.

The third variant is similar to the second variant, i.e. the first horizontal is drawn through the frame. In addition, above or underneath it, an additional thin horizontal is impressed which ends like the first horizontal on the last vertical or crosses it as well. This variant is visible on AT284, AT482, AT508, and AT527.

As mentioned before, however, the wedge impressions are often too faint to be visible, therefore, this classification is rather an assumption.

ZI

Fig. 206: AT527:33a.

The sign ZI is written on almost all the tablets, except AT505 and AT599. On AT482, the sign is written but no details are clearly visible. Therefore, it is excluded from the analysis.

The first part of the sign, the combination of two parallel verticals and a crossing horizontal, corresponds to the same part of signs like IM and RI. The verticals are basically positioned in the middle of the short horizontal, giving the sign a balanced impression. The discriminating element, i.e. the formation of Winkelhaken, is attached to the first part. There are three variants that can be distinguished on the basis of the number of wedges.

The first variant contains two parallel horizontal rows of Winkelhaken with two wedges in the lower, and three wedges in the upper row. The construction is basically the same as for the sign LI. Thus, the Winkelhaken of the upper row are usually close together, and positioned on a slightly upward oblique axis. The two wedges of the lower row can have the same size and be on the same horizontal axis. But in most of the cases, the first Winkelhaken is impressed on the tip of the horizontal while the second one is shifted downwards. Nevertheless, the parallel angles of both indicate that they were impressed in sequence. This variant is written on the tablets AT176, AT284, AT456, AT468, AT527, AT708, and AT714.

Fig. 207: AT514:25.

The second variant of this sign shows the same construction, but with four instead of three Winkelhaken in the upper row. It is consistently written on AT151, AT316, AT473, AT489, AT508, AT509, AT514, AT516, AT519, AT520, AT526, AT537, AT539, AT544, AT606, AT666, AT736, and AT781. While the first variant is consistently executed on the respective tablets, the second variant is frequently interchanged with other variants. For instance on AT526 and AT606, examples of the first variant can be found (l. 48), and on several other tablets, e.g. AT514, AT516, AT537, AT539, and AT736, the number of Winkelhaken is partly increased to five in the upper row.

Fig. 208: AT295:26.

The third variant is written with four Winkelhaken in the upper, and three Winkelhaken in the lower row. The Winkelhaken of the upper row are usually thin and closely impressed so that they overlap. The ones at the bottom are written with more space so that their triangular shape is visible. The lower row of Winkelhaken is usually positioned slightly underneath the horizontal wedge. It is written on AT295 and AT528.

In comparison with the sign LI it is notable that on most tablets the Winkelhaken formation of both signs is basically identical. The only exception is AT295. Here, ZI is written with two rows of Winkelhaken, four in the upper, and three in the lower row. LI is written with four in the upper and two large ones in the lower row.

3.4.3 Movement

Fig. 209: On AT505 at the top, the inchoated wedge heads are visible, at the bottom on AT539, the "wobbly" form of the wedges is clearly observable

Observing the tablets of Aššur-taklāku, many similarities and only few differences can be noticed. Regarding the line quality, i.e. the quality of the wedge impressions, it is notable that the writer(s) often used a somehow blunt stylus because the impressions are often lacking a clear angular spine. Instead, they are rather roundish, as well as the corners that are often not well shaped. In addition, especially vertical wedges frequently lack a clear shaped head, so they rather seem like dashes (fig. 209). Furthermore, on many of these tablets, in general, both the horizontal and vertical wedges look somehow squeezed, i.e. their outer edges are not straight anymore but dented. This phenomenon results from the impressions of other wedges and the consequent deformation of the clay (fig. 209). The pressure seems mostly even, on none of the tablets a particular pressure pattern can be found. The main differences are observed in the structures of several crossing wedges (like Ú), and in regard of the wedge size. A shorter or filling wedge is certainly not as deeply impressed as a finalising vertical.

On most of the tablets an upright script can be seen. Only on eight tablets (AT284, AT468, AT473, AT520, AT528, AT539, AT714, AT736), the signs show a certain and consistent slant to the right. Furthermore, on all the tablets, the vertical wedges are usually evenly impressed on the ruling. Exceptions seem rather to be a result of stylus, clay quality, and pressure.

One observation can be made regarding horizontals, and whether the whole wedge, a part, or nothing is impressed on the ruling. It certainly depends partly on the sign, that sometimes the uppermost wedge is not impressed on the ruling because the sign is in general rather positioned somewhere in the middle of the line and not connected to the ruling at all like, for example, the sign BI. This sign does not have a vertical wedge, and is therefore not connected to the ruling; its upper horizontal is also usually impressed underneath the ruling. On the other hand, signs like KU, MA, and ŠA have a large vertical and a high positioned horizontal wedge. Here it can be noted that on most of Aššur-taklāku's tablets, the uppermost horizontals are not impressed on the ruling, but slightly underneath (AT151, AT284, AT468, AT473, AT482, AT489, AT508, AT526, AT527, AT528, AT544, AT599, AT606, AT708, AT714, AT781). On nine tablets the uppermost wedges are directly impressed on the ruling (AT176, AT295, AT316, AT505, AT509, AT514, AT516, AT519, AT537). Finally, on five tablets

(AT456, AT520, AT539, AT666, AT736), the heads of the horizontals are mostly impressed on the ruling, but because of a light slant, the horizontals are slightly downward oblique, and therefore, they are not completely impressed on the ruling.

3.4.4 Spatial Relationships

Fig. 210: The left side of the left edge of AT736 is convex, the script follows the shape accordingly.

Aššur-taklāku's tablets can be grouped into different categories on the basis of the script alignment on the left side. On eleven tablets, the script is arranged in straight and parallel lines. Even though in some cases, these lines are very close to each other, the signs and wedges of the different lines usually do not overlap. This arrangement can be found on AT151, AT176, AT473, AT482, AT505, AT508, AT514, AT516, AT519, AT714, and AT781. On several other tablets, the script is arranged in rather curvy lines, involving varying line height. In addition, the script is partly overlapping, i.e. because of the curvy lines, single wedges can be impressed higher, and therefore overlap in another line, and even be impressed on other wedges. This phenomenon can be observed on AT284, AT316, AT456, AT489, AT520, AT526, AT537, AT544, AT599, AT606, AT666, AT708, and AT736. One reason, especially for the curvy lines, can be the shape of the tablet. Often, the lines follow the outline of the tablet. In the case it is irregular or bulgy then the script usually follows these curves (fig. 210). Obviously, the overlapping of the script and the curvy lines go hand in hand. Only on two tablets, AT527 and AT539, the writer managed to separate the script even though the lines follow the curvy outlines of the tablets. On three tablets, AT295, AT468, and AT509, the texts end either on the reverse, or the upper edge, so that the left edge is not inscribed at all. On AT528, only one straight line is written on the left edge.

The lines on Aššur-taklāku's tablets are mostly evenly filled. The rulings are usually rather straight, and have consequently an even height. The vertical wedges are impressed on the upper ruling and their tail tips end on the next ruling underneath. Depending on the sign, especially in case of stacked horizontal wedges, the lowermost one is usually not impressed on the ruling below, but often there is only little space in-between. Only on very few tablets, a different situation can be observed: On AT456, AT468, AT482, and AT714, the ruling is partly slightly curvy. While the script size remains the same, the line height varies. Therefore, some lines are not completely filled. Instead there is a little space between the wedges and the ruled line underneath. On AT666 and AT708, the verticals often do not fill the line height, so that there is little space between writing and ruling.

3.4.5 Excursus: Word Dividers


Fig. 211: In the 5th line of AT482 there are two word dividers, here marked with blue arrows.

As mentioned before, word dividers are written in Old Assyrian texts to separate words. They are vertical wedges that can be the same size as other wedges of this type, but they can also be smaller (fig. 211). Their use and distribution differs greatly, depending on writer, tablet and even on the position on the tablet (obverse/reverse). On some tablets of Tariša and Ali-ahum, certain patterns can be observed like the tendency of increasing the word dividers' frequency towards the end of the text, or general and even deployment on each side of the tablet. In modern transliterations, word dividers are usually represented with a colon (e.g. *a-hu-ru* : *mì-ma*)

On almost all the tablets of Aššur-taklāku, word dividers are used except on AT516, AT666, and AT708. The number of them differs greatly from one on AT284, AT468, and AT714, to 128 word dividers on the largest tablet AT544. Naturally, their number depends partly on the size of the tablet, but not exclusively. On most large tablets of Aššur-taklāku, the number of word dividers ranges from 40 to 128, i.e. in almost every line at least one word divider is written, in several cases even two, three, or more (especially on AT544, the largest tablet of the corpus). Nevertheless, among these large tablets there are also two tablets with less than 35 word dividers (AT520 and AT528), and one tablet, AT516, without any. Similar observations can be made for the smaller tablets of the corpus. Here, the numbers range from 1 to 33.

Especially in case of only very few word dividers on a tablet, usually no pattern can be determined. The single vertical wedges are positioned somewhere in the text, sometimes in consecutive lines, sometimes with some space in-between. On other tablets, certain patterns are recognisable. The most frequent one is that the number of word dividers increases from the beginning of the text to its end (e.g. AT514, AT544), or a few can be found on the obverse, but the larger amount of word dividers is on the reverse and possibly the following edges (e.g. AT520, AT527, AT781).

Larsen suggested that word dividers are reading aids for inexperienced writers (2015:57). Accordingly, the use and distribution of these verticals is very inconsistent, and depends entirely on the writer, his abilities, and probably his mood as well. In most cases, they were presumably inserted into the text during the process of writing. Thus, usually the space between different signs, and signs and word dividers is the same. However, on AT473:6, the word divider between ŠU and IK was inserted afterwards. Maybe the writer realised that the two signs are too close to each other (fig. 212).

Fig. 212: AT473:6: A word divider is subsequently inserted between the signs ŠU and IK.

In general, it doesn't seem that they were used habitually because their use is infrequent and irregular. Nevertheless, certain tendencies can be observed:

Word dividers are often placed between a words' ending and the beginning with the same consonant, or especially vowels. In Old Assyrian cuneiform script, the signs mostly represent CV (consonant-vowel) or VC (vowel-consonant) syllables, and while the duplication of consonants is rarely written, signs are commonly connected to a word by doubling the vowels (e.g. *ha-al-pì-im*). In addition, several vowels like /a/, /i/. and /u/, are also frequent affixes written at the beginning, or end of a word respectively. To indicate their affiliation, word dividers are frequently used. The same applies to specific CV syllables, especially the sign MA. It is used as enclitic particle, and as such it is "by far the most common way of coordinating clauses" (Kouwenberg 2017, 758).

In addition, it appears that word dividers are frequently used in front of, or after specific logograms and particular expressions. For example on Tariša's tablets, frequently after the term *A-lim*.KI (genetive of *alum* "city" = Aššur; KI is here a determinative for city or town) a word divider is placed as long as it is written somewhere in the middle of a line and not at the end (see for example TA143b:31, 42; TA198:14; TA352:4; TA543:18, 19). A similar phenomenon can be noted for the term KÙ.BABBAR on some of Aššur-taklāku's tablets. Here, a word divider is frequently placed in front of the logogram. However, the word dividers are neither used for each of these terms, nor on every tablet. But their use on these occasions is nevertheless rather unexpected because these are usually common expressions and logograms, and therefore, they shouldn't be misunderstood by any member of the Old Assyrian society. The repeated use of word dividers is also notable in front of the sign LÁ in the case it is written at the beginning of a word, or used as a negation placed in front of the verb. A possible explanation in this case could be that LÁ consists of an initial vertical wedge and a following horizontal, which is usually placed on the level of the former's head. Often, it therefore collides with the upper ruling and is sometimes hardly visible. To indicate that the initial stroke of LÁ is actually the beginning of a sign may be the reason for the word divider.

In any case, word dividers were certainly used to facilitate reading, especially in case of tightly written paragraphs or texts. While on some tablets, certain patterns in regard of distribution, or combination of words and signs can be noted, in other cases, their placing seems rather random.

3.4.6 Summary and Statistical Analysis

The use of signs has shown that Aššur-taklāku's tablets are characterized by their inconsistent use of different signs on similar occasions. This feature goes for the shape of the diagnostic signs as well. Their discussion has shown that most of the signs are written with several different variants and variations. Furthermore, they do not only differ from tablet to tablet, but also on particular tablets, so a great wealth of versions can be found. In addition, some signs are not clearly determinable because of their line quality, i.e. wedges are too faintly impressed, or overlap so that details are hardly determinable (e.g. KI, Ù). These irregular patterns, however, can be observed on almost all the tablets.

This irregular use can also be noted in regard of the use of signs. While on the tablets of his father and sister, certain consistencies are detectable, on Aššur-taklāku's tablets, especially the interchangeable use of signs was noticeable like the inconsistent writing of the phonetic value /bi/.

On the other hand, the tablets show some comparable features. One of these is the shape of the tablets, which can be classified into three subgroups based mainly on the basis of their size rather than their shape (even though there are certain differences). Another similarity is the arrangement and the typeface of the script on the tablets.

By summarising the data of the sign form analysis in a table (table 13), only the mainly used variants and variations are noted down. In the case that several variants or variations are used equally often on a tablet, all the numbers are recorded in the table.

Tablet	AM	BA	DÍ	DU	IM	KÀ	KI	KU	KÙ	LI	MA	RI	ŠA	TIM	Ù	ZI
AT151	6	2	1	4	-	8	3	2	5	2	1	2	2	-	1	3
AT176	6	-	1,6	1	2	7	2	1,2	5	3	1	2	2	-	2	6
AT284	6	1	6	4	6	8	3	2,3	5	3	1	2	2	1	3	6
AT295	1	1	5	3	7	7	2	1	2	2	1	2	2	-	2	1
AT316	7	1	6	4	5	8	2	2	5	2	1	2		1	2	3
AT456	6	2	6	4	7	-	3	2	5	3	1	2	6	1	2	6
AT468	-	2	5	3	7	7	1	2	6	3	1	2	2	1	1	6
AT473	4	1	6	4	-	7	2	2	5	2	1	2	6	1	2	3
AT482	-	1	6	4	6	7	3	2	5	2	1	2	6	1	3	-
AT489	6	1	6	4	5	-	3	2	5	3	1	2	6	-	1	3
AT505	6	1	6	4	6	7	2	2	-	2	1	2	6	-	1	-
AT508	-	2	6	-	-	-	3	2	5	2	2	2	6	2	3	3
AT509	6	1	6	4	2	7	2	2	2	2	1	-	2	-	1	3
AT514	8	1	6	1	7	7	2	3	2	2	1	2	2	1	2	3
AT516	8	1	6	1	7	7	2	3	2	2	1	2	1	1	2	3
AT519	6	1	5	-	7	6	1	2	-	2	1	2	3	1	2	3
AT520	6	2	6	4	6	8	3	1	5	2	1	2	6	1	2	3
AT526	6	1	6	4	7	7	1	2	5	2	1	2	6	1	2	3
AT527	6	1	6	4	6	7	3	3	5	2	1	2	2	1	3	6
AT528	8	1	5	-	7	7	2	3	2	1	2	2	1	1	2	1
AT537	1	1	5	1	7	7	1	1	-	2,3	1	2	1	1	2	3
AT539	4	1	5	1	7	9	1	1	-	2	1	2	1	1	2	3
AT544	1	1	5	3	7	2	1	1	2	2	1	2	1	2	2	3
AT599	6	1	6	-	2	-	1	3	2	3	2	2	-	-	2	-
AT606	7	2	6	4	6	8	2	2	5	3	1	2	6	1	1	3
AT666	1	1	6	3	6	8	2	3	-	3	1	-	3	-	2	3
AT708	1	1	1	4	5	7	2	2	5	3	1	2	2	1	2	6
AT714	1	1	5	-	7	8	3	-	-	3	1	1	3	-	1	6
AT736	4	-	1	4	-	5	2	2	2	3	1	-	2	1	-	3
AT781	7	1	1	4	2	7	1	2	5	2	4	2,3	1	1	2	3

Table 13: The different variants on Aššur-taklāku's tablets.

A large table like this one including 30 tablets can seem very confusing. On a first glance, hardly any tablet matches with another. Many of the 16 signs are written with at least three different variations, and the signs AM and KÀ are classified into five different groups.

In the following table 14, the tablets are clustered into three groups and two single tablets according to the used sign variations. Each group shows a different colour code. The mainly used variations in each group are always marked with the same colour.

Tablet	AM	BA	DÍ	DU	IM	KÀ	KI	KU	KÙ	LI	MA	RI	ŠA	TIM	Ù	ZI
AT316	7	1	6	4	5	8	2	2	5	2	1	2	3	1	2	3
AT473	4	1	6	4	-	7	2	2	5	2	1	2	6	1	2	3
AT526	6	1	6	4	7	7	1	2	5	2	1	2	6	1	2	3
AT505	6	1	6	4	6	7	2	2	-	2	1	2	6	-	1	-
AT509	6	1	6	4	2	7	2	2	2	2	1	-	2	-	1	3
AT599	6	1	6	-	2	-	1	3	2	3	2	2	-	-	2	-
AT176	6	-	1,6	1	2	7	2	1,2	5	3	1	2	2	-	2	6
AT489	6	1	6	4	5	-	3	2	5	3	1	2	6	-	1	3
AT482	-	1	6	4	6	7	3	2	5	2	1	2	6	1	3	-
AT527	6	1	6	4	6	7	3	3	5	2	1	2	2	1	3	6
AT284	6	1	6	4	6	8	3	2,3	5	3	1	2	2	1	3	6
AT514	8	1	6	1	7	7	2	3	2	2	1	2	2	1	2	3
AT516	8	1	6	1	7	7	2	3	2	2	1	2	1	1	2	3
AT519	6	1	5	-	7	6	1	2	-	2	1	2	3	1	2	3
AT528	8	1	5	-	7	7	2	3	2	1	2	2	1	1	2	1
AT295	1	1	5	3	7	7	2	1	2	2	1	2	2	-	2	1
AT537	1	1	5	1	7	7	1	1	-	2,3	1	2	1	1	2	3
AT539	4	1	5	1	7	9	1	1	-	2	1	2	1	1	2	3
AT544	1	1	5	3	7	2	1	1	2	2	1	2	1	2	2	3
AT781	7	1	1	4	2	7	1	2	5	2	4	2,3	1	1	2	3
AT520	6	2	6	4	6	8	3	1	5	2	1	2	6	1	2	3
AT606	7	2	6	4	6	8	2	2	5	3	1	2	6	1	1	3
AT666	1	1	6	3	6	8	2	3	-	3	1	-	3	-	2	3
AT456	6	2	6	4	7	-	3	2	5	3	1	2	6	1	2	6
AT151	6	2	1	4	-	8	3	2	5	2	1	2	2	-	1	3
AT708	1	1	1	4	5	7	2	2	5	3	1	2	2	1	2	6
AT736	4	-	1	4	-	5	2	2	2	3	1	-	2	1	-	3
AT508	-	2	6	-	-	-	3	2	5	2	2	2	6	2	3	3
AT468	-	2	5	3	7	7	1	2	6	3	1	2	2	1	1	6
AT714	1	1	5	-	7	8	3	-	-	3	1	1	3	-	1	6

Table 14: The three groups marked with different colours according to their group affiliation.

In each group, there are subgroups that show tendencies for different sign variations. Nevertheless, the bigger part of the signs for each group is written with basically the same variation or variant. Accordingly, the first group consists of eleven, the second group of nine, and the third groupof eight tablets. The two tablets AT468 and AT714 do not fit in any of these three groups.

When comparing these groups with each other, it is notable that even though they show several differences, they also have many elements in common. For example, the first and second group show mostly the same variations of BA and KÀ, while different variations are preferred on the tablets of the third group. The first and the third group share even more sign variations e.g. for AM, DÍ, DU, IM, KI, KU, KÙ, and ŠA. However, there are also sign variations that can be found on most tablets, regardless of their group, such as KI, MA, RI, RIM, Ù, and ZI. On the other hand, the second group has also some peculiar sign forms that cannot be found in the other groups, mostly variations of AM, DÌ, DU, and ŠA. Thus, the second group seems somehow peculiar. This impression is supported by the tablet shape. As mentioned above, the tablets of Aššur-taklāku can be grouped into three different groups. By comparing them with the sign forms, it can be noted that the first and third group of the diagnostic signs are mainly written on the small and middle-sized tablets. The tablets of the second group are mostly the very large tablets of Aššur-taklāku, including AT514, AT516, AT519, AT528, AT537, AT539, AT544, and AT781. There are only very few exceptions. The three large tablets AT520, AT526, and AT527 are grouped into other groups, while the small tablet AT295 shows the same sign variants typical for the large ones.

The two tablets AT468 and AT714 cannot be assigned to any of the three groups. Nevertheless, they show a certain consensus with the groups, especially in case of sign variants that are written mostly or exclusively on the tablets of the second group (e.g. DÍ and IM). However, on the other hand, several signs display completely different variations, so that both tablets cannot be assigned to any of the groups.

In general, however, most of the tablets show a rather conform handwriting. It becomes apparent when changing the second and third group of the table, and colouring the same versions with the same colour (table 15). Thus, one can assume that the first two groups were most likely written by the same person. The third group displaying some peculiar sign forms is also very similar, so that this group was probably also written by the same person, even though it seems that he changed his writing style (especially in case of DÍ, IM, KI, KU, and

ŠA). The two tablets AT468 and AT714 are questionable in regard of their classification. Even though both display mostly sign variations that can be found on the other tablets of Aššur-taklāku as well. The respective combination of sign variants on both tablets is very unique and cannot be found in a similar way on any other tablet.

Tablet	AM	BA	DÍ	DU	IM	KÀ	KI	KU	KÙ	LI	MA	RI	ŠA	TIM	Ù	ZI
AT316	7	1	6	4	5	8	2	2	5	2	1	2	3	1	2	3
AT473	4	1	6	4	-	7	2	2	5	2	1	2	6	1	2	3
AT526	6	1	6	4	7	7	1	2	5	2	1	2	6	1	2	3
AT505	6	1	6	4	6	7	2	2	-	2	1	2	6	-	1	-
AT509	6	1	6	4	2	7	2	2	2	2	1	-	2	-	1	3
AT599	6	1	6	-	2	-	1	3	2	3	2	2	-	-	2	-
AT176	6	-	1,6	1	2	7	2	1,2	5	3	1	2	2	-	2	6
AT489	6	1	6	4	5	-	3	2	5	3	1	2	6	-	1	3
AT482	-	1	6	4	6	7	3	2	5	2	1	2	6	1	3	-
AT527	6	1	6	4	6	7	3	3	5	2	1	2	2	1	3	6
AT284	6	1	6	4	6	8	3	2,3	5	3	1	2	2	1	3	6
AT520	6	2	6	4	6	8	3	1	5	2	1	2	6	1	2	3
AT606	7	2	6	4	6	8	2	2	5	3	1	2	6	1	1	3
AT666	1	1	6	3	6	8	2	3	-	3	1	-	3	-	2	3
AT456	6	2	6	4	7	-	3	2	5	3	1	2	6	1	2	6
AT151	6	2	1	4	-	8	3	2	5	2	1	2	2	-	1	3
AT708	1	1	1	4	5	7	2	2	5	3	1	2	2	1	2	6
AT736	4	-	1	4	-	5	2	2	2	3	1	-	2	1	-	3
AT508	-	2	6	-	-	-	3	2	5	2	2	2	6	2	3	3
AT514	8	1	6	1	7	7	2	3	2	2	1	2	2	1	2	3
AT516	8	1	6	1	7	7	2	3	2	2	1	2	1	1	2	3
AT519	6	1	5	-	7	6	1	2	-	2	1	2	3	1	2	3
AT528	8	1	5	-	7	7	2	3	2	1	2	2	1	1	2	1
AT295	1	1	5	3	7	7	2	1	2	2	1	2	2	-	2	1
AT537	1	1	5	1	7	7	1	1	-	2,3	1	2	1	1	2	3
AT539	4	1	5	1	7	9	1	1	-	2	1	2	1	1	2	3
AT544	1	1	5	3	7	2	1	1	2	2	1	2	1	2	2	3
AT781	7	1	1	4	2	7	1	2	5	2	4	2,3	1	1	2	3
AT468	-	2	5	3	7	7	1	2	6	3	1	2	2	1	1	6
AT714	1	1	5	-	7	8	3	-	-	3	1	1	3	-	1	6

Table 15: Aššur-taklāku's tablets in order of their similarities, based on the used sign variations.

Even in case of Aššur-taklāku's tablets, the same hand does not necessarily mean that he himself wrote the tablets. In his case, an identification, however, is even more difficult because the texts do not give information about his whereabouts except that he usually seems to be in Kaneš or somewhere else in Anatolia, but not in Aššur. In addition, several of his texts are most likely copies, for example the letters sent to Tariša and other representatives presumably still living in Aššur (see above).

There are, however, some letters authored by several people as well as some copies of debt notes and notes bearing his name. In the following table four additional letters are listed (AT082, AT298, AT446, AT723), three copies of single debt notes (AT436, AT442, AT584-897), and the *Sammelmemorandum* AT545, i.e. a large tablet containing five copies of debt notes, presumably produced as a private note and reminder.[163]

The letters are authored by at least two persons, and one of them is always Aššur-taklāku. AT082 is incomplete, a large part of the upper right corner and side are broken apart. AT298 and AT446 (the latter is broken, but glued together) are not completely inscribed. Both tablets bear only a few lines on the reverse. AT723 is a larger tablet and basically complete. The table shows that even though these are letters, in most cases at least four of the diagnostic signs are not written on them. The purple and green marked numbers represent common variations written on most of Aššur-taklāku's tablets, the orange marked ones are the variations written on the large tablets grouped separately (see above).

163 For more information on that topic and further literature see Beyer (*forthcoming*). Especially interesting for this tablet is that the five debt notes name different creditors. Three of them name Aššur-taklāku, in one case he is the debtor, and in the fifth case, he does not seems to be involved personally. The question why these texts were written together on this *Sammelmemorandum* has to be answered elsewhere.

Tablet	AM	BA	DÍ	DU	IM	KÀ	KI	KU	KÙ	LI	MA	RI	ŠA	TIM	Ù	ZI
AT082	-	1	1	-	5	-	1	3	-	2	3	2	1	?	2	3
AT298	-	-	2	4	2	-	2	3	2	2	2	-	9	1	2	3
AT446	-	1	6	4	5	-	1	1	-	-	2	1	1	2	2	-
AT723	7	1	6	4	2	7	1	2	2	2	1	2	1	1	2	3
AT436	3	1	2	-	-	-	1	2	2	2	1	-	1	-	-	2
AT442	1	1	-	1	2	-	2	2	2	3	3	-	-	-	-	3
AT584-897	1	-	6	4	-	-	-	-	5	3	1	-	2	1	-	6
AT545	6	1	6	1	6	4	2	2	2	3	1	1	1, 6	1	-	3

Table 16: The additional letters and copies of Aššur-taklāku.

The letters authored by several people, show much conformity with the other letters of Aššur-taklāku. In case of AT082, AT298, and AT446, there are nine to ten conform sign variations used. And even some of the sign variations which are not coloured, can be found on Aššur-taklāku's other letters (like AM~7, or IM~5). Regarding the shape of the four additional letters, AT082 is difficult to classify because it is broken and partly also corroded. AT298 has a strange form. The reverse is completely flat, the obverse strongly convex. While this shape is not unusual for tablets, in this case, the surface of the obverse and also the script seem therefore a bit bloated, and the impression of the whole tablet is different from the rest. The other two letters, AT446 and AT723, have the typical shape of Aššur-taklāku's tablets. AT446 has slightly convex edges and straight or pointy corners. AT723 seems larger (43 lines), its edges are straight, and the corners are straight as well (typical for the large tablets of this sender). Consequently, the most likely option is that the same person who wrote most of the tablets of the selected corpus above, also wrote these four letters that are authored by several persons.

As an additional comparison, there are the three copies of debt notes and the *Sammelmemorandum*. The problem with the missing diagnostic signs is here even more immanent, and in most cases (except on AT545) six to seven signs are not written and can therefore not be used for the comparison. On the other hand, the available diagnostic signs show mainly the same versions written on the letters. Also in regard of the shape, the tablets match perfectly with the letters of Aššur-taklāku. The single debt notes are rather small tablets in landscape format (wider than high) and with slightly roundish corners. This shape can also be observed for the letters AT599 and AT456. The *Sammelmemorandum* has almost straight edges and corners, just like the large letters of Aššur-taklāku.

Another common point for the eight additional tablets is that the name Aššur-taklāku is mostly written with the sign TÁK. Only on letter AT723 and debt note AT584+597, the name is written with the sign combination *ta-ak*, which can, however, also be found on some of the letters above.[164]

To sum up, the eight additional texts, including letters authored by several persons and copies of debt notes, were certainly written by the same person who also wrote most of the letters of the analysed corpus above. The composition of the selected tablets suggests that this writer was Aššur-taklāku.

3.5 Summary

The analysis of tablet shape, script, and sign form has shown that it is indeed possible to identify handwriting on cuneiform tablets. In regard of the three members of the 93/k-archive, it could be concluded that all seven texts authored by Tariša were written by the same person. The major part of Ali-ahum's corpus was written by one person as well, but four tablets, AA189, AA199, AA317, and AA889 were most likely written by someone else, and the two tablets AA191 and AA566 show several similarities, but both tablets are also missing several diagnostic signs so that the comparison is largely incomplete. The analysis of the 30 selected letters of Aššur-taklāku led to a similar result. Thus, most of his tablets seem to have been written by one person, the exceptions are the two tablets, AT468 and AT714. Even though both tablets show mainly similar sign variations as written on the other tablets, the combination of these variations differs greatly from the rest of the corpus. As it was discussed before, the uniqueness of handwriting does not only depend on unique sign variants but mainly on the unique combination of them. Therefore, these two tablets are rather questionable in regard of their classification. Apart from that, Aššur-taklāku's corpus can be divided into two groups on two different levels. One discriminating element is the tablet shape. There are eleven tablets sticking out in regard of their large format and straight edges. The other discriminating element separating nine tablets from the rest of the corpus is the

164 In this context it is interesting to note that the debt note AT584+597 is actually copied on the *Sammelmemorandum* as well. But on the latter, the name is written with TÁK. Thus, the writer – presumably Aššur-taklāku – followed his usual writing style. Also notable in regard of the *Sammelmemorandum* is that it is sloppily written, i.e. the sign shapes are often rather inconsistent, the ruling often cuts off the tips of the verticals, and the impressed wedges are very blurry as if they were written when the clay was still very wet. Thus, the tablet indeed looks like a private note.

form of a few signs, especially DÍ and IM (and partly KI, KU, and ŠA). The two groups are not completely identical, but a large part of the respective tablets combines indeed both discriminating elements. Thus, the eight tablets AT514, AT516, AT519, AT528, AT537, AT539, AT544, and AT781 are both very large, and display some peculiar sign forms which are rarely written on the other tablets of Aššur-taklāku. A reason for the different shape of the tablet and the signs cannot be given yet. Maybe the tablets represent a change of writing habits that can certainly happen over the course of time, and that would also explain the common elements that these eight tablets share with the rest of the corpus. But this question can probably only be answered by studying the content of the texts carefully and arranging them according to Aššur-taklāku's life.

The identification of handwriting, however, cannot answer the question about the identity of the writer. Therefore, different approaches were applied to the three corpora. The analysis of Ali-ahum's tablets was the most comprehensive one. Here, different places of sending could be determined for a few letters. Furthermore, additional texts, letters authored by several senders as well as copies of contracts were analysed in regard of their sign forms and tablet shapes. The combination of these approaches led to the quite certain conclusion of Ali-ahum being the author of these texts. In case of Aššur-taklāku's corpus, the clear identification of any place of sending was not possible. However, additional letters and private notes could be consulted as well. And their analysis, especially of the private notes, led to his identification of most of his texts as well.

In case of Tariša's tablets, their place of sending seems to be Aššur. All her letters, being authored by her only as well as authored by a group, show the same handwriting. According to Stratford's suggestion, as well as the observations of Ali-ahum's and Aššur-taklāku's corpora, it should therefore be possible to identify her as the writer of the texts. However, in case of her father and brother, not only letters authored by several people were analysed, but also private notes were included. And only the combination of the different textual sources led to the positive result. In case of Tariša, there are only letters. And a final answer, only based on her material, cannot be given yet.

Chapter 4: Comparing Families – Learning and Teaching?

The subject of school and curriculum in Mesopotamia, especially in Babylonia, is a topic discussed in detail. Based on thousands of texts, mainly dated to the Old Babylonian period at the beginning of the 2nd millennium BCE, and excavated in several ancient cities in Babylonia such as Nippur, Sippar, and Ur, a curriculum of that time could be reconstructed. Furthermore, several Sumerian literary compositions, the so-called Edubba-literature or "school-stories", give an insight into the daily life of student scribes, their schedule, and challenges.[165] While the Old Babylonian educational situation is well documented, not much is known about schooling in the Old Assyrian period.

The following is a brief overview of schools, curricula, and teaching methods in the Old Babylonian period, and what is known about the same topic in the Old Assyrian period. The focus of this chapter lies on a new approach to learn more about teaching methods of the Old Assyrian merchants.

4.1 Schooling in the Old Babylonian period

"Schools"[166] and Teachers

In the Edubba-literature, the educational institution which is nowadays translated and abbreviated as "school" is mentioned as É.DUB.BA.A (edubba), a Sumerian term which means literary "the house that distributes tablets". A former simplified translation as "tablet house" refers mainly to the corresponding Akkadian expression *bīt ṭuppim* (Volk 2000, 2-3).

Several literary texts report of a student going to the edubba to learn the art of writing – and several additional necessary disciplines – from his teacher, implying that a specific building existed housing such kind of institution. Such a building, however, could not be identified yet (Michel 2018b, 2). Instead, archaeological data suggests that – at least during the Old Babylonian period – the educational training took place in private houses. Some could be identified: The most famous one is probably the so-called house F in Nippur (see for a detailed description Robson 2001). Here, thousands of tablets were discovered, giving insight into the curriculum of the students and their training. In addition to the textual material, also some furnishing led to the conclusion, i.e. in one of the rooms in which many tablets were found, also a box made of backed bricks and filled with tablet fragments was discovered,

165 See for example Black *et al.* (2004), Kramer (1949), Sjöberg (1975) Vanstiphout (1997), and Volk (2000).
166 For more information on the subject, see for example George (2005), Volk (2000), Waetzold/Cavigneaux (2009).

which might have been a recycling bin “into which old tablets could be thrown for soaking, reshaping and re-using” (Robson 2001, 44). A similar building with a rich archive (c. 2,500 tablets) is the house of the chief dirge singer Ur-Utu in Sippar (see Gasche 1989, Tanret 2011). And also in Ur, such an establishment was identified, containing more than 2,000 tablets of different genres like lexical, mathematical, and literary texts (Charpin 1986).

Thus, an institution like our modern understanding of “school” did not exist during the Old Babylonian period. The students were taught in private houses, and their teachers were private individuals, presumably professional scribes, or priests. Veldhuis (1997, 25) pointed out that the art of writing was presumably taught mostly in the family context, like any other craftsmanship. Two designations of the teacher written in literary texts point to his conclusion. One is the Akkadian term *ummiānum* which can be translated as “craftsman” or “artisan”. The other term is the Sumerian expression AD.DA-É.DUB.BA.A which can be translated as “father of the Edubba”. The latter points to the family context, the former one to craftsmanship (see also Waetzold/Cavigneau 2009, 295). The “class” consisted most likely of the sons of the teacher, and probably some other apprentices (George 2005, 131).

The Curriculum[167]

Because of the rich findings in Nippur, the curriculum of the students could be reconstructed.[168] It consisted of two main phases. In the first, elementary phase, the students had to learn how to form a tablet and the handling of the stylus. The first writing exercises comprised the technique of how the basic sign elements i.e. the different wedge types, had to be impressed into the clay. This was followed by simple signs and name lists. These lists are very repetitive so that the student had to write the same sign over and over again, in different combinations. In this way, he became acquainted with common signs. The primary aim of these exercises was to learn the correct execution of the signs without having to deal with their meaning yet (Tanret 1998, 40).

Once the student had mastered these lists, more complex so-called lexical lists followed. These lists were still monolingual Sumerian, and thematically sorted, with topics like trees and wooden objects, clay vessels, metal objects, animals, stones and plants, etc. The next part

167 For detailed information on the curriculum and its reconstruction, see Robson (2001(, Tinney (1998, 1999), and Veldhuis (1997, 2004).

168 The general structure of the curriculum in Nippur and in other cities was the same. But it depended on the teacher, his preferences and probably also special needs, which material he used, especially in the later phase of education (for corresponding studies see Robson 2001, and Tinney 1999).

of the curriculum included advanced lists with more complex sign combinations like city names and occupational titles. On their basis, the student not only expanded his sign repertoire, but he also learned the different readings of cuneiform signs (Veldhuis 1997, 40-57). Presumably at the same time, also mathematical and metrological tables were introduced, the latter containing i.a. lists of different kinds of measures like weights or capacities, the mathematical tables covered topics like reciprocal, multiplication, and square roots (Michel 2018b, 5).[169] In the last part of the elementary phase, the student was confronted with Sumerian grammar in form of juridical documents, model contracts and proverbs.

In the second phase of the curriculum, the student copied literary texts including "short hymns of no more than 60 lines, to complex and lengthy epics, such as 'Enmerkar and the Lord of Aratta', which numbers 600 lines" (Veldhuis 1997, 64). However, the exercise texts that the students learned and copied were not a fixed set, but their selection depended on the teacher, his "personal taste and pedagogical preferences" (Robson 2001, 62).

It is believed that not every student finished the second phase of the curriculum, but "graduated" after the elementary phase to take up a post in the administration of a temple, palace, etc. (Waetzold/Cavigneaux 2009, 303).[170]

How did they learn?

The brief overview of the curriculum above has shown a well considered and pedagogical setup of the learning content. Accordingly, the student was introduced to the fundamental elements of the script, and then taught step by step more complex lessons. Veldhuis (1997) reconstructed the sequence of the learning content, and observed thereby four tablet types which give insight into the teaching methods:

Type I are prisms and large tablets on which either long parts or entire lexical compositions were written, the latter usually with two to six columns on obverse and reverse. There are for instance objects with the elementary sign lists like Syllable Alphabet B or TU-TA-TI (Veldhuis 1997, 28-29). Type II are tablets with teacher-student exercises, i.e. the teacher wrote a text excerpt on the left side of a tablet, for example, which the student had to copy on the right side. This text was usually new to the student. On the reverse, a different exercise

169 The mathematical tables are discussed in great detail by Proust (2007) and Robson (2008).

170 See also Michalowski (2012, 46-47), and Veldhuis (1997, 40), with further literature. Especially noteworthy is also Tanret's article on the chief dirge singer Ur-Utu because apparently, in his house only exercises of the elementary phase were found which points to the conclusion that he only taught the basics of writing (2011, 278).

was written, presumably a repetition of a previously learned text (Veldhuis 1997, 31-37). Type III are tablets containing an excerpt of a text arranged in a single column. Veldhuis points out that the tablets of type III can clearly be identified as student tablets on the basis of the quality of the handwriting (Veldhuis 1997, 37-38). Type IV are lentil-shaped tablets, and like type II they contain teacher-student exercises. Especially in Nippur, two lines written by the teacher and their copy by the student can be found on the same side. But there are also other types, for example three lines written by the teacher on the obverse, and the student's copy on the reverse. The student's handwriting on these lentils is very diverse including very accurate, but also rather crude hands. These tablets certainly served the students to learn new text lines, written by their teacher. The difference to type II tablets, however, is not clear yet (Veldhuis 1997, 38-40).

The tablet types show the different ways of learning the cuneiform script. One was certainly the copying of the teachers writing. But additionally, the student also had to learn the contents by heart, and repeat them over and over again. Some findings suggest that sometimes, texts were also dictated by the teacher. Tinney mentions two tablets excavated in Ur that contain exactly the same text, but in a few cases, words are differently written. It indicates that they were not copied from each other, but rather dictated by a teacher, and written by two students (1998, 49).

Veldhuis summarises that during the elementary phase of the curriculum, the student was closely supervised by his teacher. But in the later stage of his education, he worked more independently. Therefore, the tablet types II, III, and IV were mostly written and used in the first phase. Especially type II and IV also contain the writing of the teacher, pointing to an earlier phase of the education. Type III comprises only the copy of the student, but Veldhuis assumes that they might have been copied from a type II tablet. In the later phase of the curriculum the literary texts were written without a model (Veldhuis 1997, 40).

4.2 The Curriculum of the Old Assyrian period?

From the contemporary Old Assyrian period, almost nothing is known about the educational situation. Only a little more than 20 school texts were discovered and identified. Some of them were found in different private houses in the city of Kaneš, and some of them in Aššur.[171] Most of them are lentil tablets containing small mathematical exercises dealing with "small conversion exercises of one product into another, usually silver" (Michel, *in press*, 4). This knowledge was very important for the merchants because of the different measurement systems in Anatolia and Aššur, and the necessity to calculate prices, which were usually paid in silver (Michel, *in press*, 3). In addition, two fragments of a metrological list were excavated in Kaneš (level Ib). This list, kt t/k 76+79, contains a list of measurement values on the obverse, and a lexical list of metals, stones, and plants on the reverse. Michel observed that the tablet must have been written by a student because of irregular lines and a coarse script. In addition, she noted that this list is different from the material discovered in Southern Mesopotamia (*in press*, 5, 9).

Furthermore, there are a few lexical lists, and some literary compositions like copies of royal inscriptions, incantations, and a text about Sargon of Akkad. The latter, however, were not used for the scribal education, but clearly written by professional scribes (Michel 2010, 85). Regarding educational material, especially the two fragments kt v/k 7 + kt u/k 31, also discovered in a house in Kaneš (level Ib) are interesting because they are parts of a large tablet, identified as a paradigmatic letter (Hecker 1993, 282, Veenhof 1996, 425). The text is written in approximately six columns and contains a compilation of phrases that can be used in letters (Michel 2008b, 350). This type of tablet is not unique, and similar tablets were discovered, but none of them is published yet, and they are nevertheless rather rare in Mesopotamia. For the Assyrian merchants, however, the formulation of letters was a daily necessity, thus, "scribes had to get familiar with this literary genre during their studies" (Michel 2010, 85).

In regard of their structure the school texts from the Old Assyrian period remind clearly of the Old Babylonian educational material of the first phase of the curriculum. However, the content of these texts is different from the known sources from Babylonia. Especially the metrological list and the paradigmatic letter contain information necessary for the business

171 A list of possible educational material from Kaneš was first selected by Hecker (1993), school texts from Aššur were published by Donbaz (1985) and Pedersén (1985). Michel discussed these texts in detail (2008b).

life of a merchant. Thus, it appears that even though the formal structure of the school tablets coincides with the Old Babylonian material, their content was adapted to the needs of the merchants (Michel 2008b, 351).

Learning in the Old Assyrian period?

Almost nothing is known about Old Assyrian schooling. Michel noted that especially the school material discovered in Kaneš is mostly dated into the second phase of the trade, level Ib. Thus, she suggested that "we can guess that if the Assyrians in the early phase received their education in Assur, later on they developed a scribal education in Kanesh" (Michel 2010, 85). And in only one letter, a boy or young man asks his father for a present for his teacher of the scribal arts. In CCT 4, 6e:4-8 is written: DUB.SAR-*tám wa-dí lá-am-da-ni e-pá-tá-am a-na um-me-a-ni-a šu-bi-lam* „As you know, we are learning the scribal art. Send me an *epattum*-garment for my teacher".[172]

Regarding the handwriting of an individual, Tom Davis wrote that "the writer has an internalized model hand, acquired by practise, imitation, and to a small extent, creativity" (Davis 2007, 260). The term imitation indicates that a student copies, at least in part, the writing style of another, maybe his teacher. From the Old Babylonian period is known that an important exercise for the student was to copy the writing of his teacher. Thus, it could be assumed that the student also learned the typical sign forms used by his teacher. Such a study, however, was not conducted yet. And also for the Old Assyrian period, such an analysis was not yet performed.

Therefore, the following analysis will compare the writing of at least two generations of different families. Its aim is to possibly detect elements in the handwriting of different families that might lead to a greater understanding of learning and teaching in the Old Assyrian period.

172 See also Larsen (1976, 305 n. 47), and Michel (1998, 250 and n. 2).

4.3 A Comparison of Families

The included letters stem from several members of three different families. These families are those of Ali-ahum and his two children Aššur-taklāku and Tariša, Ali-ahum's brother Elamma and two of his children, Ennam-Aššur and Ummī-Išhara, as well as the family of Aššur-idī, his three sons, and his grandson. The writing characteristics of the family members are compared to each other, and additionally, they are compared to the writing of the other families. Even the selection of families is interesting for the comparison. Ali-ahum and Elamma were brothers, thus, their writing style might be similar, while Aššur-idī is not related to them, hence, his family's tablets might show completely different habits and peculiarities.

The basis for the overview and general analysis of the hands is an excel chart named *dataset_all* (for an excerpt see fig. 213, the complete dataset can be found in the appendix on the attached CR-ROM).

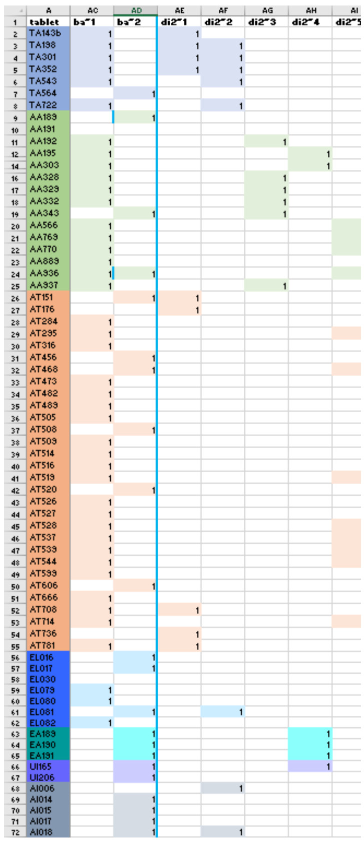


Fig. 213: An excerpt of the dataset_final_all.

The chart contains the different variations of the diagnostic signs according to the observations noted in chapter 2 for Ali-ahum's family as well as the data of the other families discussed in this chapter. The rows are divided by colours, each representing one letter sender (in fig. 213 for example light blue at the top for Tariša, green for Ali-ahum, terracotta-coloured for Aššur-taklāku, etc.). Each row contains the data of one letter of the respective letter sender. They are arranged according to the ascending order of their excavation number.[173] The columns are separated into different sections by thick light blue lines. These sections contain the elements discussed in the use of signs part as well as the diagnostic signs. Each column in such a section therefore represents the respective sign (e.g. *bi*/*bí*/*bi*$_4$), or one variant or version of the phonetic segment. For technical reasons, the different variants and variations of each diagnostic sign will be numbered.[174] To prevent any confusion with index numbers of certain signs like *bi*$_4$ or KÙ (KU3), the version number is added

173 While the two letters AA199 and AA316 of Ali-ahum's corpus are not discussed further, they are still included into the dataset. On the one hand to have a result as complete as possible, on the other hand also as a kind of control unit.

174 For a list of all the sign variations see the document Appendix_sign_variants on the attached CD-ROM.

with a tilde symbol. For instance, the second variant of AM is written as AM~2. In case of a sign with an index number like DÍ, the index number is added in normal script size, e.g. the second variant of DÍ is written as DI2~2. In fig. 213 the two different variations of BA (BA~1 and BA~2) are visible, as well as several variations of the sign DÍ (DI2~1 to DI2~5). Here as well, only the main variants and variations of each tablet are recorded. Only in case several variants are equally represented, or a peculiarity like oblique wedges instead of Winkelhaken can be found, more than one version per sign is noted. Elements supporting a discrimination of writing styles especially in regard of different family traits are also discussed on the basis of the individual sign forms. The classification corresponds to the variants and variations discussed above (ch. 2).

Furthermore, a second table is analysed in which sign variations and also partly variants are grouped together (for the complete dataset see excel chart named *dataset_all_resort* in the appendix on the CD-ROM).

This is because it is precisely when a character can be written in different variants, i.e. a different number of wedges or a significantly different arrangement (such as the short and long variants of DU), that this variant can also be distinguished into different variants, which are often identified by the slight rearrangement of a single wedge. For instance the variations AM~3 and AM~6 are very similar. However, the former is written only on Ali-ahum's tablets, the latter only on the tablets of his son. The construction and the number of Winkelhaken of both, and even the size of the vertical is basically the same. The discriminating element is the impression of the last upper Winkelhaken. On variation AM~3, the three Winkelhaken of the upper row have the same size. On variation AM~6, the last Winkelhaken of the upper row is as large as the one at the bottom (fig. 214). Another sign variation similar to these two is consistently written on Tariša's tablets. This variation, AM~1, is basically the same as AM~6, i.e. there are three Winkelhaken in the upper row, and the top one is enlarged. The distinguishing element is here the size and position of the vertical. While for variation AM~3 and AM~6, it is placed underneath the upper horizontal, AM~1 displays a vertical that is impressed above the upper horizontal. Thus, these three variations represent the same variant, but small differences in the execution characterise them (see fig. 214). For the discrimination

Fig. 214: AM~3 (AA770:29), AM~6 (AT489:24), and AM~1 (TA198:28).

of handwriting and the identification of writers, such details are decisive. However, for the analysis of a common educational background, probably also the variant of a sign matters. Consequently, some of the sign variations were grouped together as follows[175]:

Sign	Combined numbers of sign variations[176]	Explanation
AM	• 1 + 3 + 6 + 11 • 2 + 4 + 7 + 12 + 14 + 16 • 8 + 10 • 5 + 9 + 13 + 15 • 17	The groups are clustered according to the number of Winkelhaken in the upper row of the Winkelhaken formation (independent of stroke order or enlargement of any wedge), and whether they are written with Winkelhaken or intersecting oblique wedges.
DÍ	• 1 + 2 + 5 + 6 + 7 • 3 + 4 + 8	The different variants are based on the number of Winkelhaken in the upper row.
DU	• 1 + 2 + 4 • 5 + 6 • 3 + 7	The main difference is whether it is a short or long variant, as well as the position of the first vertical (crossing the first lower horizontal or not).
IM	• 1 + 2 + 6 + 7 • 4 + 5 + 10 • 3 + 8 + 9	The discriminating element is the number of Winkelhaken, and whether the one at the bottom is a Winkelhaken or an oblique wedge.
KÀ	• 1 + 2 + 6 + 10 • 4 + 5 + 7 + 8 + 9 + 14 • 12 + 13 + 15 + 16 • 3 + 11 + 17 + 18	Here, the discriminating element is not the number of horizontals or small verticals, but their arrangement, whether the wedges have the same length or not, as well as the Winkelhaken or oblique wedges at the end of the sign.
ŠA	• 1 + 2 + 10 • 3 + 4 + 7 + 11 • 6 + 9 • 5 + 8 + 12	The same as KÀ.
TIM	• 1 • 2 • 3 • 5 • 4 + 6 + 7	In case of TIM, most of the sign variants cannot be grouped. The only cluster is made on the basis of missing verticals and oblique wedges instead of normal small Winkelhaken in the middle.
ZI	• 1 + 2 + 9 • 3 + 4 + 6 + 10 • 5 + 7 + 8	The discriminating element of ZI is the number of Winkelhaken in the lower row.

175 Not all the diagnostic signs were grouped because it was not always possible to find clear variants for the different variations, for example for KÙ and LI.

176 Each number represents the respective sign variation as it is noted in the *dataset_all*, i.e. 1 = AM~1 / BA~1, etc.

First, the three families will be discussed separately to identify potential family traits and shared characteristics that might point to a common educational background. The focus lies on the family of Ali-ahum, the two other families are briefly introduced and their handwriting is analysed including elements which are also included into the *dataset_all*. Other elements, that are not suitable for a statistical approach like the movement of spacing are not discussed unless they are very peculiar and specific to a writer.

Finally, the three families are compared with each other. The aim is the same as above: such a comparison might emphasise specific family traits, but also discriminating elements. In addition, an analysis of the different generations might also give more information on general writing habits, and the use and evolution of script.

4.4 The Family of Ali-ahum

4.4.1 Comparing the general Use of Signs

As mentioned before, Aššur-taklāku has the largest corpus with 30 tablets, at least most of them written by the same person. For a comparison, all of them are included into this part of the study. A total of 121 different signs, excluding numbers and word dividers, are written on these 30 tablets. From his sister Tariša seven tablets remained, all of them written by the same person. A total of 110 different cuneiform signs can be found on her tablets. From their father Ali-ahum, 17 tablets were included into the study of his handwriting, but the two tablets AA199 and AA317 which are certainly written by someone else are therefore excluded from this part of the study. The other two tablets AA189 and AA889 which are also very questionable still show several similar sign variants as the rest of the corpus so that they are included into the following comparison. Because of the exclusion of two tablets, the total of different signs here is reduced from 114 to 110 signs, because four particular characters, ÌŠ, Ištar, LA, and SIPA are only written on one of those two tablets.

Regarding the general use of signs, most of them are obviously commonly used by all the writers. Therefore, more interesting are signs that are not found on every tablets. Here, however, the use or non-use of a sign seems to depend mostly on the context rather than the ignorance of the writer. For example the two logograms GIG (*aršātum* "wheat"), and DIRI (*watrum* "in addition") can only be found in Aššur-taklāku's corpus. However, especially the latter is a common term in the merchants' documents, and the sign was certainly known to Ali-ahum as well. In addition, logograms and rather rare CVC signs are often elements of names or probably titles that are also not found in every text. On Ali-ahum's tablets, the sign for LUGAL ("king") is written as part of a personal name, as it is the case for the CVC sign DAN on the tablets of Aššur-taklāku and Tariša.

Furthermore, in some cases, the use of specific signs also points to the personal living conditions of the individuals. Ali-ahum and his son were travelling merchants, therefore donkeys (ANŠE) and caravans (ELLAT) were essential for them, and an important topic for the implementation of their business. For Tariša, staying in Aššur, they were probably less important, and both terms are therefore not used in her texts. On the other hand, she was dealing with family affairs in the City, thus, she had to handle completely different matters like officials (NU.BÀNDA = *laputtum* "steward"), gods (NIN.ŠUBUR = *Ilabrat*), and emblems of the City (GÍR = *patrum* "dagger"[177]).

In regard of the syllabic signs it has to be noted that especially on Tariša's tablet TA543 the two signs AP and DÌ (TI) can be found. In the Old Assyrian texts, usually other signs with the same phonetic value, ÁB and DÍ, are preferred (and both common signs are actually written on the same tablet as well). Kryszat suggests to ascribe both signs to the early Old Assyrian writing style (2015, 111-112).

tablet	bi	bi2	bi4	la	la2	šur	šur3	um-ma	u-corr.	tak-use
TA143b	1		1	1	1		1		1	
TA198	1		1	1	1		1		1	
TA301			1		1		1		1	1
TA352			1		1		1		1	
TA543	1		1	1	1		1		1	1
TA564	1		1				1		1	
TA722	1			1	1		1		1	
AA189			1		1		1	1		1
AA191		1			1		1	1	1	
AA192		1	1		1		1	1		
AA195	1				1		1	1		1
AA303	1	1	1		1		1	1		1
AA328	1	1	1		1		1	1		1
AA329	1		1		1		1	1		
AA332	1	1	1		1		1	1	1	1
AA343		1			1		1	1		1
AA566	1				1		1		1	
AA769	1	1			1		1	1	1	
AA770	1	1	1		1				1	
AA889			1		1	1		1	1	
AA936			1		1	1		1	1	
AA937	1		1		1		1	1		1
AT151	1		1		1		1	1		
AT176	1		1		1		1	1		1
AT284	1		1		1		1	1		
AT295	1				1		1		1	
AT316	1		1		1		1	1		
AT456	1				1		1	1	1	1
AT468	1		1		1	1	1	1	1	1
AT473	1		1	1	1	1	1	1		1
AT482	1		1	1	1		1	1		1
AT489	1		1		1		1	1	1	1
AT505	1		1		1		1	1	1	1
AT508	1		1		1		1			1
AT509	1		1		1		1		1	1
AT514	1		1		1		1		1	1
AT516	1		1		1	1	1	1		1
AT519	1		1		1		1	1	1	1
AT520	1		1	1	1		1	1	1	1
AT526	1		1	1	1		1	1		1
AT527	1		1	1	1		1	1		1
AT528	1		1		1	1	1	1		1
AT537	1		1	1	1		1			1
AT539	1		1		1		1		1	
AT544	1	1	1		1		1	1		1
AT599	1				1		1	1	1	1
AT606			1		1		1	1	1	1
AT666	1		1		1		1		1	1
AT708	1		1		1		1	1	1	1
AT714			1		1		1	1	1	1
AT736	1		1		1		1	1	1	1
AT781	1		1		1	1	1	1		

Fig. 215: The use of signs of the family of the 93/k-archive.

As mentioned above, the writing of the other phonetic values /bi/, /la/, and /šur/ can be distinguished in earlier and later traditions according to Kryszat (2015, 112). But on the tablets of the 93/k-family, their use is not very distinct (see fig. 215). While the earlier sign BÍ (NE) is written in a very specific context (*qí-bí-ma*) on most of Ali-ahum's tablets, on Aššur-taklāku's tablets it is only written once on AT544, in the same context. It is missing in Tariša's letters. Instead, on her tablets, as far as they are preserved, the sign BI is used for *qibi-ma*. On Aššur-taklāku's tablets, all three signs BI, NE (BÍ), and BE (BI_4) are used for this term. Regarding the writing of /la/, the early writing LA can be found on four of seven tablets of Tariša, and on six of the 30 tablets of Aššur-taklāku. In the letters of Ali-ahum it is only written on the two tablets that show a completely different handwriting, AA199 and AA317, which are excluded from this part of the study. On the other tablets of Ali-ahum, only LÁ can be found. Regarding the signs ŠUR and ŠÙR, Kryszat suggests that ŠÙR belongs to an early writing style and ŠUR to a later one. On the tablets of Ali-ahum and his son, both signs can be found. While on the latter's tablets, both signs are used interchangeably, on Ali-ahum's tablets, either one or the other sign is written. In Tariša's texts, only ŠÙR can be found.

177 The *patrim ša Aššur*, the "dagger of Aššur" can especially be found in Old Assyrian legal texts. It was presumably a sacred artefact of the City god, and oaths were sworn in front of it (Veenhof 2008, 56).

The ligature of the sign combination *um-ma* is not written on Tariša's tablets, but mostly executed on the tablets of the two other senders. The distinguished use of the two signs Ú and Ù can be observed on all of Tariša's tablets, while on Ali-ahum's and Aššur-taklāku's tablets, in half of the texts they are correctly applied, and in the other half their use is irregular. Finally, the use of the sign TÁK instead of the sign combination *ta-ak* differs from individual to individual. On the tablets of Aššur-taklāku TÁK is clearly preferred, with only a few exceptions. On Ali-ahum's tablets, the difference between the two representations of the sound is not that big, but TÁK is still more often used. The opposite can be found on Tariša's tablets. Here, the sign combination *ta-ak* is clearly favoured, while TÁK is only written twice (see for these three discriminating elements also fig. 215).

To conclude, while there is no clear distinction in regard of the use of signs and the three letter senders, there are certain tendencies. On Tariša's tablets, probably the strongest tendency to a certain conservatism is notable in regard of the use of specific signs. Also on Ali-ahum's and Aššur-taklāku's tablets several signs of the older writing style can be found, but while Ali-ahum seems to follow certain conventions like the use of the sign NE (BÍ), the non-use of LA, and the distinct writing of the phonetic value /šur/, his son used the respective signs interchangeably.

On a more general level (see *dataset_all*), it can be observed that the tablets of Ali-ahum and Aššur-taklāku show more similarities to each other in comparison to Tariša's tablets. The writer of her tablets has a very regular and even handwriting. He (or she) does not only show peculiar tendencies in regard of the use of signs, but there is also a very distinct writing style on her tablets. The only indecisions can be found for the writing of the phonetic values /la/ and /tak/. On the other hand, on the tablets of her father and brother, hardly any sign version is consistently written on a tablet, but several natural variations can be found frequently, with tendencies towards a preferred use towards one or another. Regarding the use of signs, on their tablets, such tendencies can be observed as well, especially in case of the ligature *um-ma*, and the writing of /la/ and /tak/. These tendencies show the opposite of Tariša's writing style.

4.4.2 A Comparison of the Form

In general – The Dataset (*dataset_all*)

A general overview of the *dataset_all* shows that in several cases, most of the tablets of the three senders show basically the same sign variations. Especially in case of the sign BA (see above fig. 213) where the only distinction is made between a horizontal or an oblique lowermost wedge, the three corpora show the same main tendency towards the variation with an oblique wedge at the bottom, while the second variation with a horizontal is only represented on a few tablets each. Similar distribution patterns can be observed for the signs KI, MA, TIM, and Ù.

On the one hand, in several cases specific sign variations can be assigned to mainly one person. For instance the sign DU is represented with a total of four variations on the tablets of the three senders. The first variation, DU~1, can be found on tablets of all three senders, however, it is written on most of Tariša's tablets, and only written on one tablet of Ali-ahum (AA889) and five tablets of Aššur-taklāku (AT176, AT514, AT516, AT537, AT539). On the other hand, DU~3 is written on all the other tablets of Ali-ahum, but only on two tablets of his daughter and four tablets of his son. The sign variation DU~4 is exclusively written on most of Aššur-taklāku's tablets, but neither on the tablets of his father nor of his sister (see fig. 216). Thus, even though there are some overlaps, in general, each sender seems to have one or more major variants, unique or at least particular to his handwriting. The same distributional phenomenon can be observed for the signs AM, DÍ, IM, KÀ, KÙ, and ŠA.

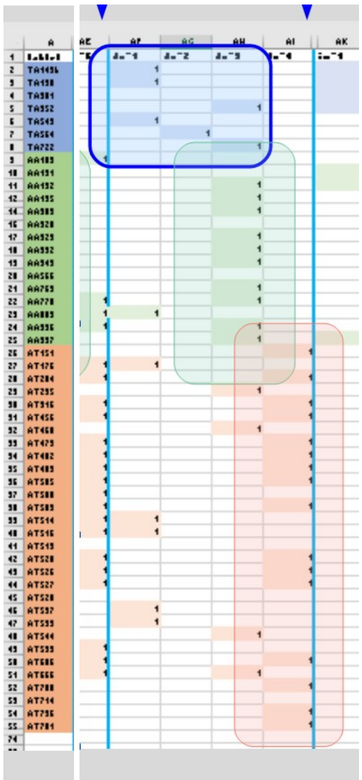


Fig. 216: The variations of the sign DU on the tablets of TA, AA, and AT.

In the case of the signs KU, LI, RI and ZI, their variations are distributed between two parties, i.e. the tablets of two senders have the same variations, while the tablets of the third sender have predominantly different variations. For instance the sign RI is distinguished on the basis of the position of its Winkelhaken. On most of the tablets of Ali-ahum and Tariša, the Winkelhaken is on the same level, while on most of Aššur-taklāku's tablets, it is differently placed. The same phenomenon but with altered parties can be found for the signs KU, LI, and

ZI. Here, Ali-ahum and his son show the greatest consensus, while Tariša's tablets display mostly different variations of the respective sign.

In general II – The Resorted Dataset (*dataset_all_resort*)[178]

As mentioned above, on the excel chart named *dataset_all_resort*[179] a selection of signs are rearranged on the basis of their variants (e.g. AM, DÍ, DU, IM, KÀ, ŠA, TIM, ZI). By comparing this selection with the signs mostly written with unique or at least peculiar variations on the three writer's tablets (i.e. AM, DÍ, DU, IM, KÀ, KÙ, ŠA), it can be noted that the two lists coincide in most cases: This applies for the clustered sign variations of AM, DÍ, DU, IM, KÀ and ŠA, and in addition KÙ, TIM and ZI.

Two main observations can be made: The first one is that especially on the tablets of Tariša and her brother Aššur-taklāku frequently the same sign variant is preferred. The second observation is that the tablets of Ali-ahum are partly divided into two groups, and while on one half of the tablets the same variant is written as on the tablets of his children, on the other half, another variant is used.

Regarding the common variants on the tablets of the two siblings, this pattern can be observed especially with the signs AM and DU. For the former, the most common variant is the one with three Winkelhaken in the upper row. The main discriminating element is the position and size of the small vertical wedge in front of the Winkelhaken formation. On Tariša's tablets, it is usually impressed above the upper horizontal, while on her brother's tablets, it is more often positioned between the two horizontals, and sometimes also shifted towards the heads of the horizontals. On the tablets of their father, the variant with four Winkelhaken in the upper row is preferred, written with different variations especially in regard of the size of the last upper Winkelhaken.

Fig. 217: The sign DU on TA143b:47, and AT489:6, while both represent the same variant, they are classified as two different variations.

The sign DU on most of Tariša's and Aššur-taklāku's tablets is written with the long variant, i.e. the combination of a horizontal and the Winkelhaken on its tip is shifted from the middle downwards so that it is placed

178 This part of the study focuses on the general tendencies of the individual writers. Therefore, as a rule, only the mainly used variants are discussed. However, this does not mean that there are no overlaps or exceptions of the general use of sign variants on the corpus of a sender.

179 The chart can be found in the appendix on the CD-ROM.

after the first horizontal at the bottom. Regarding the variations, on Tariša’s tablets mostly the upper horizontal is connected to the first vertical while there is a gap between its tip and the second vertical. On Aššur-taklāku’s tablets, this upper horizontal is mostly shifted towards the second vertical and leaves a gap to the first vertical (see fig. 217). On the other hand, on Ali-ahum’s tablet the short variant of DU is preferred.

The two signs DÍ and IM are written on the sinling’s tablets with the same variant that is also used on about half of their father’s tablets. On the other half, another variant is preferred. The common variant of DÍ is written with three Winkelhaken in the upper row. It is notable that father and son have the same preference for positioing the wedge at the bottom (i.e. either under all the upper Winkelhaken, or slightly shifted to the right so that the upper left wedge is protruding) while the writer of Tariša’s tablets preferred another positioning (i.e. either the upper left and right wedges protrude, or only the right one). On the other half of Ali-ahum’s tablets, a variant is preferred with four Winkelhaken in the upper row. It is interesting that on Ali-ahum’s tablets, both variants are represented with two different variations. These variations, however, correspond in regard of the position of the lower wedge and therefore the shape of the sign (fig. 218). The difference is, as mentioned, the number of wedges in the upper row.

Fig. 218: The two variants and four variations of DÍ on Ali-ahum's tablets: AA936:8a, AA769:4, AA195:9, AA328:14.

The discriminating element of the sign IM is the Winkelhaken formation, which has very often the same shape as the sign DÍ on the respective tablet. Accordingly, the variant written on Tariša’s and most of Aššur-taklāku’s tablets is similar to the sign DÍ on the respective tablets, i.e. the variant with three Winkelhaken in the upper row. The same applies to Ali-ahum’s tablets. Also here, his tablets are divided into two groups. One shows the variant written on the tablets of his children, on the tablets of the other group IM contains four wedges in the upper row of the Winkelhaken formation.

In the case of ŠA, not only Ali-ahum’s tablets, but also Aššur-taklāku’s tablets can be divided into two main groups. One half of their corpora as well as Tariša’s corpus show the same sign shape which is defined by a horizontal at the bottom of the stack that is longer than the rest of the wedges (which are all impressed on the same vertical axis). In case of this sign, its variations are not clustered on the basis of the number of wedges. Instead, only the general shape, i.e. mainly the length of the horizontals was taken into consideration. The reason for this is the frequent inconsistency of the wedge numbers. As mentioned before, it is possible that the number of the horizontals seems to depend partly on the quality and thickness of the stylus. If it was possible to impress very thin wedges, the writer simply "filled in" as many wedges as possible, or as were aesthetically pleasing for him or her.

The second half of Ali-ahum's corpus shows a shape with equally long horizontals. It is basically the same group of tablets on which also another variant of the sign DÍ and partly IM is written. Thus, they might show a change of handwriting style. The second main group of Aššur-taklāku's corpus shows a kind of "sloppy" variation of ŠA. Here, the stacked horizontals are shifted to the right, and from the bottom to the top.

The signs KÀ and ZI are clustered differently. Like the sign ŠA, KÀ is not clustered according to the number of horizontals or vertical wedges because their number is often not very consistent. Instead, the different variations are grouped according to their general shape. Here, Tariša's and Ali-ahum's tablets show in general the same sign shape, i.e. variations and variants with stacked horizontals of the same length and normal Winkelhaken at the end. On Aššur-taklāku's tablets, on the other hand, the standard type of KÀ has a prolonged horizontal wedge at the bottom while the upper ones are positioned on the same vertical axis.

In case of the sign ZI, the tablets of father and son show mainly the same type which has two Winkelhaken in the bottom row and a different number of Winkelhaken in the upper row. On Tariša's tablets, a variant with three Winkelhaken at the bottom is written. Here, too, the number of Winkelhaken of the upper row is not completely consistent.

4.4.3 Preliminary Conclusion

The comparison of the use of signs of the three individuals does not lead to a conclusive answer yet. The analysis of the detailed sign variations has shown that the five signs BA, KI, MA, TIM, and Ù are basically written with the same variation on most of the tablets of the three corpora. Seven other signs, AM, DÍ, DU, IM, KÀ, KÙ, and ŠA show several peculiarities for each of the sender. Specific variations of the remaining four signs, KU, LU, RI, and ZI, are written by two of the three writers while the third one preferred another variation. Here, Ali-ahum's and Aššur-taklāku's tablets show the most similarities.

However, the analysis of the general sign variants shows a different picture. Here, especially the tablets of Tariša and Aššur-taklāku show more common variants compared to the preferences of their father. Furthermore, in case of the latter, it can be noted that his tablets are partly divided into two groups. While on one half the same variant is written as on the tablets of his children, on the other half of his tablets, another variant is used.

Consequently, a tentative conclusion would be that Aššur-taklāku's tablets show several similarities with his father's tablets, but they also show several similarities with the tablets of his sister, which they do not share with those of their father. Accordingly, the writing style of the writers of Tariša's and Ali-ahum's tablets share hardly any similarity that is not also written on Aššur-taklāku's tablets. On the basis of these observations, the drawing of any conclusion about any educational background is not possible yet.

In general, the comparison has shown that although the three corpora have some differences, they also have many similarities. However, the comparison of similar objects cannot lead to conclusive results, but requires a contrast that makes the similarities and differences obvious. Therefore, the handwriting of Ali-ahum's family has to be compared with the writing of unrelated individuals as well, like the family of Aššur-nādā and the family of Elamma.

4.5 The Family of Aššur-nādā[180]

In 2002, M.T. Larsen published the reconstructed archive of the Old Assyrian merchant Aššur-nādā and his family. The 176 texts, which are now housed in public and private collections all over the world[181] reflect the live and business affairs of three generations of his family.

Aššur-idī was the head of the family and boss of the trading company (AI).[182] Together with his three sons Aššur-nādā (AN), Aššur-taklāku (AS), and Ilī-ālum (IA), he managed the trade in Anatolia. In addition, a few letters of Aššur-nādā's son Iddin-Ištar (II) remained, who took part in his father's business as well.[183]

The main aim of this analysis is the comparison of the handwriting of family members in order to learn more about potential educational interactions. Hence, an extensive analysis of the individual handwriting, as it was done for the family of the 93/k-archive, is not included. Nevertheless, each family member and his corpus is introduced briefly and peculiarities of their handwriting are summarised.

4.5.1 Aššur-idī

The identification of Aššur-idī, father of Aššur-nādā, is rather difficult because there are at least 23 known patronymics. Larsen, however, suggested that the father of Aššur-nādā might have been the son of Šuli. In that case, he would have been active from at least c. 1925 to 1878 B.C. (REL 48 to 95) giving him an active career of at least 47 years. If he was not the son of Šuli, the only known dates are eponyms mentioned in his letters AI012, AI036, and AI041 pointing to the years c. 1895 to 1886 BC (REL 78 to 87) (see for the discussion of filiation and date Larsen 2002, xx). At least the latter and much shorter period identifies him as a contemporary of Ali-ahum of the 93/k-archive (who was at least active from c. 1893 to 1878 BC).

All the letters from Aššur-idī seem to have been sent from the city of Aššur, and there is no indication in these texts that he had been travelling, or even living in Anatolia before. The

180 My gratitude to Cecile Michel for most of the pictures in this chapter. Additional images were provided by the Cuneiform Digital Library Initiative (https://cdli.ucla.edu/), namely the pictures for tablets AN046, AN051, AN054, AS086, IA075, IA078, IA079, IA082, and OAAS 1, 149, and 153.

181 See for the complete list of tablets, publications, and current whereabouts Larsen 2002, 244-247.

182 The tablets were not legally excavated, hence they do not have excavation numbers but only museum numbers. In this study, they will be named according to their sender, e.g. Aššur-idī = AI, and the text number in Larsen's publication (OAAS 1). For example the letter sent by Aššur-idī, and published in OAAS 1 as the seventh text, is named as AI007.

183 For more information abut the family, see Larsen 2002, xix-xxxiii.

name of his wife is unknown, but three sons of his are mentioned and addressed in his letters: Aššur-nādā, Ilī-ālum, and Aššur-taklāku. A woman named Ša-Aššur-mādā might have been his daughter. From his letters is known that he was involved in the overland trade to Anatolia, and dealt with textiles and tin (Larsen 2002, xxi).

The Tablets of Aššur-idī

Twelve letters from Aššur-idī are included into this study, all of them authored by him alone. They are mostly addressed to his sons, especially Aššur-nādā. Only AI006 is addressed to two men, presumably a business partner and a transporter.

On the twelve tablets, a total of 113 different signs can be found with all in all 181 different readings. On the individual tablets, the number of different signs ranges from 36 to 81, but the average lies between 55 and 66 (in table 17 marked with blue colour). The different readings range from 39 to 101, with an average between 69 and 83.

Tablet	Sender and position	Addressee(s)	Total of signs	Different reading	Different signs
AI006	mentioned first	two men	230	69	55
AI014	mentioned first	Aššur-nādā	299	75	57
AI015	mentioned first	Aššur-nādā	310	83	66
AI017	mentioned first	Aššur-nādā	376	83	66
AI018	mentioned first	Aššur-nādā	385	92	71
AI024	mentioned first	Aššur-nādā	73	39	36
AI026	mentioned first	Aššur-nādā	242	76	63
AI032	mentioned first	his three sons	127	53	49
AI036	mentioned first	Aššur-nādā and Aššur-taklāku	507	101	81
AI040	mentioned first	Aššur-nādā and Ilī-ālum	231	80	66
AI041	mentioned first	Ilī-ālum and Aššur-taklāku	215	74	59
AI042	mentioned first	Aššur-taklāku	204	69	60

Table 17: The letters of Aššur-idī and an overview of the use of signs.

The tablets of Aššur-idī can be divided into tablets shaped in the portrait format (AI014, AI015, AI017, AI018, AI036, AI040, and AI042), and square format (AI006, AI024, AI026, AI032, and AI041). All the tablets are complete. A peculiarity of AI040 is that the tablet seems to have been fallen while not completely dried yet so that it is slightly deformed on the left side. In general, the shape of these tablets looks very similar. The edges are only slightly convex, and especially on the larger tablets like AI015, AI017, and AI036, they are basically straight. They usually end in straight corners, which are partly even rounded. The ruling on most of the tablets is mainly straight, and only in a few cases it is bend upwards like on AI006.

Use of Signs

Regarding the use of signs, hardly any pattern is discernable. For the phonetic value /bi/ the two signs BI and BE (BI_4) are used while the latter is clearly preferred. The sign can be found on ten tablets, and on seven of them it is the only used sign. The sign BI, on the other hand, is written on five of these tablets, and solely used on two of them. Similar patterns can be observed for the phonetic syllables /la/ and /šur/. For the former, LÁ is preferred, it is written on every tablet while LA can additionally be found on four of them. The sign ŠÙR can be found on almost all the tablets except AI024. On this tablet, only ŠUR is used, and furthermore, it is used in addition to ŠÙR on AI026. For the distinguished use of the two signs Ú and Ù the tablets are divided into equal groups.

Tablet	BI	BE (BI_4)	LA	LÁ	ŠUR	ŠÙR	/u/ corr.	*um-ma* lig.
AI006		x		x		x	x	
AI014		x		x		x		
AI015	x		x	x		x		x
AI017	x	x	x	x		x		x
AI018	x	x		x		x	x	
AI024	x			x	x		x	x
AI026		x		x	x	x		
AI032		x		x		x	x	x
AI036	x	x	x	x		x		x
AI040		x	x	x		x	x	
AI041		x		x		x	x	
AI042		x		x		x	x	x

Table 18: The use of signs on Aššur-idī's tablets.

Form[184]

On table 19, the different variants written on Aššur-idī’s tablets are recorded. The tablets are arranged according to their similarities. The mainly used variations are marked in red, other more often written variations are marked in either green or blue. The table shows that especially KÀ was written with a wide range of variations. It is problematic that the movement on Aššur-idī’s tablets is very uneven, and often wedges are hardly visible due to very faint impressions or the overlapping of wedges so that details are partly not recognisable. In addition, the writer tends to scribble and to correct his writing by adding further wedges (see fig. 219, AI015:22). Therefore, the number of wedges changes frequently.

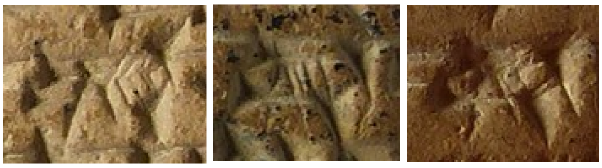


Fig. 219: A correction on AI015:22; and AM~10 (AI014:19), and AM~12 (AI041:7).

For instance, the sign AM is written with four different variants. However, the number of wedges is sometimes not clearly countable, and for instance AM~10 and AM~12 might be the same (see fig. 219). The other signs are usually written with two to three variations. No sign is written in the same way on all twelve tablets. Nevertheless, none of these tablets really stands out in regard of a completely different usage of sign variants. Thus, for the time being, it will be assumed that they were written by the same writer. An identificaton of the writer of these texts, however, is not possible yet.

Tablet	AM	BA	DI2	DU	IM	KA3	KI	KU	KU3	LI	MA	RI	ŠA	TIM	U3	ZI
AI014	10	2	6	4	2	7	1	2	-	2	2	4	7	5	2	3
AI015	10	2	6	5	8	7	1	3	7	2	2	-	8	5	4	7
AI017	10	2	6	5	8	7	1	3	7	5	2	4	8	5	4	7
AI036	12?	2	6	5	8	8	1	2	7	5	1,2	4	8	5	4	7
AI040	11	2	6	4	6	7,11	2	2	7	5	1	4	2	-	5?	7
AI024	11?	2	2	-	8	-	3	2	7	5?	1	-	2?	-	-	-
AI018	11	2	2	4	2	9	2	2	7	2	1	-	2	5	5	7
AI026	11	2	6	5?	2	7	1	1	7	2	1	2	2	5	5	-
AI032	9?	-	6	-	-	-	3	2	7	2	1	2	7	-	2?	-
AI006	9	-	2	4?	-	2	3	2	-	2	1	2	2	4	4	3
AI041	12	-	2	5?	2	7	3	2	2	2	2	4	2	-	5	3
AI042	12	1	2	-	2	10	1	2	2	2	2	4	2	4?	2	3

Table 19: The sign variations on Aššur-idī's tablets.

184 For the image tables see the document Appendix_ch4_Assur-idi on the attached CD-ROM.

4.5.2 Aššur-nādā[185]

Aššur-nādā was the oldest son of Aššur-idī. His letters indicate that he was living in Kaneš, and hardly visited Aššur. He managed the family business in Anatolia, and also travelled a lot. In addition to the family trade with textiles and tin, he seems to have been involved into the copper trade. He had a wife living in Aššur, possibly named Parrurtum, with whom he had at least one son and two daughters (the name of the son was Iddin-Ištar, the names of the daughters are unknown). He also had an *amtum*-wife, an Anatolian woman, called Šišahšušar. She managed his household in Kaneš, and they had children as well; one daughter with the name Ištar-lamassī is known (for more detailed information on Aššur-nādā see Larsen 2002, xxv-xxix).

According to Larsen, Aššur-nādā was active at least from REL 77 to 101, i.e. c. 1896 to 1874 BC. Thus, at least the first ten years of his known activities overlap with the active period of his father Aššur-idī (c. 1895-1886), and an even longer period with Ali-ahum of the 93/k-archive (c. 1893-1878).

The Tablets of Aššur-nādā

Six tablets of Aššur-nādā are included into this study. Three of them are addressed to his father Aššur-idī, and in all of them the latter is mentioned before the sender (AN046, AN047, AN048). Unfortunately the provenance of these tablets is unknown, but it is very likely that they were found in Kaneš. In this case, these three tablets addressed to Aššur-idī would be copies of the originals sent to Aššur.

On three other tablets, Aššur-nādā is mentioned before the addressees. Two of these tablets are addressed to his *amtum*-wife Šišahšušar (AN051, AN052). Regarding their provenance, would they have been excavated in Kaneš, these tablets would certainly be the original tablets that Aššur-nādā had sent to his wife. The last letter is addressed to one of his younger brothers, Aššur-taklāku (AS) and his wife Šišahšušar (AN054). Here, too, the provenance is unknown, but since some domestic matters are addressed, the letter was probably mainly meant for Šišahšušar, and in case the tablet was excavated in Kaneš, it would most likely be the original as well.

185 Stratford (2015, 123-124, 126) studied several of Aššur-nādā's tablets as well. A clear answer is not given by the author whether Aššur-nādā is the writer of his own texts. But he points out that in case of Aššur-nādā it is possible to distinguish between different homonymous individuals on the basis of the handwriting.

Five of the tablets are complete, only on AN048 the lower left edge is broken apart. Four tablets have basically a square format (AN046, AN047, AN051, AN052), and only two are a bit larger and shaped in the portrait format (AN048, AN054).

The shape of the tablets strongly resembles the shape of Aššur-idī's tablets. Namely, the edges of the portrait format are slightly convex while especially the edges of most of the square tablets are quite straight. A difference can be observed regarding the corners. On Aššur-idī's tablets, they are straight or rounded. On Aššur-nādā's tablets, they are mostly straight or slightly pointy. On the portrait formats they seem almost a bit squeezed.

An exception is only AN046, here, the left and right edge are a bit more convex and especially the corners are considerably rounded.

Also the ruling is peculiar. On five of these tablets (the exception is AN046), it becomes upward oblique after only a few lines. In addition, on their obverse, the first ruling is drawn through, but the following two to maybe three ruled lines end approximately in the middle of the tablets, while the rest of written line becomes oblique and messy (see fig. 220). On AN046, the ruling is basically straight and evenly drawn through.

Fig. 220: The ruling ends somewhere in-between on AN051.

Most of Aššur-nādā's texts are not very long, and have between 17 (AN046) and 39 (AN048) lines. Hence, the total of signs per tablet, the different readings and signs are not very high compared to other senders. All in all, 88 different signs can be found with a total of 124 different readings.

Tablet	Sender and position	Addressee(s)	Total of signs	Different reading	Different signs
AN046	mentioned second	Aššur-idī	101	39	36
AN047	mentioned second	Aššur-idī	151	57	50
AN048	mentioned second	Aššur-idī	250	77	63
AN051	mentioned first	Šišahšušar	160	58	53
AN052	mentioned first	Šišahšušar	111	56	48
AN054	mentioned first	Aššur-taklāku and Šišahšušar	171	66	56

Table 20: An overview of the tablets of Aššur-nādā and the use of signs.

Use of Signs

Also on Aššur-nādā's tablets the sign NE (BÍ) is never used for the phonetic value /bi/. Instead, on most of the tablets BI and BE (BI_4) are written. On AN047 only BE, and on AN051 BI can be found. In case of the phonetic value /la/, on all tablets LÁ, and only on AN048 additionally LA is written. A similar use can be noted for /šur/. Here, ŠÙR is written on every tablet, and on AN046 and AN048 additionally ŠUR. In case of the latter, no specific pattern can be found. In the letterhead of AN046 ŠUR is used twice while in the following text ŠÙR is written. On A048, mostly ŠÙR can be found, but somewhere in-between ŠUR is written as well (l. 32). The same applies basically to the two other phonetic values. On most of the tablets – when BI is written there as well – it is used for the imperative *qibi-ma* in the letterhead. An exception is AN046, here, BI_4 is used for the imperative. The two signs Ú and Ù are both written on four of the six tablets, the exceptions are AN046 and AN052. Nevertheless, on all six tablets the signs are used correctly, i.e. in particular functions as vowel or conjunction.[186]

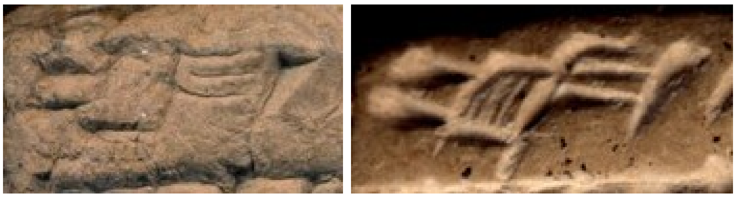


Fig. 221: The connection um-ma, AN054:1 vs. AN051:1.

On all of Aššur-nādā's tablets, *um-ma* is written with ligature. However, a peculiarity is notable in regard of MA especially in this combination. Usually the lowermost horizontals of UM and MA are on the same level. On most of Aššur-nādā's tablets, however, they are not on the same level, but MA is shifted upwards so that its lowermost horizontal is positioned in the middle of the sign UM or higher. On some tablets, MA is then simply squeezed so that its uppermost horizontal is still on the same level as the heads of the verticals of UM. On other tablets, the complete sign is shifted upwards (see fig. 221).

186 In the transliteration of AN048:36 published by Larsen, an Ú is written in the position of a conjunction. However, this part is partly broken and the remaining impression of the sign hardly reminds of Ú. Therefore, it is not included into the analysis.

Tablet	BI	BI_4	LA	LÁ	ŠUR	ŠÙR	/u/ corr.	*um-ma* lig.
AN046	x	x		x	x	x	x	x
AN047		x		x		x	x	x
AN048	x	x	x	x	x	x	x	x
AN051	x			x		x	x	x
AN052	x	x		x		x	x	x
AN054	x	x		x		x	x	x

Table 21: The use of signs.

Form[187]

A comparison of the diagnostic signs shows a mostly consistent hand on five of the six tablets. As it is also notable in regard of tablet shape and ruling, tablet AN046 differs from the rest of the tablets. The same observation can be made for sign forms. It is problematic that half of the 16 diagnostic signs are not written on AN046. But five of the remaining eight signs show variants not found on the other five tablets of Aššur-nādā. Consequently, this tablet seems to have been written by someone else.

The remaining five tablets were most likely written by the same person. In general, it can be noted that most of the sign variants are consistently written on each tablet. Only in case of KÀ and ŠA, especially in regard of the number of stacked horizontals, several irregularities can be noticed. Another tablet that seems a little bit different is AN048. It is the largest tablet of this corpus, and in a few cases it shows different sign variants. However, most signs match with their typical form on the other tablets. In addition, the ruled lines in the upper part of the obverse also end partially in the middle of the tablet here. Therefore, it will be considered as written by the same writer as well.

The observations are recorded in the following table. Because of the great consistency of sign variants, only the differing versions are marked with colours.

187 For the image tables see the document Appendix_ch4_Assur-nada on the attached CD-ROM.

Tablet	AM	BA	DI2	DU	IM	KA3	KI	KU	KU3	LI	MA	RI	ŠA	TIM	U3	ZI
AN046	-	2	2	-	-	-	1	2	8	-	1	-	5	1	-	-
AN047	9	2	6	5	9	-	2	2	2	-	3	5	6	6	2	-
AN048	9	2	6	5	9	12	2	2	2	4?	3	5	6	4	2	8
AN051	9	2	6	4	9	13	2	-	-	6	3	-	6	-	2	-
AN052	9	2	6	5	9	-	2	2	-	6	1	5	6	6	2	9
AN054	9	2	6	5	9	13	2	2	2	6	3	-	6	6	2	9

Table 22: The sign forms on Aššur-nādā's tablets.

The three letters AN051, AN052, and AN054 are addressed to his *amtum*-wife Šišahšušar who was living in Kaneš. Thus, Aššur-nādā must have been somewhere else in Anatolia. His exact location, however, is not identifiable. The two other letters, addressed to his father in Aššur, implicate also that he was currently staying somewhere in Anatolia, but the exact whereabouts are not determinable. An identification of Aššur-nādā as the writer on the basis of the tablets and the location of their dispatch is not possible.

However, there are at least two other tablets, OAAS 1, 149, a debt-note with Aššur-nādā being the creditor, and OAAS 1, 153, the copy of a contract in which Aššur-nādā is one of the creditors, too. On both tablets, the signs AM and TIM show a very peculiar variation, which is also found on Aššur-nādā's letters. Here, the sign AM has two small vertical wedges placed between the horizontals and crossing the lower one. Instead of Winkelhaken, the sign is finalised by two intersecting oblique wedges, their space in-between is filled by three smaller downward oblique wedges.

Fig. 222: The sign AM on the contract and the copy of a contract, OAAS 1, 149:2, and OAAS 1, 153:7.

Also the sign TIM corresponds to the typical and peculiar variation written on Aššur-nādā's letters. The sign begins with a horizontal wedge only, and is finalised by a double structure of intersecting oblique wedges. That all three, his letters, his contract, and private note are written with the same peculiarities, and therefore by the same person, is a strong indication that he wrote his texts himself, be it a letter, a legal text, or a private note.

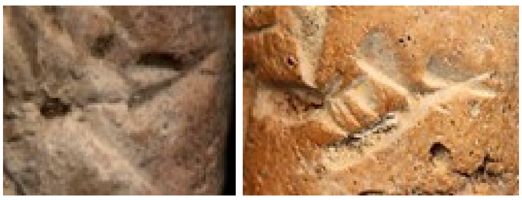


Fig. 223: The sign TIM on OAAS 1, 149:5, and OAAS 1, 153:10.

4.5.3 Ilī-ālum[188]

Ilī-ālum was a younger brother of Aššur-nādā. Larsen assumed that he must have had a house in Kaneš, too, but it was not discovered yet. The few texts concerning him give very little information about his private and business life. One letter (OAAS 1, 77:11) refers to an *amtum*-wife in Kaneš, and a few text mentioning him are dated to the years c. 1895-1891 BC. He worked for the family business of his father. He travelled in Anatolia, and frequently between Kaneš and Aššur. Like his brother Aššur-nādā, he was trading with textiles and tin, but was also involved in the copper trade in Anatolia (for more information, see Larsen 2002, xxx).

The Tablets of Ilī-ālum

Six letters sent by Ilī-ālum are included into this study. All of them were sent by him only, and he is always mentioned after the addressees. All of the letters were sent to at least one member of the family, usually Aššur-nādā. Two texts are addressed to him (IA074, IA075), three letters are addressed to Aššur-nādā and Aššur-taklāku (IA082), or other business partners (IA078, IA079). One letter (IA133) was sent to a close partner and Ilī-ālum's second brother Aššur-taklāku.

Fig. 224: The varying corners, here on IA074, and IA075.

Most of the tablets are complete, only the upper left edge of IA082 is broken off. Three of the tablets are shaped in the portrait format (IA074, IA078, IA082), and three have a square format (IA075, IA079, IA133). The edges are usually only very slightly convex, and the right and left edge more than the upper and lower one. The corners, on the other hand, vary constantly. For example on IA074, IA078, and IA079, they are mostly straight, and partly even a bit pointy and squeezed. On IA075, IA082, and IA133, the corners are straight to roundish.

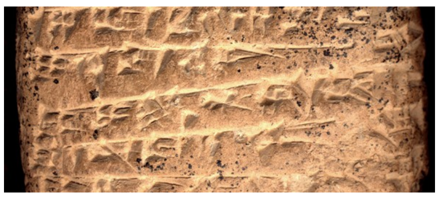


Fig. 225: The varying ruling on IA075.

Interestingly, the ruling on most tablets is straight in the upper and lower parts and only slightly inclined upwards in-between. At least the last line at the bottom, however, is straight again (especially on IA075). An exception is IA074, here, the bottom line is not completely visible, and the ruling is slightly oblique down to the bottom.

188 Stratford (2015, 126) studied some texts of Ilī-ālum as well and noticed that the hand on his tablets "is ordered, compact, but well managed".

Tablet	Sender and position	Addressee(s)	Total of signs	Different readings	Different signs
IA074	mentioned second	Aššur-nādā	384	93	73
IA075	mentioned second	Aššur-nādā	156	67	57
IA078	mentioned second	Aššur-nādā and two other merchants	606	99	79
IA079	mentioned second	Aššur-nādā and one of the men of IA078	254	79	63
IA082	mentioned second	Aššur-nādā and Aššur-taklāku	268	73	61
IA133	mentioned second	a close business partner, and Aššur-taklāku	173	46	41

Table 23: The overview of Ilī-ālum's letters and the use of signs.

The length of the letters and therefore the total of signs, but also the number of different signs and readings vary greatly. On the largest tablet IA078 a total of 79 different signs are written with 99 readings. The shortest text seems to be IA075 with a total of signs of 156. However, this tablet is not the one with the least different signs and readings. On IA133, a total of 173 signs are written, but only 41 different signs with 46 readings (see table 23).

Use of Signs

On the six tablets of Ilī-ālum, the use of signs is almost consistent. On the tablets neither BI[189], LA, nor ŠUR are written, but consistently BE (BI_4), LÁ, and ŠÙR. In addition, the sign combination *um-ma* is not written with ligature, instead, MA has always its "own" first vertical. The use of Ú and Ù is on most tablets clearly distinguished according to the different functions, except on IA133. Here, according to the transliteration of Larsen, in line 6 Ú is used as a conjunction. But this part is quite broken so the reading is uncertain. However, in line 8 the sign Ù is clearly used as a vowel of the negation *ula*. Thus, it is the only tablet on which a slight inconsistency for the use of signs can be noted.

Tablet	BI	BI_4	LA	LÁ	ŠUR	ŠÙR	/u/ corr.	*um-ma* lig.
IA074		x		x		x	x	-
IA075		x		x		x	x	-
IA078		x		x		x	x	-
IA079		x		x		x	x	-
IA082		x		x		x	x	-
IA133		x		x		x		-

Table 24: The use of signs on Ilī-ālum's tablets.

189 In OAAS 1, 82:37 (IA82), mistakenly BI is written, the sign on the tablet, however, is BE (BI_4).

Form[190]

While the use of signs is very consistent on Ilī-ālum's tablets, the sign forms vary more frequently. The greatest range of variants can be noted for the sign KÀ. This diversity, however, cannot only be observed from tablet to tablet, but also on most of the tablets, especially in regard of the number of the stacked horizontals. The same applies to the sign ŠA. While on most of the tablets a certain tendency can be observed, usually, there are also some exceptions with different numbers of wedges. The same phenomenon can be noted on the tablets of his brother Aššur-nādā. Several signs, however, show also a great consistency, especially some more elaborate signs like AM, DU, KI, and TIM. All in all, the tablets nevertheless show a rather great consistency. Therefore, it can be assumed that they were written by the same person (see table 25, again, because of the overall consistency, only the unusual sign variants are colour-coded).

Tablet	AM	BA	DI2	DU	IM	KA3	KI	KU	KU3	LI	MA	RI	ŠA	TIM	U3	ZI
IA074	13	2	6	5	9	13	1	2	2	2	1	3	2	4	4	6
IA075	13	2	2	-	9	13	1	2	2	3	1	-	2	-	4	-
IA078	13	2	6	5	9	12	1	2?	9	2	1	2	1	4	4	3
IA079	13	2	2	5	-	14	1	2	9	2	3	2	1	4	2	6
IA082	13	2	2	5	-	8	1	2?	-	2	1	2	1	4	4	1,6
IA133	13	-	6	5	9?	8	1	2?	2?	-	1	3	2	4	-	-

Table 25: The sign variants on Ilī-ālum's tablets.

A peculiarity of Ilī-ālum's letters is that some of them hint about his whereabouts. In IA78:35-36 he asks the addressees to send their answer to him in Durhumit.[191] In IA079 he does not mention his current stay, however, he speaks about a journey to the City, which indicates his current stay is somewhere in Anatolia.[192] On the other hand, in text IA082, Ilī-ālum speaks of textiles and garments that he sends to his brother. Such a shipment points to Ilī-ālum's stay in Aššur.[193] These three letters show – more or less – the same handwriting and peculiarities even though they were presumably sent from different places. Even though there is a possibility that Ilī-ālum might have had travelled with a scribe who wrote for him, it is more likely that

190 For the image tables, see the document Appendix_ch4_Ili-alum on the attached CD-ROM.
191 IA078 [35]*tí-it-ta-ku-nu* [36]*a-na Du-ur-hu-mì-it li-li-kam* "your message shall come to me in Durhumit".
192 Ilī-ālum writes, "have the silver paid, so I shall not perish on the journey to the City" ([26]KÙ.BABBAR [27]*ša-áš-qí-il*$_5$*-ma ha-ra-nam a-na* [28]*A-lim*[KI] *lá a-ha-li-iq*).
193 At the beginning of the text (l. 4-8) the goods are listed followed by instructions about their further handling.

he managed his own correspondence. And so the six texts were indeed written by Ilī-ālum, the son of Aššur-idī.

4.5.4 Aššur-taklāku (AS)

Aššur-taklāku was the youngest of the three brothers. He was married to a woman called Ištar-ummī who was at least temporarily living in Aššur. At the same time, he was married to another woman in Anatolia which is not mentioned by name (about the complicated relationship see Larsen 2002, xxxi). Like his brothers he worked in the family firm, and was mostly engaged in the transport of goods between Aššur and Kaneš. He was also travelling in Anatolia and some texts report him as being in Durhumit and in Luhusaddia. He is attested in texts mentioning dates from c. 1892 to 1886 BC (REL 81-87) (for more information see Larsen 2002, xxxi-xxxii).

The Tablets of Aššur-taklāku

The four letters were sent by Aššur-taklāku alone, and he is usually mentioned after the addressee who is his older brother Aššur-nādā. In the two letters AS085 and AS086, it is only him, in AS090 and AS091, in addition to Aššur-nādā another man called Uṣur-ša-Aššur is addressed.

The three tablets AS085, AS086, and AS091 are shaped in the portrait format, AS090 is a square tablet. AS085 and AS091 seem to be larger, their edges are straight and their corners are straight and pointy. The edges of the two other tablets AS086 and AS090 are convex, but only a little. The main difference to the two other tablets are the corners which are rather roundish.

The ruling on most of the tablets becomes slightly upward oblique after a few lines so that the lowermost line is not completely visible. An exception is AS090, on the square format the ruled lines are a bit oblique in-between, but at the bottom of the tablet they are straight again.

There are two long and two short texts according to the number of signs. The two tablets AS085 and AS086, both with rather roundish corners, show great similarities in regard of the number of different signs and their readings, as well as in the total of signs on each tablet. The other two tablets are larger, they are also written with almost the same number of different signs and readings (even though on both tablets several different signs were used). Nevertheless, the total of signs on both tablets differs for about 100 signs.

Tablet	Sender and position	Addressee(s)	Total of signs	Different reading	Different signs
AS085	mentioned second	Aššur-nādā	394	92	75
AS086	mentioned second	Aššur-nādā	179	69	58
AS090	mentioned second	Aššur-nādā, and a business partner	170	63	52
AS091	mentioned second	same addressees as in AS090, and specification to the partner	490	100	74

Table 26: An overview of the tablets of Aššur-taklāku (AS).

Use of Signs

The signs BI and BE (BI_4) are used on almost every tablet, except AS086. Here, only BI is written once. On the other tablets no clear pattern for the use of the one or the other sign can be noted. For example on AS085 BE is written six times, and only once BI is used in-between. On AS091 it is the opposite. Here, BI is written ten times, and the other sign can be found once at the edge of the obverse. The phonetic value /la/ is written on three tablets with both signs, but on AS090 only with LA. Usually no pattern is observable, i.a. because the words written with the rather rare LA are not repeated in the texts. For the phonetic value /šur/ on AS085, AS086, and AS091 ŠÙR is used, while on AS090 ŠUR is written.

On all the tablets Ú and Ù are written, and most of the time, both signs are used for their different functions as vowel and conjunction. The exception is AS085. Here, the sign Ú is written several times as conjunction, too (e.g. l. 20, 30, 42).

The sign combination *um-ma* is usually written without ligature, only on AS091 the sign MA uses the last vertical wedge of UM as its first vertical.

Tablet	BI	BI_4	LA	LÁ	ŠUR	ŠÙR	/u/ corr.	*um-ma* lig.
AS085	x	x	x	x		x		-
AS086	x	x	x	x		x	x	-
AS090	x	x	x		x		x	-
AS091	x	x	x	x		x	x	x

Table 27: The use of signs on Aššur-taklāku's (AS) tablets.

Form[194]

An analysis of the sign forms shows a large diversity of variants on the four tablets of Aššur-taklāku. No pairing of two or more tablets has a consensus of sign variants of more than nine of the 16 diagnostic signs. Nevertheless, there are usually two to three overlaps so that the four tablets still show some similarities. The only sign written with four different variations on the four tablets is the sign RI, which is distinguished on the basis of the position of the two verticals and the Winkelhaken.

The two tablets with a consensus of nine diagnostic sign variations are the two larger tablets AS085 and AS091, which have also the same tablet shape. In comparison, on the square tablet AS090 only four signs show the same variations that are also written on the pair of large tablets. However, five additional signs are similar to a variation on one of the two tablets (e.g. AS090 and AS091 have the same variation of KU, and AS090 and AS085 show the same variation of MA). Thus, there are all in all nine overlaps.

The decision whether the four tablets were written by the same person is difficult. The tablets show a great diversity of variation, but also on the tablets the writing is often inconsistent. The tablets AS085 and AS091 show the most similarities, and both have the same tablet shape. Therefore, they were most likely written by the same person. The two other tablets are differently formed, but both are also small in size. Regarding the sign variants, however, both tablets still show several similarities to AS091 and AS085. Therefore it is possible that they were written by the same person.

Tablet[195]	AM	BA	DÍ	DU	IM	KÀ	KI	KU	KU3	LI	MA	RI	ŠA	TIM	Ù	ZI
AS086	7	2	2	5	2	15	2	3	9	2	1	2	9	-	6?	3
AS090	7,9?	1	6	-	2	13	2	2	2	2	2	5	10	-	6	10
AS091	4	1	6	3	2	12	2,3	2	7	7	1	1	10	1	6	3
AS085	4	1	6	3	9	15	2	3	7	2	2	6	9	1	6	3

Table 28: The sign variations on the tablets of Aššur-taklāku (AS).

The whereabouts of Aššur-taklāku cannot be determined for sure. The four letters were most likely sent from somewhere in Anatolia. In AS086 he speaks of a copper load that he is preparing, so he must be in one of the copper centres, and Larsen suggests Durhumit (2002, 127). In the other texts, several places are mentioned like Durhumit (AS085:5), Kaneš

194 For the image tables see the document Appendix_ch4_Assur-taklaku_AS on the attached CD-ROM.
195 The tablets are arranged according to their similarities.

(AS091), and Aššur (AS085:24), but it is not clear whether Aššur-taklāku is still there, or whether he had already left. Therefore, it cannot be determined if he was the writer of these four tablets.

4.5.5 Iddin-Ištar

Iddin-Ištar was the son of Aššur-nādā and his Assyrian wife. He grew up in Aššur, the first years with his mother, but after her early death, he and his two sisters stayed with their grandfather Aššur-idī. However, they had a falling out with him and left his house. Aššur-idī wrote to Aššur-nādā in OAAS 1, 22:24-32: “I have raised your son, but he said to me: ‘You are not my father.’ - He got up and left. (…) they [the three children] got up and left to go to you”.[196] Apparently Iddin-Ištar and his sisters did not immediately leave for Kaneš, but were taken care of by colleagues of Aššur-nādā. One of them, Kukkulānum, asks Aššur-nādā for money so that the children do not have to starve (OAAS 1, 104). After arriving in Kaneš, Iddin-Ištar must have worked for his father as travelling merchant, involved in the trade of copper (for more information, see Larsen 2002, xxxii-xxxiii).

The Tablets of Iddin-Ištar

Four tablets sent by Iddin-Ištar are included into the study.[197] All the tablets were sent by him to his father who is mentioned first. All four tablets seem to be intact. The three tablets II114, II116, and II118 are formed to the portrait format, II117 is square. The three tablets in portrait format have four slightly convex edges. But the corners of II114 and II118 are straight, and mostly a bit pointy while the corners of II116 are squeezed. So the latter has the typical characteristics of a pillow-shaped tablet. The square tablet II117 shows a rather irregular shape, the left edge is only slightly convex while the right edge is very bulgy. The corners are straight and partly a bit roundish. The ruled lines are mostly straight so that the lowermost line is normally completely readable. On II114 and II116, the beginning of this line is not readable because it is written on the lower edge, but the incompleteness is rather due to the form of the tablet and not the condition of the ruling.

The three portrait format letters have more or less the same length with 257 to 288 signs in total, the square format is much shorter with only 58 signs in total. The tablets can also be

196 See for the text and Larsen’s comment OAAS 1, 35-36,

197 From II116, II117 and II118 only images from obverse and reverse are available. They were provided by the British Museum © Trustees of the British Museum. The pictures of II114 were kindly provided by Klaus Wagensonner.

distinguished accordingly with regard to different signs and readings. Thus, the longer texts have very similar numbers of different signs ranging from 65 to 69 signs, with 77 to 85 different readings. The short text has only 30 different signs with 32 different readings.

Tablet	Sender and position	Addressee(s)	Total of signs	Different reading	Different signs
II114	mentioned second	Aššur-nādā	257	77	67
II116	mentioned second	Aššur-nādā	279	82	65
II117	mentioned second	Aššur-nādā	58	32	30
II118	mentioned second	Aššur-nādā	288	85	69

Table 29: An overview of the signs on Iddin-Ištar's tablets.

Use of Signs

Like on the tablets of the other members of the family, the phonetic segment /bi/ is written with BI and BE (BI_4). The former is only used on II116 and II118, the latter can be found on all four tablets. Especially on the two tablets containing both signs, no particular use of them can be noted.

Fig. 226: II114:11 - at the beginning of this picture the sign ma *is visible, and at the end KI. In-between most likely the phonetic value /la/ is written.*

The phonetic segment /la/ is written on II116 with LÁ, and on II117 with LA. On the two other tablets II114 and II116, it is written with LA and LÁ. On II114 LA is preferred. However, problematic with this tablet is that especially obverse and upper edge are badly corroded so that some signs are rather guessable than readable. Thus, in l. 11 Larsen read LÁ, but the space between the other signs rather points to LA (see fig. 226). But in l. 33 remaining impressions point to LÁ, thus, this sign was indeed written once on the tablet. On II118 the sign LA is only written twice and in both cases for the same word (l. 3, 7: *la-ma* “before”).

For the phonetic segment /šur/ the same inconsistent use can be observed. On II114 and II118 only ŠÙR is used, on II117 only ŠUR. On II116 both signs are written, but with a preference for ŠUR, the other sign is written only once in-between.

Only on II114 both signs Ú and Ù are written, and both are also used with their specific functions. On II116 and II118, only Ú can be found, and here in both functions as vowel and as conjunction. On II117 none of the two signs are written.

The definition of ligature has to be re-defined for Iddin-Ištar’s tablets. The two signs UM and MA are not always closely written, nevertheless, MA uses the last vertical wedge of UM as its first one. The peculiarity on Iddin-Ištar’s tablets is that the first vertical of MA is mostly slightly impressed in front of the horizontals. This habit leads to the slight separation of UM and MA even though they are “connected” with a ligature (see fig. 227).

Fig. 227: An example of um-ma on II116:2, and the peculiar MA in l.22.

In regard of the use of signs, there is hardly any clear pattern discernible. On II114 and II118 the use of the phonetic values /la/ and /šur/ is the same, but other elements differ, e.g. the use of BI on II118, and the writing of /u/ on II114. On the other tablets, the use varies greatly.

Tablet	BI	BI_4	LA	LÁ	ŠUR	ŠÙR	/u/ corr.	*um-ma* lig.
II114		x	x	x		x	x	x
II116	x	x		x	x	x		x
II117		x	x		x			x
II118	x	x	x	x		x		x

Table 30: The use of signs on Iddin-Ištar's tablets.

Form[198]

Comparing the form of the diagnostic signs on Iddin-Ištar’s tablets leads to a very confusing and inconsistent result. The sign KI is the only sign written in the same way on all four tablets. In case of BA, DÍ, and MA, at least three tablets show the same variation, and on two tablets the same variation of IM, KU, or LI respectively, can be found. The other signs, i.e. AM, DU, KÀ, KÙ, RI, ŠA, and TIM show completely different variants on every tablet on which they are written (see fig. 228). An additional problem is that several signs are not written on every tablet, e.g. ZI is only written on II116, Ù only on II114, and RI and TIM only on II114 and II118.

Fig. 228: The three different variations of AM on the tablets II114:24, II116:28, and II117:9.

198 For the image tables, see the document Appendix_ch4_Iddin-Ishtar on the attached CD-ROM.

Tablet	AM	BA	DÍ	DU	IM	KÀ	KI	KU	KU3	LI	MA	RI	ŠA	TIM	Ù	ZI
II114	9?	2	6	5?	2	7?	1	2	-	5	3	1	10	7	6	-
II116	10	2	4	1	10	16	1	3	6	2	1	-	8,6	-	-	3
II117	14	2	6?	-	-	15	1	2	9	1	1	-	7	-	-	-
II118	-	1	6	3	2	4	1	1	-	2	1	5	1	1	-	-

Table 31: The diagnostic signs on Iddin-Ištar's tablets.

Regarding Iddin-Ištar's whereabouts, at least II114 and II116 seem to have been sent from Durhumit.[199] In both letters, he meticulously reports to his father and explains his actions and delays. It indicates that he was still rather inexperienced, and depended on the orders of his father (Larsen 2002, 159). Both letters show partly very different versions of the diagnostic signs. The general appearance of the tablets – apart from the squeezed corners – however, is very similar. On both tablets, the script is strongly oriented on the upper ruling, i.e. not only the heads of the verticals are impressed on the ruling or even above, but also the higher horizontals are usually impressed on the ruling. The writing of the sign combination *um-ma*, as mentioned above, is the same. On both tablets, the writer tends to prolong either the lowermost wedge of MA, or he positions the first vertical in front of the horizontals. Similar elements can also be observed on II118, even though the script appears more stable here. Thus, not the sign shape but the writing habits are similar, or even the same. Therefore, the possibility should not be excluded that the tablets were written by the same young man, who was still very inexperienced in writing, and still had to find his very own writing style.

199 In II114 he reports about his activities in Durhumit since his arrival there (see especially ^{3}*iš-tù a-na* Dur_4*-hu-mì-it* ^{4}*e-ru-bu* "after I arrived in Durhumit"). In II116, he informs his father about the copper business, and reminds of their meeting in Durhumit, a centre for the copper trade. He writes: "since the day you came to Durhumit and we met" (^{6}*iš-tù* ^{7}u_4*-mì-im ša a-Du-<ur->hu-mì-it* ^{8}*ta-li-kà-ni-ma ni-na-me-ru*). Thus, it can be assumed that he was still there (see also Larsen 2002, 162).

4.5.6 Comparison of the script of Aššur-nādā's family members[200]

tablet	bi	bi2	bi4	la	la2	šur	šur3	um-ma	u-corr.
AI006			1		1		1		1
AI014			1		1		1		
AI015	1			1	1		1	1	
AI017	1		1	1	1		1	1	
AI018	1		1		1		1		1
AI024	1				1	1		1	1
AI026			1		1	1	1		
AI032			1		1		1	1	1
AI036	1		1	1	1		1	1	
AI040			1	1	1		1		1
AI041			1		1		1		1
AI042			1		1		1	1	1
AN046	1		1		1	1	1	1	1
AN047			1		1		1	1	1
AN048	1		1	1	1	1	1	1	1
AN051	1				1		1	1	1
AN052	1		1		1		1	1	1
AN054	1		1		1		1	1	1
IA074			1		1		1		1
IA075			1		1		1		1
IA078			1		1		1		1
IA079			1		1		1		1
IA082			1		1		1		1
IA133			1		1		1		
AS085	1		1	1	1		1		
AS086	1		1	1	1		1		1
AS090	1		1	1		1			1
AS091	1		1	1	1		1	1	1

Fig. 229: The use of signs for the corpora of Aššur-idī's family.

The corpora of Aššur-idī, Aššur-nādā, and Ilī-ālum, and presumably also Aššur-taklāku (AS), were written by the same person each. Furthermore, in case of Aššur-nādā and Ilī-ālum, both could be identified as the writers of their texts. Problematic are the tablets of Aššur-nādā's son Iddin-Ištar, which show hardly any similarities, and it is very uncertain how many writers wrote his four tablets. In an initial comparison of the family, his corpus is therefore excluded, and only the corpora of Aššur-idī and his three sons are included.

Regarding the use of signs, it can be noted that especially Ilī-ālum used the signs very consequently (see for the comparison the excerpt of the *dataset_all*, fig. 229). For each of the phonetic values of the use of signs section he used only one specific sign. In addition, the sign combination *um-ma* is always written separately. A different use of signs can be observed on the tablets of his father and older brother. Both also frequently use the sign BI_4 in addition to BI. In addition, both writers show a similar use of the different signs for the phonetic values /la/ and /šur/. On the tablets of the youngest brother Aššur-taklāku, there is even less distinction of the different signs. On his tablets both signs BI and BE (BI_4) are written, as well as mostly LA and LÁ (even though clear preferences for one or the other sign can be noted in regard of the number of occurrences on each tablet). Deviating from the typical writing on the tablets of his family members, on his tablets, the sign combination *um-ma* is mainly written without ligature. To sum up, while the letters sent by Ilī-ālum and Aššur-taklāku show almost two different extremes regarding the use of signs, the writers of Aššur-idī's and Aššur-nādā's letters have similar habits concerning the phonetic values.

200 The following comparison is mainly based on the *dataset_all*.

A general overview of the sign forms shows that differences and similarities of the diagnostic signs are quite balanced – at least in case of the father and the two older brothers: On their tablets, the signs BA, DÍ, DU, and KU are basically written with the same sign variations. In case of DÍ it can be noted that the tablets of the three men share the same main variation (DI2~6) as well as the same natural variation (DI2~2) (see fig. 230). But each writer has his peculiar sign form(s) as well, especially for the five signs AM, RI, ŠA, TIM, and ZI (see fig. 230). Nevertheless, there are some overlaps, too, which can mostly be observed in regard of Ilī-ālum and his father Aššur-idī, especially for the sign RI.

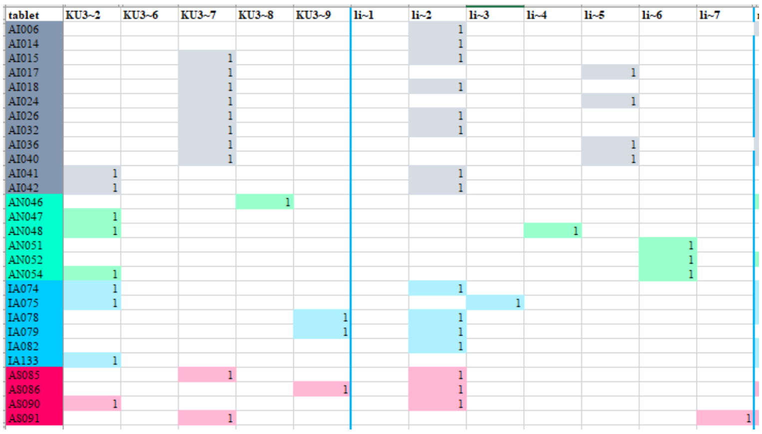
tablet	di2~2	di2~3	di2~6	tim~1	tim~4	tim~5	tim~6
AI006	1				1		
AI014			1			1	
AI015			1			1	
AI017			1			1	
AI018	1					1	
AI024	1						
AI026			1			1	
AI032			1				
AI036			1			1	
AI040			1				
AI041	1						
AI042	1				1		
AN046	1			1			
AN047			1				1
AN048			1		1		
AN051			1				
AN052			1				1
AN054			1				1
IA074			1		1		
IA075	1						
IA078			1		1		
IA079	1				1		
IA082	1				1		
IA133			1		1		
AS085			1	1			
AS086	1						
AS090			1				
AS091			1	1			

Fig. 230: An excerpt of dataset_all, showing the sign variations of DÍ and TIM.

The analysis of the variants (*dataset_all_resort*) shows that in case of AM and TIM, Aššur-nādā and Ilī-ālum share more similarities, while on the tablets of their father, mostly different variants are written (for a detailed description see below). On the other hand, the signs ŠA and ZI are mostly written with the same variant on Aššur-idī's and Ilī-ālum's tablets, while different variants were used by Aššur-nādā. Thus, even though each writer developed his own variations of the respective signs, the written variants of Aššur-idī's and Aššur-nādā's letters match partly with the variants on Ilī-ālum's tablets, but hardly with each other.

The tablets of the youngest brother, Aššur-taklāku, show different variations in several cases (*dataset_all*). For the signs AM, BA, DU, ŠA, TIM, and Ù variations are used, which are hardly written on the tablets of his family members. In case of DÍ, IM, KU, KÙ, LI, MA, and ZI, all the variations written on his tablets are also written on some of the tablets of his father. The three signs KÀ, KI, RI are mostly written with variations that can be found on the tablets of one or the other brother. Thus, even though his tablets have a few sign variations in common with the tablets of his brothers, they show the most similarities to his father's writing. On the other hand, in several other cases also a rather unique style is displayed, incomparable to the writing style of his family.

Some of the specific sign variations are preferred by several members of the family. Aššur-nādā and Ilī-ālum for instance write the same variation of the signs IM, KÀ and KÙ (for the latter, see fig. 231). These specific sign forms are rarely found on the tablets of the father and the younger brother. But also Aššur-idī, Ilī-ālum, and partly Aššur-taklāku share some sign variants that are hardly written on Aššur-nādā's tablets like KI, LI (see fig. 231), and MA. Finally, the sign Ù is written with three different variations on Aššur-idī's tablets. One of them is found on Ilī-ālum's tablets, too, and another one is mainly written on Aššur-nādā's tablets. Only on Aššur-taklāku's tablets, a completely different variation is preferred.



tablet	KU3~2	KU3~6	KU3~7	KU3~8	KU3~9	li~1	li~2	li~3	li~4	li~5	li~6	li~7
AI006							1					
AI014							1					
AI015			1				1					
AI017			1							1		
AI018			1				1					
AI024			1							1		
AI026			1				1					
AI032			1				1					
AI036			1							1		
AI040			1							1		
AI041	1						1					
AI042	1						1					
AN046				1								
AN047	1											
AN048	1								1			
AN051											1	
AN052											1	
AN054	1										1	
IA074	1						1					
IA075	1							1				
IA078					1		1					
IA079					1		1					
IA082							1					
IA133	1											
AS085			1				1					
AS086					1		1					
AS090	1						1					
AS091			1									1

Fig. 231: An excerpt of the dataset_all*, displaying the sign variations of KÙ and LI.*

This general overview shows that Aššur-idī and his oldest son Aššur-nādā share similar habits in regard of the use of signs, but the sign variants and variations often differ while on the other hand, the younger son Ilī-ālum wrote frequently sign variations and variants that are either found on the tablets of his father (KI, LI, MA, ŠA, ZI) or his older brother (AM, IM, KÀ, KÙ, TIM). One half of the signs on the tablets of Aššur-taklāku shows consensus with his father's tablets, while the other half is written with forms different from the forms of his family members.

While this comparison does not give any particular indication of the educational background, the comparison of the distinctive sign variations of these four men with the sign variations of the members of Ali-ahum's family of the kt 93/k-archive shows some peculiarities: Regarding the use of signs, it is especially notable that in the family of Ali-ahum, the name Aššur-taklāku is very frequently written with the sign TÁK (except on Tariša's tablets), while on the tablets of Aššur-idī's family, the name is always written with the combination *ta-ak*.

More interesting, however, are the written sign forms. For both families it was noted that each member uses more or less individual variants for the sign AM. It is peculiar that in Ali-ahum's family, and on the tablets of Aššur-idī,

Fig. 232: The different types of AM on AI015:11, and AN054:23.

and Aššur-taklāku (AS)[201] sign variations with normal Winkelhaken at the end are mostly written while the two brothers Aššur-nādā and Ilī-ālum prefer variants with oblique intersecting wedges. A type of the sign AM which is only found on one of Ali-ahum's tablets (AA343), and on two tablets of Aššur-idī (AI006, AI032).


Fig. 233: The two types of IM, on AI018:8a, and AN051:20.

A similar phenomenon can be observed for the sign IM. Here, the family of Ali-ahum generally prefers a Winkelhaken formation at the beginning of the sign, which usually resembles the sign DÌ on the respective tablets. On most of Aššur-idī's tablets the same combination can be found. But on a few of his, as well as on the tablets of his two sons, the lower element of the initial formation is a long, oblique wedge. Moreover, in Aššur-nādā's and Ilī-ālum's variation, the typical small wedges on top of the oblique one are also preceded by a vertical broken wedge (see fig. 233, right). In Aššur-taklāku's case, on AS085 the same special variant is written which is typical for his brothers' writing, while on his other three tablets, different variations with normal Winkelhaken can be found.

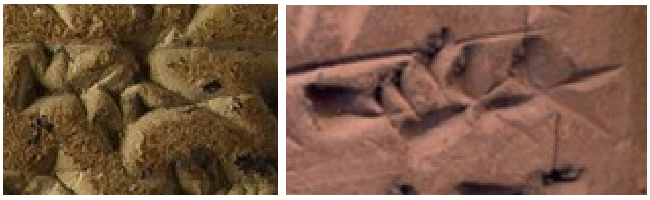


Fig. 234: The sign TIM on AI014:6, and IA079:20.

The third example is the sign TIM. Again, especially on the tablets of the two brothers Aššur-nādā and Ilī-ālum a very peculiar variant of this sign is found. It is a long variant lacking the typical two verticals at the beginning, but instead contains a structure of two pairs of intersecting oblique wedges (fig. 234, right). Again, a similar variation can be found on two tablets of their father (AI006, AI042), while on his other tablets, as on the tablets of Aššur-taklāku (AS), there is a variant more reminiscent of the style written on the tablets of Ali-ahum's family.

While the afore mentioned examples point especially to the similarities of the handwriting of the two brothers Aššur-nādā and Ilī-ālum, there are two additional signs that seem to reveal some kind of family trait or writing preference. On the tablets of Ali-ahum and his children, the sign BA is written mainly with an oblique wedge at the bottom. On the tablets of Aššur-idī and his two older sons, on the other hand, the variation with three parallel horizontals is

201 Since it is not clear whether Tariša wrote her tablets or not, including her into the comparison of family traditions is pointless.

preferred. The exception is – again – Aššur-taklāku, on his tablets mainly the variation with an oblique wedge is used.

Fig. 235: Same variant, but peculiar execution, on AT708:5, and AI015:33.

The second sign is DU. The variation written on most tablets of Aššur-idī and Aššur-nādā as well as on some of Ilī-ālum is in general the same long version that is written several times on the tablets of Aššur-taklāku, son of Ali-ahum. However, the peculiar and discriminating element of the variation written by Aššur-idī's family is that the first vertical wedge is shifted downwards so that it forms a cross with the first horizontal wedge at the bottom. The black sheep of the family is again Aššur-taklāku, on his tablets, the long variation with the cross-structure is only written on AS086 while on the other tablets the short variation of DU can be found.

To conclude, even though the corpora of Ali-ahum's family as well as the four members of Aššur-idī's family show several similar sign variations and variants, some very peculiar variants can be detected which might point to family traits[202] or to a different writing tradition. Regarding the different family members, the sign forms on the tablets of the two older brothers Aššur-nādā and Ilī-ālum show some consensus with the tablets of their father or younger brother, but in addition, especially the "family traits" are most distinct on the tablets of these two. The conclusion that Ilī-ālum's tablets were written by himself was drawn on the basis of the peculiarities of the script and the circumstance that some of his letters were sent from different places. In case of Aššur-nādā, his identification as the writer of his texts was drawn on the basis of the identification of the same script on texts of different genres. The similar script, and especially the same peculiar sign forms of the two brothers point to a common educational background. In addition, it also supports their identification of being the writers of their own texts.

Regarding the father, Aššur-idī, it can be noted that some of the family traits can only be found on some of his tablets. Since after all, his tablets seem to have been written by the same person, a possibility might be that he changed his writing style. This assumption is presumably supported by the observation that on the tablets of his youngest son, Aššur-

202 In this study, only three families are included, and among them, the discussed sign forms of AM, DU, IM, and TIM are very peculiar on the tablets of Aššur-idī's family. However, it is certainly possible that these sign forms were not only used by this specific family, but several other members of the Old Assyrian society as well, which, for example, might have had the same education and were taught by the same person in Aššur.

taklāku, many signs are written in a similar way. On the other hand, there are not many overlaps with the sign forms of his older brothers. And the family traits that are typical for his older brother can hardly be found on his tablets. An interpretation of these observations could be that the age difference of Aššur-taklāku (AS) and his two older brothers was large so that he learned the art of writing from his father, who stayed at home while his brother managed the business in Anatolia. Another hypothesis could be that the tablets of Aššur-idī were actually written by someone else, maybe another member of the family who taught the children. These questions, however, can only be answered by adding more texts to the study and by learning more about the background of the family members. But that needs to be done elsewhere.

4.5.7 About the Tablets of Aššur-idī's Grandson Iddin-Ištar

As mentioned above, the four tablets sent by Iddin-Ištar are neither assignable to the same writer nor to Iddin-Ištar as the writer. Nevertheless, the sign variations on his tablets should be compared to the ones on his family's tablets.

On the four tablets, at least two to four different variants for each sign can be found. Consequently, there are frequently overlaps with the sign variants written on the tablets of the other family members, especially with sign variations written on the tablets of his uncle Aššur-taklāku (AS), and/or his grandfather Aššur-idī. This phenomenon can especially be noted for the signs IM, KU, LI, MA, RI, Ù, and ZI. The overlaps, however, are not only on a specific tablet of Iddin-Ištar, but sometimes on one tablet, sometimes on another. So there is no consistency.

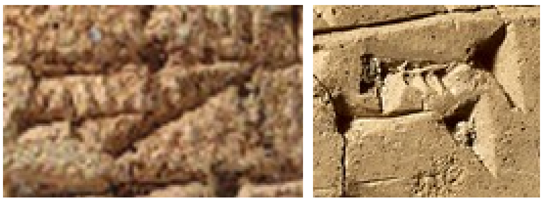


Fig. 236: The sign AM on II114:26, and II116:22.

Fig. 237: The sign TIM on II114:13, and II118:10.

Regarding the family traits, as it could be observed in case of his uncle Aššur-taklāku (AS), only occasionally a sign form reminds of them. In the case of AM, the variant on II114 is the same with oblique wedges as on his father's tablets. On two other tablets, however, variants with normal Winkelhaken are written. In these cases it can be noted that the upper horizontal is shifted to the right so that it is shorter (see II116, fig. 236, right). This variant is otherwise only written on Aššur-idī's tablets. On II114, also the family variant of the sign DU can be found. On II118, however, a short version of this sign is written, which is also found on his uncle Aššur-taklāku's (AS) tablets. The sign IM is written on three tablets of Iddin-Ištar. The variant on II116 is unique and therefore incomparable. But the variant on the two other tablets II114 and II118 is written with normal Winkelhaken. Thus, it does not correspond to the variant with the family traits, but it is the same one written on most of the tablets of Aššur-taklāku (AS).

Finally the sign TIM is written on two tablets. The variant on II118 seems to be the same version written on the tablets of Aššur-taklāku (AS). However, the variant written on II114 is a long variant where the two parallel verticals are omitted. Even though it is not exactly the variant with the family traits, it strongly reminds of it (see fig. 237).

To conclude, because of the very inconsistent writing on the four tablets, they cannot be assigned to the same writer. Regarding the sign forms, there are some overlaps with variations written on the tablets of the other family members, and several are comparable to the script on Aššur-taklāku's (AS) and Aššur-idī's tablets. Furthermore, some signs can also be found with the family traits, which gives the impression that the writer(s) might have had a similar educational background as his uncle. Nevertheless, the similarities are too irregular, and any assignment or identification of a writer is too uncertain. Therefore, the corpus will be excluded from further studies of family traits and education.

4.6 The Family of Elamma

The house of Elamma was mainly excavated in 1991 (and completed in 1992), in grid square LVI/127-128 in Kaneš. It contained a private archive of an Assyrian family with more than 500 tablets, fragments, and envelopes.[203] The family living in the house was the family of Elamma, son of Iddin-Suen, and brother of Ali-ahum (of the 93/k-archive). On the basis of the archive texts, and with support of Michel's data, Veenhof was able to reconstruct five generations of the family, including Elamma's grandfather and father as well as the generation of his children and grandchildren (for the family tree see ch. 3, for more general information on archive and inhabitants see Veenhof 2017, xxv-xlix).

For this study, only the letters of Elamma, his son Ennam-Aššur, and his daughter Ummī-Išhara are analysed.

4.6.1 Elamma

Elamma was presumably the third son of Iddin-Suen. As a younger son, he had not inherited his father's house in Kaneš, but had to build or buy his own, which was nevertheless not far from his father's (and later brother's) house. He was married to a woman called Lamassutum[204] who seems to have been living with him in Kaneš. Together they had at least eight children. According to his texts, Elamma must have been an active merchant in Kaneš. Like many of his colleagues he was mainly involved in the trade of textiles and tin from Aššur to Anatolia as well as into the copper trade in Anatolia. Presumably he first worked for his father before becoming independent after his father's death (Veenhof 2017, xxxvi). He was active for at least 30 years, and his dated texts indicate the period from c. 1906 (REL 67) to an unspecified year after c. 1881 BC (REL 92). Veenhof assumes that Elamma died in Kaneš and may have been buried there under his house (Veenhof 2017, xxxi).

The Tablets of Elamma

This study includes seven letters of which six were sent by Elamma alone and one, EL082, by him and one of his business associates called Kurub-Ištar. The letters are addressed to at least two or more men, often his business partners or representatives, and Elamma is mostly mentioned after them, i.e. the addressees. Two exceptions are EL080 and EL082. The

203 For detailed information about archive and family see Veenhof (2015, and 2017).

204 According to Veenhof, her name is partly also spelled with vowel harmony as Lamassatum (2017, xxxi, n. 11).

addressee of the former is probably his own son Aššur-ṭāb, the latter is addressed to one of his transporters and another person. In both cases, Elamma is named before the addressees.

The tablets EL016, EL017, EL079, and EL081 were sent to his partners and representatives in Aššur, therefore, the tablets from his archive must be archive copies. The same applies most likely to EL080, which is presumably addressed to Elamma's son who was travelling in Anatolia while Elamma was possibly in Kaneš (Veenhof 2017, 122). Also EL082 is likely an archive copy since the topic of the letter is the purchase of tin, a task usually accomplished in Aššur. Hence, the addressees must have been in Aššur while the senders were in Anatolia.

Regarding Elamma's whereabouts, EL030 is addressed to his partners in Kaneš, and a load of tin and textiles is mentioned, thus, Elamma must have been in Aššur (Veenhof 2017, 46). For the other texts, an exact location is hardly mentioned, but it must have been somewhere in Anatolia, probably Kaneš. In EL081, he mentions that "here I turned to the colony"[205] which was most likely the one in Kaneš (Veenhof 2017, 126).

Tablet	Sender and position	Addressee(s)	Total of signs	Different reading	Different signs
EL016	mentioned second	group, including his principals, his brother Ali-ahum and other representatives	168	55	51
EL017	mentioned second	two representatives of Elamma	244	68	62
EL030	mentioned second	two of his associates in Kaneš	208	55	48
EL079	mentioned second	business partners in Aššur	230	83	64
EL080	mentioned first	Aššur-ṭāb, probably one of Elamma's sons	201	72	61
EL081	mentioned second	buiness partners in Aššur	294	69	64
EL082	Elamma and Kurub-Ištar, mentioned first	two (?) transporters	150	54	48

Table 32: An overview of Elamma's letters.

From the two tablets EL079 and EL081 the left lower edge is broken apart, and from EL030 the upper edge is almost completely broken off so that its shape cannot be reconstructed. On EL079, a small part of the clay is chipped off, but it does not influence the general form of the tablet. Regarding the shape in general, all of them are formed to the portrait format. EL016 has straight edges and straight, pointy corners. EL017 has convex edges, and its corners are straight, but because of the convex edges they are not very pointy. The tablets EL079, EL080,

205 EL081: [17]*a-na-kam a-na kà-ri-im* [18][*a*]-*tù-ur*.

EL081, and EL082 can be described as a mix of both previously described shapes. They are irregularly formed so that either one or the other side is slightly longer. While upper and lower edges are usually convex, the left and right one are rather straight. The corners are a mix of straight and pointy, simply straight, or slightly rounded. As mentioned before, EL030 is partly broken. It seems to have had a similar shape to EL017, but the corners appear roundish. In general, this tablet seems rather roughly formed and written while the other six tablets were formed and inscribed more carefully.

The Use of Signs

While his brother Ali-ahum is frequently using the sign NE (BÍ) to write *qibi-ma* in the letterhead, this sign is not written on Elamma's tablets.[206] Instead, either BI or BE (BI_4) are used. Only on EL081 both signs can be found. Almost the same diversification can be found for the phonetic value /šur/. Thus, a certain pattern can be noted: On the three tablets EL016, EL017, and EL079 only BE and ŠUR are written, while on EL030 and EL080 only BI and ŠÙR can be found. The exception is EL081, here only ŠÙR is written, but both BI and BE. On EL082 no sign for /šur/ was used.

Regarding the phonetic segment /la/, on EL016, only LA is written. On the other tablets LÁ is always used, and on EL079 and EL081 in addition LA. It is notable here that this sign is only used in personal names, while LÁ is used for other words.

Tablets	BI	NE (BÍ)	BE (BI_4)	LA	LÁ	ŠUR	ŠÙR	/u/ corr.	*um-ma* lig.
EL016			x	x		x		x	x
EL017			x		x	x			-
EL030	x				x		x	x	x
EL079			x	x	x	x			x
EL080	x				x		x	x	x
EL081	x		x	x	x		x		x
EL082	x				x			x	-

Table 33: The use of signs on Elamma's tablets.

The two signs Ú and Ù are used differently on four tablets (EL016, EL030, EL080, EL082), while on three tablets their usage is mixed up (EL017, EL079, EL081). The pattern, however, does not correspond to the one of /la/ and /šur/. The same applies to the ligature of the sign combination *um-ma*. On most of tablets it can be found, the exceptions are EL017 and EL082.

206 The reading of EL080:7 *šé-bí-lam* is wrong, and the sign has to be read as *bi*.

Form[207]

The sign forms written on the seven tablets of Elamma are as diverse as the shape of these tablets. The three tablets EL079, EL080, and EL082, show almost the same sign forms. Only for the signs IM and KU, there is one exception each. In addition, the sign KÙ is written differently on every tablet. However, the actual difference is usually the placement of the Winkelhaken, the general arrangement is the same (see fig. 238). Thus, these differences can also be the results of a sloppy writing especially because on these three tablets, KÙ is only written once. Furthermore, the three tablets show a similar shape. Thus, they were certainly written by the same person.

Fig. 238: The sign KÙ on EL079:12, EL080:5, and EL082:24.

The three other tablets EL016, EL017, and EL030, show for six of sixteen diagnostic signs the same variant. While in case of EL016 and EL017 almost all the diagnostic signs can be found, on EL030, five of them are not written on the tablets so that the comparison is limited to eleven diagnostic signs, six of which match with the sign variations on the three described tablets above. Furthermore, as mentioned before, the tablet seems to have had a completely different shape before it broke. Regarding EL030's background, it is the only tablet of the selected corpus which was sent from Aššur. However, even though there were certainly many professional scribes in the city, the uneven ruled lines and the irregular script and spacing rather do not point to one of them. Whether it was written by Elamma, however, is another question.

The two other tablets EL016 and EL017 are consistent with the first group in regard of six signs, but the larger part of the diagnostic signs shows several differences. The last tablet, EL081, displays even less similarities with the first group, even though the tablet shape is similar.

To summarise, three tablets match well together (EL079, EL080, EL082), but four tablets (EL030, EL016, EL017, EL081) show several different sign variations, which hardly fit together.

207 For the image tables see the document Appendix_ch4_Elamma on the attached CD-ROM.

A comparison of the variants (*dataset_all_resort*) does not change the impression. It shows that not only different variations were used, but also different variants.

On the basis of the discussed material, a classification or even assignment of Elamma as the writer of them is therefore not possible yet.

Tablet[208]	AM	BA	DI2	DU	IM	KA3	KI	KU	KU3	LI	MA	RI	ŠA	TIM	U3	Z’
EL079	8	1	6	3	8	15	3	2	9	2	2	2	9	1	-	3
EL080	8	1	6	3	8	15	3	3	3	2	2	2	9	1	6	3
EL082	7	1	6	-	2	15	3	2	7	2	2	-	9	1	6	3
EL030	-	-	6	-	2	17	3	2	-	2	1	-	6	1	6	1
EL016	6	2	7	6	3	7	2	2	3	2	1	2	11	1	6	3
EL017	6	2	6	3	2	7	3	2	5	3	2	5	2	-	6	-
EL081	12	2	2	3	2	18	4	2	9	2	1	2	12	-	6	-

Table 34: The sign variations on Elamma’s tablets.

4.6.2 Ennam-Aššur

Ennam-Aššur was presumably the second son of Elamma and Lamassutum.

The Tablets of Ennam-Aššur

There are only three tablets sent by Ennam-Aššur. In all three letters he is mentioned after the addressee, who is usually his brother-in-law Ir’am-Aššur. On EA190, the latter is addressed together with another man. Veenhof points out that Ir’am-Aššur must have been the older because Ennam-Aššur refers to him as “my father and lord”[209] (2017, 272).

From the texts, the whereabouts of Ennam-Aššur are not entirely clear. All three letters deal with the same affair, therefore, they must have been sent in a rather short period of time. In the texts he speaks of textiles that he had brought to representatives of Ir’am-Aššur in Wahšušana, and that he had sold some of the merchandise for 2 ½ minas of silver (EA189:3032, EA190:31-34). In a letter sent by representatives of Ir’am-Aššur and addressed to the latter (AKT 8, 194:13-20), they mention the same affair and state that “Ennam-Aššur

208 The tablets are arranged here according to their similarities.
209 EA189 [58]*a-bi*$_4$ *a-ta be-lí a-ta*. The same expression can also be found on EA190:34. With this phrase, the sender expresses the higher standing of the addressee (see Larsen 2001, 281-282).

brought them into Šaladuwar (…) and Ennam-Aššur is now on his way to you with 2 ½ minas of silver” (Veenhof 2017, 279). While the letter sent by the representatives points out that Ennam-Aššur is already on his way to Aššur, in his own letters, he was presumably still in one of the cities mentioned in the texts, i.e. Wahšušana or Šaladuwar.

Tablet EA190 is complete. But the upper right corner of EA189 is broken apart, and EA191 is missing the lower left corner as well as almost the complete lower edge.

The remaining parts of the tablets look similar. All three are formed to the portrait format with slightly convex edges and pointy corners. In EA190 the corners are straight, in EA189 and EA191 they seem partly a bit squeezed. The ruling on all three tablets is straight, and the script even and regular.

The two tablets EA189 and EA190 are large, and therefore, they are written with a high number of signs in total. Even though there is a difference of 100 signs in total, the number of different signs and their readings are very similar. On EA191 much less signs are written, and the number of different signs and different readings is therefore much smaller.

Tablet	Sender and position	Addressee(s)	Total of signs	Different reading	Different signs
EA189	mentioned second	Ir’am-Aššur	673	108	79
EA190	mentioned second	Ir’am-Aššur and Šamaš-bānī	525	103	81
EA191	mentioned second	Ir’am-Aššur	297	81	66

Table 35: Overview of Ennam-Aššur’s tablets.

The Use of Signs

On Ennam-Aššur’s tablets BI and BE (BI_4) are used almost equally often. The imperative *qibi-ma* in the letter head is always written with BI. The phonetic segment /la/ is mainly written with LÁ. On EA189 and EA190, LA can be found once. Rather surprising is the use of the sign ŠUR. It is written on every tablet, while ŠÙR is not used at all.

On the three tablets, both signs Ú and Ù are used in the correct way, i.e. according to their distinguished function. On EA189 and EA190, the sign combination *um-ma* is written with ligature, on EA191 it is written without.

The use of signs shows a great consistency. Only on EA191, there are small differences. There is neither the sign LA, nor a ligature of *um* and *ma*. However, LA is also only once written on the two other tablets, and regarding *um-ma*, on EA191, both signs are nevertheless very closely written.

Tablets	BI	BÍ	BI$_4$	LA	LÁ	ŠUR	ŠÙR	/u/ corr.	*um-ma* lig.
EA189	x		x	x	x	x		x	x
EA190	x		x	x	x	x		x	x
EA191	x		x		x	x		x	-

Table 36: The use of signs on the tablets of Ennam-Aššur.

Form[210]

The three tablets show a very consistent handwriting with mostly the same variants of the diagnostic signs. Only in case of LI, RI, ŠA, and ZI two to three different variations can be found.

Notable is also, that the writing on the tablets is very consistent so that there is hardly any natural variation. So the writer of these three archive copies (the originals were in Aššur with the addressee) must have been well trained and experienced.

Tablets	AM	BA	DÍ	DU	IM	KÀ	KI	KU	KÙ	LI	MA	RI	ŠA	TIM	Ù	ZI
EA189	4	2	4	3	7	2	2	2	2	2	1	2	9	5	2	3
EA190	4	2	4	3	7	2	2	2	2	3	1	4	9	2	2	6
EA191	4	2	4	3	7	2	2	2	2	8	1	2	4	5	?	-

Table 37: An overview of the sign variations on Ennam-Aššur's tablets.

4.6.3 Ummī-Išhara

Ummī-Išhara was one of Elamma's daughters, and she was living in Aššur as a priestess (*gubabtum)*. Only two of her tablets remained in the archive, and both look quite different. While UI206 is a well shaped tablet with a tiny but neat and regular script, the other tablet UI165 is badly shaped with a crude script. Veenhof assumed that "the cursive writing, occasional mistakes and peculiarities (lines 4, 13, 15) are perhaps indications that Ummī-Išhara herself wrote this very personal letter" (2017, 231).

Although both texts were written by different individuals, and most likely their writer cannot be determined, a short analysis of both tablets concerning tablet shape, use of signs, and the sign forms shall be included into the study. The letters of her father and brother are not

210 For the image tables see the document Appendix_ch4_Ennam-Assur on the attached CD-ROM.

conclusively assignable to a writer, or individual. Maybe the study of Ummī-Išhara's letters might at least support the identification of some kind of family traits.

The Tablets of Ummī-Išhara

The tablet UI165 was sent to her brother Pilah-Ištar and has a square format. It was broken vertically, and both pieces are glued together. On the reverse at the bottom and on most edges, parts of the upper layer of clay are chipped off. The damage does not influence the general form of the tablet, but gives it an irregular impression. The edges of the tablet seem almost straight, the corners are straight or slightly rounded. The ruling is straight. The inconsistent pressure pattern is especially notable on the obverse and in case of several consecutive vertical wedges (e.g. SÚ, Ú, UM) or Winkelhaken (e.g. LI). In general, tablet and script make a very irregular impression. The reasons are not only the edges and the pressure pattern, but also the clay itself. Especially on the obverse, it seems to be kind of swollen up around the wedge impressions. Maybe it was very soft so that the pressure pattern strongly deformed it.

Fig. 239: UI165.

The second tablet, UI206, is addressed to Ummī-Išhara's mother Lamassutum, and her sister Šalimma, both living in Kaneš. The tablet is almost a square format with slightly convex edges. The corners are basically straight. The ruling begins to be slightly slanted upwards in the upper part of the obverse and reverse. The script seems very even, and the tablet gives in general a very regular impression.

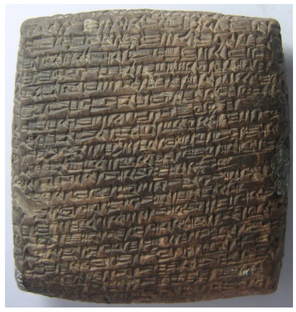


Fig. 240: UI206.

The total of signs on both tablets is completely different even though both tablets have almost the same size (see for a comparison ch. 1). The neatly and tiny written text on UI206 comprises 605 signs, while UI165 contains 157 signs in total. Consequently, the number of used signs and readings are also far apart (see table 38).

Tablet	Sender and position	Addressee(s)	Total of signs	Different reading	Different signs
UI165	mentioned second	Pilah-Ištar	157	51	46
UI206	mentioned second	Lamassutum and Šalimma	605	95	64

Table 38: An overview of the two tablets of Ummī-Išhara.

Use of Signs

The phonetic value /bi/ is written with BE (BI_4) on UI165, and with BI on UI206. The other observed elements of the use of signs are basically the same. Thus, on both tablets only LÁ is written. The phonetic element /šur/ is not used on any of the tablets. On both tablets, mainly Ú is used in the function of Ù as well, i.e. it is used as a conjunction, too. On UI165, the sign Ù is written once, used as a vowel (l. 21).

The ligature of *um-ma* on UI206 is clearly visible, on UI165 it is rather unclear. Both signs are very closely written, but the vertical wedges are not well visible, thus, it is not clear whether there is an additional one for MA.

Tablet	BI	BE (BI_4)	LA	LÁ	ŠUR	ŠÙR	/u/ corr.	*um-ma* lig.
UI165		x		x	-	-		x?
UI206	x			x	-	-		x

Table 39: The use of signs on the two tablets.

Form

The comparison of the diagnostic signs shows that mostly different variations were used. Only in case of BA and KI, the same ones are written.

Tablets	AM	BA	DÍ	DU	IM	KÀ	KI	KU	KÙ	LI	MA	RI	ŠA	TIM	Ù	ZI
UI165	17	2	4	3	10	2	2	-	1	9	1	-	2,3	5	6	-
UI206	16	2	8	7	5	6	2	2	3	2	2	2	1	1	-	3

Table 40: An overview of the used sign variations on Ummī-Išhara's tablets.

4.6.4 A Comparison of the Hands of Elamma's Family

By comparing the tablets of Elamma and his two children one has to keep in mind that in case of Elamma, most likely several writers wrote these tablets, and none of them could be identified as Elamma himself. In regard of Ennam-Aššur's tablets, they were certainly written by the same person, but Ennam-Aššur cannot be identified as their writer for sure. Finally, in case of Ummī-Išhara, both texts were written by different writers, and while one of them might have actually been written by her, it cannot be proven. Thus, a comparison of the 12 tablets should rather show whether there are any similar patterns which point to a similar educational background – or the opposite.

Probably the only unique element of Ennam-Aššur's tablet shape are the slightly squeezed corners of EL189 and EL190. However, apart from that, his three tablets, and Elamma's "hybrid"-tablets EL079, EL081, and EL082 as well as UI206 have a similar shape with slightly convex edges and straight to partly pointy corners. Ii is interesting that EL030, Elamma's tablets sent from Aššur, and UI165, the crudely written tablet from Ummī-Išhara, have a very similar shape with almost straight edges and slightly rounded corners.

In regard of the phonetic value /bi/ hardly any consent can be found. While on Elamma's tablets either the one or the other sign is preferred, on the tablets of his son, both signs are used. In regard of /la/ on all the tablets LÁ is clearly preferred even though for father and son, a few exceptions can be observed. More interesting is the comparison of ŠUR and ŠÙR because on Elamma's tablets either one or the other sign is written, while on Ennam-Aššur's tablets, solely ŠUR is used. In this regard, EL016, EL017, EL079 and the three tablets of Ennam-Aššur match. Then again, the distinguished use of the two signs for /u/ is consistently applied to the latter's tablets, but only to the other tablets of the father. Thus, this discriminating element does not match for father and son (see table 41).

Since for the two writer's of Ummī-Išhara's tablets only one tablet for each is available, every use or non-use can be a coincidence. Therefore, especially in this regard a comparison makes no sense.

Tablets	BI	BE (BI_4)	LA	LÁ	ŠUR	ŠÙR	/u/ corr.	*um-ma* lig.
EL030[211]	x			x		x	x	x
EL080	x			x		x	x	x
EL082	x			x			x	-
EL081	x	x	x	x		x		x
EL017		x		x	x			-
EL016		x	x		x		x	x
EL079		x	x	x	x			x
EA189	x	x	x	x	x		x	x
EA190	x	x	x	x	x		x	x
EA191	x	x		x	x		x	-
UI165		x		x	-	-		x?
UI206	x			x	-	-		x

Table 41: The use of signs on the tablets of Elamma's family.

211 The order of Elamma's tablets is changed according to their similarities.

A first overview of the different variants (*dataset_all_resort*) shows that in case of Elamma and Ennam-Aššur there is not much difference to the afore discussed diversity of sign forms. The sign variants and variations on Ennam-Aššur's tablets are already very consistent so that their clustering does not change much. In case of Elamma, the variations on his tablets can hardly be clustered so that there is no big difference. On the other hand, the clustering according to variants shows that the writing on Ummī-Išhara's two tablets is not as different as expected. The signs DÍ, DU, IM, KÀ, and ŠA are differently executed on the two tablets, but nevertheless, the different variations belong to the same sign variant. Even though it is no implication that the two tablets were written by the same person, it could point to someone with a similar educational background.

The comparison of the sign variations on the tablets of the three senders (see below table 42) shows that for some of the diagnostic signs mostly the same variation was used. For example in case of BA, only on three tablets of Elamma, EL079, EL080, and EL082, the wedge at the bottom is oblique, while on the rest of his tablets as well as on the ones of his children, the bottom wedge is horizontal. A similar observation can be made for instance for the signs DU (exceptions: EL016, UI206), KU (exception: EL080), RI (exceptions: EL017, EA190), and ZI (exceptions: EL030, EA190).

Apart from that, Elamma's and Ennam-Aššur's tablets do not have much in common. In the case of KI, LI, MA, and ŠA, there is some overlap, but very rarely are the same variations preferred on the tablets of both senders. Thus, on none of Elamma's tablets, more than five diagnostic signs are written with the same variation as on Ennam-Aššur's tablets[212] (EL016, EL081).

The case is different for the two tablets sent by Ummī-Išhara. Tablet UI206 has only four sign variations in common with Ennam-Aššur's tablets (BA, KI, KU, RI). These are four of the five diagnostic signs written in the same way on most of the tablets of the three senders (see above).

On the other tablet, UI165, seven signs are written with the same variations as on Ennam-Aššur's tablets. Unfortunately, three further diagnostic signs are not written on this tablet so they cannot be compared with the ones on her brother's tablets.

Fig. 241: The sign DÍ on EA290:15a and UI165:18.

212 Excluded are the signs LI and ZI since they are written with different variations on Ennam-Aššur's tablets, and only one of them is comparable with the variations on Elamma's tablets.

However, usually 7 out of 13 diagnostic signs is not much. But in case of these tablets not only the variants are similar, but partly also the same peculiar execution can be observed. For example the sign DÍ on UI165 and on the tablets of Ennam-Aššur is written with the same variant with four Winkelhaken in the upper row. Furthermore, on UI165, the strong emphasis of the Winkelhaken at the bottom can be observed which makes its appearance peculiar (see fig. 241). This variation is not unique to their tablets[213], it can be found on some tablets of their uncle Ali-ahum (AA195, AA303). Nevertheless, it is a rather uncommon variant in the studied corpus.

In addition, the sign TIM is written in a rather specific way on UI165 and on two tablets of Ennam-Aššur: in front of the two large Winkelhaken, a pair of small ones is impressed (fig. 242). A similar variant can only be found on tablets of Aššur-idī.

Fig. 242: The sign TIM on EA290:39, and UI165:14.

Furthermore, the sign KÙ is not written with the same version, but the same variant on the tablets of Ennam-Aššur and on UI165. The difference is that on Ennam-Aššur's tablets, there are usually three Winkelhaken impressed between the vertical wedges, while on UI165, there seem to be only two Winkelhaken between the verticals.

213 A very similar variation is also written on UI206, but with more wedges.

Tablet	AM	BA	DÍ	DU	IM	KÀ	KI	KU	KÙ	LI	MA	RI	ŠA	TIM	Ù	ZI
EL079[214]	8	1	6	3	8	15	3	2	9	2	2	2	9	1	-	3
EL080	8	1	6	3	8	15	3	3	3	2	2	2	9	1	6	3
EL082	7	1	6	-	2	15	3	2	7	2	2	-	9	1	6	3
EL030	-	-	6	-	2	17	3	2	-	2	1	-	6	1	6	1
EL016	6	2	7	6	3	7	2	2	3	2	1	2	11	1	6	3
EL017	6	2	6	3	2	7	3	2	5	3	2	5	2	-	6	-
EL081	12	2	2	3	2	18	4	2	9	2	1	2	12	-	6	-
EA189	4	2	4	3	7	2	2	2	2	2	1	2	9	5	2	3
EA190	4	2	4	3	7	2	2	2	2	3	1	4	9	2	2	6
EA191	4	2	4	3	7	2	2	2	2	8	1	2	4	5	?	-
UI165	17	2	4	3	10	2	2	-	1	9	1	-	2,3	5	6	-
UI206	16	2	8	7	5	6	2	2	3	2	2	2	1	1	-	3

Table 42: The sign variations on the tablets of Elamma's family. The red marked numbers are the ones most common on Ennam-Aššur's tablets, and green and blue are the ones most common on Elamma's tablets.

A definite answer cannot be given regarding handwriting and identification of the writers. However, it is remarkable that especially the letters of Ennam-Aššur which are archive copies written in Anatolia, and the crude letter UI165, sent from Aššur and certainly not written by a professional or experienced scribe, show most similarities.

On the other hand, it is also notable that even though the script on Ummī-Išhara's letter UI165 has not much in common with the writing on the letters of her father, the other letter of Ummī-Išhara, UI206, has a total of eight sign variants in common with Elamma's variations (especially EL016).

Hypothetically, it can be questioned whether the woman was rather learning from her father, and consequently, UI206 might have been written by Ummī-Išhara herself. Or she was learning together with her brother from another person, and therefore UI165 was written by her. As mentioned above, basically nothing is known about the growing up and upbringing of

214 The order of Elamma's tablets represents the order of the table in his sub-chapter above.

the children. However, since Elamma was travelling it could be assumed that he was most of the time on the road, and therefore, someone else took care of the education of his children.

4.7 A Comparison of the three Families

In this part of the study, the 94 letters[215] of ten senders from three families are compared in regard of their similarities, differences, and family traits. The preceding discussions have shown that eight of the individual corpora, at least the largest parts with only very few exceptions, were most likely written by one individual each (the corpora of TA, AA, AT, EA, AI, AN, IA, and AS), while the letters of two corpora show different hands (the corpora of EL and UI). For Ali-ahum, Aššur-taklāku, Aššur-nādā and Ilī-ālum, it could be determined that their tablets were (mainly) written by themselves. In case of Ennam-Aššur and Ummī-Išhara (UI165), it can be assumed that they were also most likely the writers of their letters.

Name		Name		Name	
AA	c. 1893-1878 BC	EL	c. 1906 - after 1881 BC	AI	c. 1895-1886 BC
AT	c. 1877-1859 BC	EA	(?)	AN	c. 1896-1874 BC
TA	(contemporary to AT)	UI	(?)	IA	c. 1895-1891 BC
				AS	c. 1892-1886 BC
				II	(?)

Table 43: Known dates of the three families.

The table containing the known dates of the three families (table 43) shows the minimum period during which the individuals were active. In none of the cases the dates represent, however, their lifespan or total number of years as active traders. It indicates that Aššur-nādā and his brothers probably rather belonged to the generation of Ali-ahum and Elamma, and not to the one of their children. These dates are interesting in regard of the palaeographic aspects of the script and its use.

The comparison of the three corpora is mainly based on the *dataset_all* and the *dataset_all_resort*. The focus will be on the comparison of possible family traits, common writing styles, and possible generational tendencies.

4.7.1 Use of Signs

When analysing the use of signs on the tablets of the three families, two observations can be made immediately. One is the use of the sign NE (BÍ), which is frequently used on Ali-ahum's

215 All in all 98 letters were analysed but as before, the two tablets of Ali-ahum (AA199, AA317), one letter of Aššur-nādā (AN046), and Iddin-Ištar's four letters are excluded because they were most likely written by different writers than the rest of the respective corpus.

tablets, and once on a tablet of his son. But it is neither written on the tablets of his brother Elamma, nor on any other tablet of the analysed material. The second observation striking the eye is the use of the sign TÁK. On the tablets of Ali-ahum's family, it is often used, especially on Aššur-taklāku's (AT) tablets, but also on more than half of the tablets of his father, and at least on two sent by his sister. On the other hand, one of Aššur-idī's sons was also called Aššur-taklāku (AS), thus, his name is frequently written on his own, and also on the tablets of his family. However, on their tablets, solely the sign combination *ta-ak* is written. Thus, Ali-ahum's family shows a clear writing habit regarding this name.

Apart from that it is rather difficult to find any clear pattern because there is no distinct use or non-use of a sign. For instance on Ali-ahum's tablet there is a clear preference for the sign ŠÙR, which is written on most of his tablets. Nevertheless, on two tablets, ŠUR is used instead. A rare exception is Ilī-ālum, son of Aššur-idī. His tablets are the only ones of the analysed material on which always only one particular sign is used for each phonetic segment, and also the writing of /u/ and the ligature of *um-ma* is consistent. The same phenomenon can partly be noted on Tariša's and Ennam-Aššur's tablets as well. In the latter's case, /šur/ and *um-ma* are consistently written in a specific way while the other observed elements show more variability. In case of Tariša's tablets, the writing of /šur/, *um-ma*, and the use of both /u/-signs are consistent. On the tablets of the other senders, there is much more variation.

In this regard, it has to be noted that the different numbers of the corpora are problematic. While the selected corpus of Aššur-taklāku (AT) consists of 30 letters, the other included corpora have mostly less than ten tablets. Consequently, three exceptions for Aššur-taklāku (AT) would be only 10%, while they would represent 50% of Ilī-ālum's corpus. Furthermore, the smaller the corpus, the more inexact the analysis because each tablet is only a snapshot of the current ability or mood of the respective writer.

Regarding the use of BI and BE (BI_4), it can be noted that on most corpora of the three families,[216] there is a clear preference for the sign BI_4, but nevertheless, also BI is written on more than half of the tablets. Only on the tablets of Aššur-idī and his son Ilī-ālum, the sign BI is not so frequently used, and in case of the latter not at all.

216 Ummī-Išhara is excluded from this part of the study because the two tablets sent by her, were written by two different persons, consequently every use or non-use of a sign is actually like 100% or zero and can therefore not be evaluated.

The comparison of LA and LÁ gives a similar impression: LÁ is clearly favoured and written on almost every tablet, while LA is rather rare. Only on Tariša's, Ennam-Aššur's and Aššur-taklāku (AS) tablets, it is written on more than half of their tablets.

The same observation can be made for /šur/. On most tablets ŠÙR is preferred or even the only sign used, while ŠUR is rare. But on the tablets of Elamma and his son Ennam-Aššur, it is used on half or all of the tablets respectively.

The ligature of *um-ma* is also very common, except on the tablets of Tariša, Ilī-ālum, and his brother Aššur-taklāku (AS). The distinguished use of the two /u/-signs is varying. On Tariša's, Ennam-Aššur's, Aššur-nādā's, and Ilī-ālum's tablets, the distinction is consistent, on the tablets of the others it is applied more or less often.

To summarise, especially in regard of the use of signs, there is almost no clear pattern recognisable. The only two differences are the above discussed applications of TÁK and NE (BÍ).

4.7.2 The Comparison of Variants (*dataset_all_resort*)

This part focuses especially on the diagnostic signs that have been clustered into variants in the table *dataset_all_resort*, i.e. AM, DÍ, DU, IM, KÀ, ŠA, TIM and ZI. In addition, neither every single detail, nor every exception of the different letter senders will be discussed, but the focus is on the mainly used variants of the different senders. Exceptions are equally divided corpora like for instance Elamma's corpus in regard of the sign KÀ. Here, it is divided into three almost equal groups, and two of them show variants that also occur in the corpora of other senders. Therefore, they are mentioned.

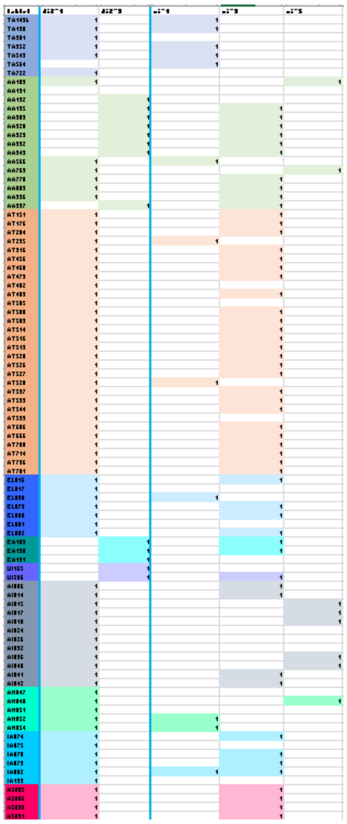


Fig. 243: Even though no details are visible, clear preferences for certain variants are obvious.

In general, there are only two signs, which are mostly written in the same variant on the tablets of all senders. One is the sign DÍ, which is mostly written in a variant containing three Winkelhaken in the upper row. Only on the corpora of Ennam-Aššur and his sister Ummī-Išhara (both tablets), as well as on half the corpus of their uncle Ali-ahum, the sign is written with four or more Winkelhaken in the upper row. A similar observation can be made for the sign ZI. Here, the most common variant is written with two Winkelhaken in the lower row and is preferred by almost all the senders. Only on Tariša's, Aššur-idī's, and Aššur-nādā's tablets, variants with different numbers of Winkelhaken in the lower row are more often written (see fig. 243).

The use of variants of the other diagnostic signs is more diverse. As it could already be noted in the individual analyses, especially some of the "children", thus, the members of the second generation show several similarities among each other like Ennam-Aššur and Ummī-Išhara, or Aššur-nādā and Ilī-ālum. Therefore, it is more interesting whether for example the younger generation or the parental generation have much in common. Regarding the latter, first of all it can be noted that for almost every sign, more than one variant was used in the corpora of Ali-ahum, Elamma, and Aššur-idī (see fig. 244). The comparison shows that hardly any pattern can be recognised. For example, three different variants are broadly used for the sign IM on each of the corpora. The first variant is used in all three corpora, the second variant is used on Ali-ahum's remaining tablets, and the third variant is preferred by Elamma and Aššur-idī. On the other hand, the sign DU is basically written with the same variant on the tablets of the two brothers, while on the corpus of Aššur-idī two different variants are used. Thus, the comparison of the variants on the parental generation shows no pattern.

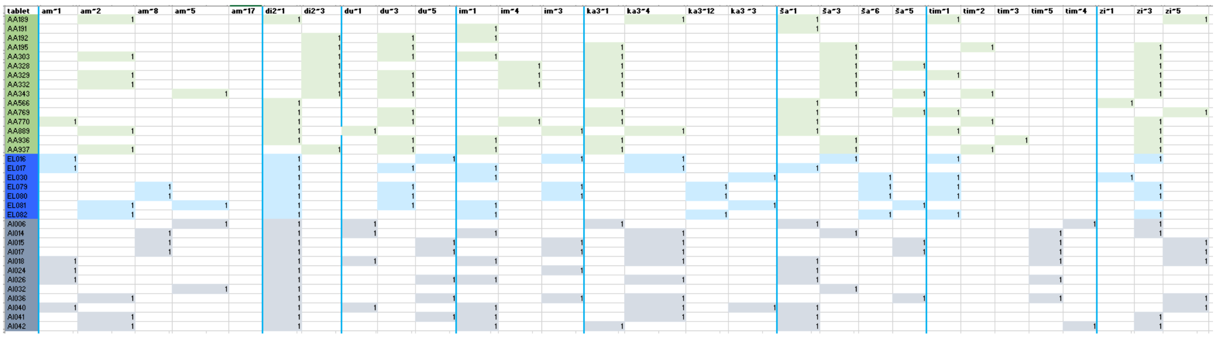


Fig. 244: The used variants on the tablets of the parent-generation, green = Ali-ahum, blue = Elamma, grey =Aššur-idī.

For the younger generation, the first impression is much more differentiated (see fig. 245), i.e. the individual corpora do not show as many different variants as was observed in the corpora of their parents. Furthermore, it can be noted that especially Aššur-nādā and Ilī-ālum stand out. For the signs AM, DU, IM, TIM and partly for KÀ and ŠA, they show completely different sign variants than written on the tablets of Elamma's and Ali-ahum's children. A similar observation can be made for the corpora of the two other families, even though the segregation is not so strict. Thus, Ennam-Aššur and his sister used specific sign variants for the signs AM, DÍ, DU, and TIM, and partly IM and ŠA. In these cases, there are occasional overlaps with tablets of other senders like Aššur-taklāku (AT). Nevertheless, on most of the latter's tablets, other variants are preferred. In case of Tariša and Aššur-taklāku, especially for the signs AM and DU particular variants can be found on their tablets. In case of IM, the letters of Aššur-nādā and Aššur-taklāku, the sons of Aššur-idī, show a similar variant, and in case of the sign TIM, the variant on Aššur-taklāku's (AS) tablets is comparable.

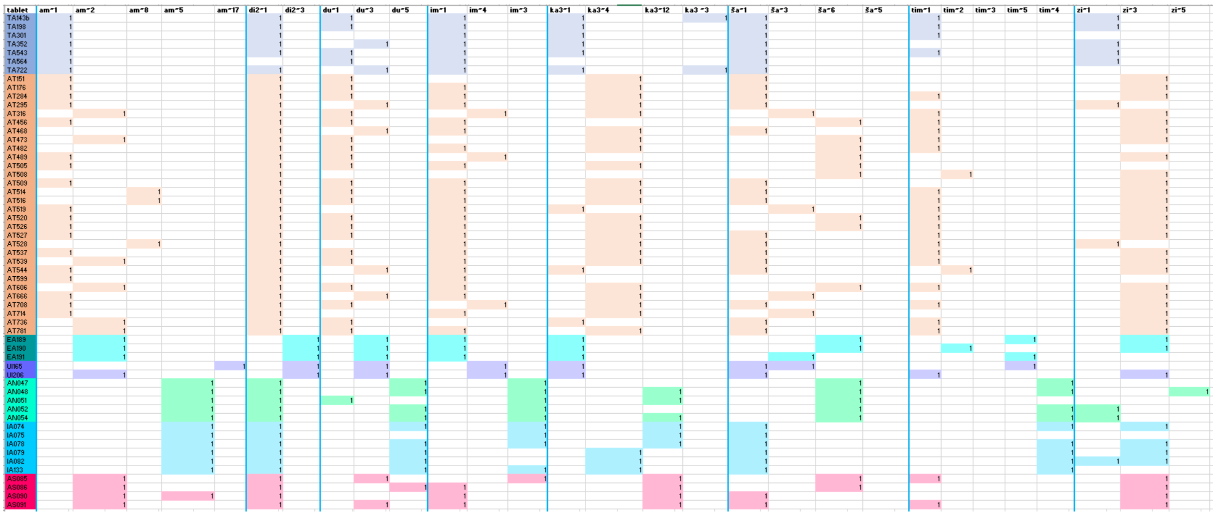


Fig. 245: The variants on the tablets of the second generation, from the top: Tariša, Aššur-taklāku (AT), Ennam-Aššur, Ummī-Išhara, Aššur-nādā, Ilī-ālum, Aššur-taklāku (AS).

To conclude, while the corpora of the older generation show a lot of variation, but at the same time share most of these variations, the next generation shows much more consistency and segregation. Thus, on their tablets, not so many variations are usually used, and mostly each family seems to have their own preferences for variants. Here, it can be additionally noted that the two brothers Aššur-nādā and Ilī-ālum show a completely different style, but the tablets of their younger brother Aššur-taklāku (AS) show more overlaps with other individuals, above all with his father. Furthermore, it can also be noted that there is more overlap in regard of Ali-ahum's and Elamma's children.

4.7.3 The Comparison of Variations

(dataset_all)

The comparison of the variations is more complicated because there are far more variations than variants, and their use varies more. Therefore, the analysis is focusing on the main tendencies of the different senders. Iddin-Ištar's corpus is excluded because his writing is too inconsistent. UI206 is also excluded. While for the other letter of Ummī-Išhara, the possibility is given that it was actually written by her, this letter cannot be assigned to anyone.

Some of the signs are only written with few variations, and the different senders show therefore a relative uniformity. The best example is perhaps the sign BA, which is classified into only two variations. On most of the tablets of Ali-ahum's family, Elamma, and Aššur-taklāku (AS) one variation is written, while on the tablets of Elamma's children and Aššur-idī and his two older sons, the second variation is preferred. Thus, it can be observed that a whole family can prefer a certain variation (family of Ali-ahum prefers BA~1), while members of other families use different variations (EL (BA~1) vs. EA, UI (BA~2), AI, AN, IA (BA~2) vs. AS (BA~1)) (see also fig. 246).

Another rather clear classification can be noted for the sign KU. Here, most of the senders show a clear tendency towards the second variation of KU. Only on Tariša's tablets, another variation is consistently written. Similar observations can be made for the signs LI, MA, and ZI (see fig. 246). There is usually one variation that is mainly used in most corpora, and only on the tablets of one to three senders another variation is preferred. While for MA, the exceptions are to be found on the tablets of Aššur-nādā, and on some of Elamma and Aššur-idī, in case of LI and ZI, it is mainly Tariša, as well as partly Aššur-nādā, and his father.

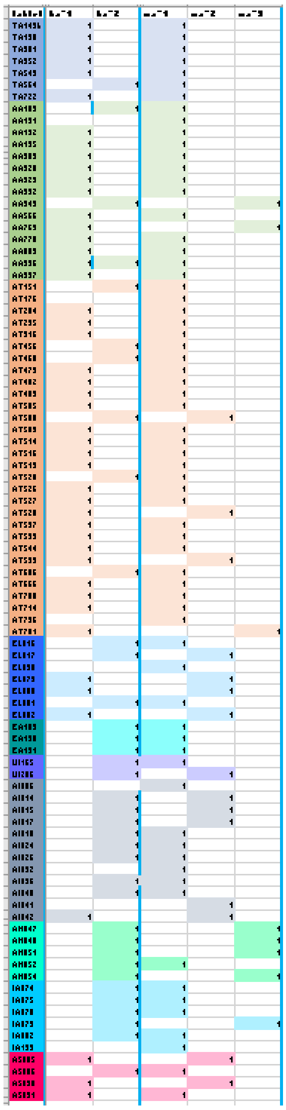


Fig. 246: The signs BA and MA.

Also for this dataset, the senders can be divided according to their generation. Regarding the generation of the fathers, it can be noted that although there are usually several overlaps, in case of the five signs AM, KÀ, KÙ, RI, and Ú, in each corpus of the three men specific sign versions are preferred which are hardly written on the tablets of the others.

For the remaining diagnostic signs, different constellations can be observed. For instance, Ali-ahum and Elamma prefer the same variation of the signs DU and TIM while on Aššur-idī's tablets other versions are written. On the other hand, Aššur-idī and Elamma use the same two variations of DÍ and IM while Ali-ahum prefers other sign forms. And also Ali-ahum and Aššur-idī used specific sign variations of KI and ŠA which are hardly written on Elamma's tablets. Thus, on the tablets of the three men several similarities, but also differences regarding the sign variations can be noted, but no clear pattern is discernible.

By comparing the variations on the tablets of the children, the first thing to note is that although the siblings often showed the same sign variant, the variations often differ. In the case of the tablets of Aššur-nādā and Tariša, the writers preferred the same variations only for the five signs BA, KI, MA, TIM, and Ù. For the other eleven diagnostic signs – even though there is some overlap – different versions are mainly used. The same goes for the two brothers Ennam-Aššur and Ilī-ālum. The four signs BA, DU, IM, and KU are mainly written with the same variation. In case of DÍ and KÀ, only half of Ilī-ālum's tablets show different version. The rest of the diagnostic signs is differently written on both of their corpora.

The tablets of the third brother, Aššur-taklāku (AS) show hardly any similarity. Only the signs DÍ and KU are written with the same variation as on the tablets of his two brothers. In addition, his preferred variation of KI matches with the mainly written one of Aššur-nādā, and his variation of LI with the one of Ilī-ālum. The other 13 diagnostic signs show mainly different variations that are not, or rarely written on his brothers' tablets.

In this regard, probably the small corpus of Ennam-Aššur and the one tablet of his sister, UI165 are exceptional. Here, the variations of seven diagnostic signs are the same (BA, DÍ, DU, KÀ, KI, MA, TIM), while six show different variations (the three signs KU, RI, and ZI are not written on UI165 and can therefore not be compared). Here, the number of similar and different sign versions is quite balanced.

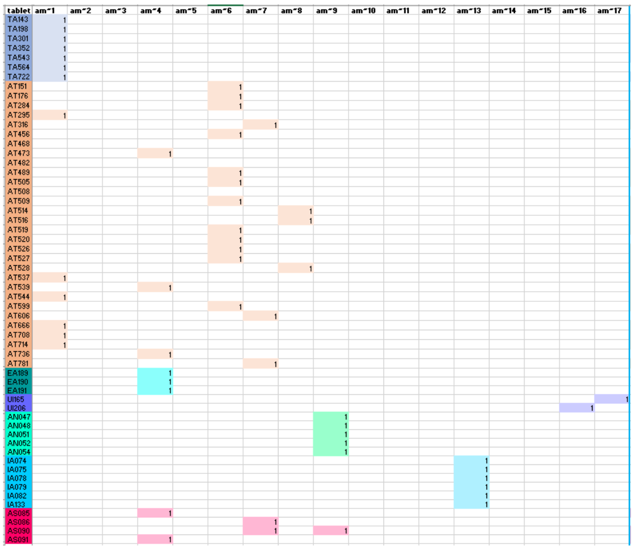


Fig. 247: The sign AM as example for the individual preferences. Again from the top Tariša, Aššur-taklāku, Enna-Aššur, Ummī-Išhara, Aššur-nādā, Ilī-ālum, and Aššur-taklāku.

By comparing the variations of all the "children", hardly any pattern can be noted apart from the ones discussed above. But here, too, is noticeable that especially the two brothers Aššur-nādā and Ilī-ālum use different variations more often than the other two pairs of siblings. Especially the signs AM, DU, IM, KÀ, and TIM are written with peculiar variations that can hardly be found on tablets of other senders (of the second generation). Furthermore, Aššur-nādā in particular used almost unique forms for the signs LI, MA, and RI, which are not even written on Ilī-ālum's tablets.

This kind of observation, however, is not peculiar to them. In case of Elamma's children, there are also five signs (AM, DÍ, DU, KÀ, TIM) that are written with variations hardly found on the tablets of the others.

By comparing the signs that are written with unique forms, it can be noted that they are often the same signs, e.g. AM, DU, KÀ, and TIM. In comparison with the observations of the older generation, it can be noted that also here, especially AM and KÀ are mainly written with unique variations as well. Fig. 247 shows that each sender of the younger generation preferred another sign variation of the sign AM. And this impression does not change when the older generation is added (see *dataset_all*).

4.8 Conclusion

The comparison of the three family corpora revealed more information about writing habits, family traits, and possibly schooling. Especially notable is that not only the use of specific sign forms can tell more about family traits, but also the use of particular signs. Thus, the writers of the tablets of Ali-ahum and his son Aššur-taklāku show a clear preference in writing the name of the latter with the sign TÁK, while on the tablets of Aššur-nādā's family, the same name is written with the sign combination *ta-ak*.

By comparing the different sign forms it is notable that especially the comparison of variants shows interesting results. The individuals of the parental generation are hardly distinguishable from each other. First of all, they generally have much greater variety of sign forms. And in addition, there is hardly any pattern recognisable. Thus, all three men sometimes used sign variants that are unique to them, but also frequently used variants that can also be found on the tablets of the others. Thus, there are no clear differences between the corpora, but also no clear correlations either. Furthermore, the comparison of the sign variations does not change this impression. A next step for future studies could be an analysis of the syllabary and whether there are any peculiarities or obvious differences and changes in the use of signs.

The individuals of the next generation show more consistency in their own corpus. It is also apparent that especially tablets of siblings show several similarities, notably Ennam-Aššur and UI165, as well as Aššur-nādā and Ilī-ālum. It can be assumed that the siblings had a similar educational background, and were most likely taught by the same person. Furthermore, while the tablets of Aššur-nādā and Ilī-ālum have peculiar sign forms that are not written on the others' tablets, the corpora of Ali-ahum's and Elamma's children have more sign forms in common.

While the comparison of the sign variants revealed some interesting observations, the comparison of the sign variations did not lead to any new insights.

Regarding the question of literacy and education, first of all, the analysis of the families has shown that several individuals were able to write, men and (very likely) women. Even though it is partly not provable yet that all the letter senders of this study were the writers of their own texts, it actually seems very likely. And especially in regard of the second generation, their literacy could be confirmed (e.g. Aššur-taklāku, Aššur-nādā, Ilī-ālum). Furthermore, as written above, especially the tablets of the children of Elamma, as well as of the two older sons of Aššur-idī display several sign forms and peculiarities that indicate that the siblings had a similar educational background differing from the educational background of their respective father. On the other hand, in both cases some specific or probably rather familial traits noticeable, which lead to the assumption that there were either family traits or different writing "schools". In case of family trait, the children were then probably not taught by the father, but by relatives who had a similar educational background, i.e. were taught in the same writing "school".

Chapter 5: Computational Analysis

This chapter introduces the attempt of a computational analysis of the before analysed material. The idea was suggested by Prof. Dr. Niek Veldhuis from the Department of Near Eastern Studies of the University of California, Berkeley. In close collaboration with him a computer program was written. The aim is to cluster the collected data according to their similarities and therewith support the identification of the same handwriting, especially in case of a large amount of data.

I am neither a specialist in data science nor experienced in coding. Therefore, the different methods used might not be the most suitable ones, and they can only be explained insufficiently. The main focus lies on the results of the analysis, and a discussion on further development and improvement of the computer program.

5.1 Terms and Tools

The program is written in the open-source programming language Python, which emerged to a tool "of scientific computing tasks, including the analysis and visualization of large datasets" (VanderPlas 2016, xiii). It is a high-level language, which means it cannot be run by a computer without being processed before because computers run only low-level languages. Consequently, running such a program takes some time. The advantage of the high-level programming languages is that they are easier and faster to write, and they are portable, i.e. "they can run on different kinds of computers with few or no modifications. Low-level programs can run on only one kind of computers and have to be rewritten to run on another" (Downey 2012, 1).

It is used in Anaconda 5.3.1 (https://www.anaconda.com/), an open-source distribution for Python and R (another programming language for data science). Anaconda is a distribution "for large-scale data processing, predictive analytics, and scientific computing" (Embarak 2018, 7).

The code was written and used in a Jupyter Notebook, which is a browser-based graphical interface. It creates a Jupyter Notebook document (file ending .ipynb) containing the complete code, text, plots and further media.

> The so-called cluster analysis is "a data analysis tool which aims at sorting different objects into groups in a way that the degree of association between two objects is

> maximal if they belong to the same group and minimal otherwise. Given the above, cluster analysis can be used to discover structures in data without providing an explanation/interpretation" (http://www.statsoft.com/Textbook/Cluster-Analysis, accessed 17.12.2018).

The program aims to group objects according to their homogeneity, i.e. objects of one group (= cluster) are more similar to each other than they show similar elements to objects from other clusters. The classification of the similarity is based on a selection of discriminating elements (Eckey *et al*. 2002, 203, 205). In case of the presented study on handwriting identification, these discriminating elements are the different sign variations and the use of signs discussed in ch. 3 and 4.

The direct distance between two objects in a multidimensional space is calculated on the basis of the data of the discriminating elements. The so-called Euclidian distance, the straight-line distance between the two objects, provides information on the similarity of the two points. The longer the distance, the more dissimilar they are (Eckey *et al*. 2002, 205-207). The calculation of the distance is greatly influenced by the different scales of the discriminating elements. If they have different scales, then they are evaluated unequally (Eckey et al. 2002, 208). Regarding the data of the handwriting analysis, the signs usually occur with varying frequency. For instance the sign MA is one of the most used signs on a tablet while the signs TIM or AM occur only very few times. Consequently, the inclusion of their number of occurrences into the table would strongly influence the result of the computational analysis. Therefore, for the present study not the number of occurrences of the sign version per tablet was recorded, but only the existence (1) or non-existence (0) of a sign variation on the respective tablet (*dataset_all*). Furthermore, only the most written variation is recorded since it is assumed that every experienced writer has usually a habitual handwriting.[217] In computer science, such a data type that only records the existence or non-existence of data (referred to here as true = 1, and false = 0) is called a Boolean data type.

For the computational analysis, two methods were applied, the hierarchical clustering, and the k-means clustering.

217 It has to be kept in mind that the letters might reflect different stages of the development of the writer's hand, which – in theory – might become more stable and consistent over time.

5.1.1 Method 1: Hierarchical clustering

The hierarchical clustering method builds a multi-level hierarchical cluster structure and is a suitable approach when the number of clusters is unknown. There are mainly two types, the divisive[218] and the agglomerative method. For the present study, only the latter was applied.

The agglomerative method is a so-called "bottom-up" approach. On the first initial level, each object is a cluster in itself, as measured by its unique characteristics. At the next level, it is then linked to another object that has the most similarities. On each level, the similarities of all the sub-clusters are newly computed and compared. The different clusters are disjoint and form separated partitions. But at the same time, they are also the subsets of the cluster of the next level. Successively, all sub-clusters are linked to each other until all of them are joined in one group.

Because of the hierarchical structure, it is frequently plotted into a dendrogram. On the basis of such a plot, the hierarchical classification can easily be comprehended. The consecutive level of the hierarchical cluster can be very close to each other which indicates, that they show a higher level of similarity. On the other hand, an abrupt rise of the distance indicates a strong decrease of similarities (Eckey *et al*. 2002, 229-231).

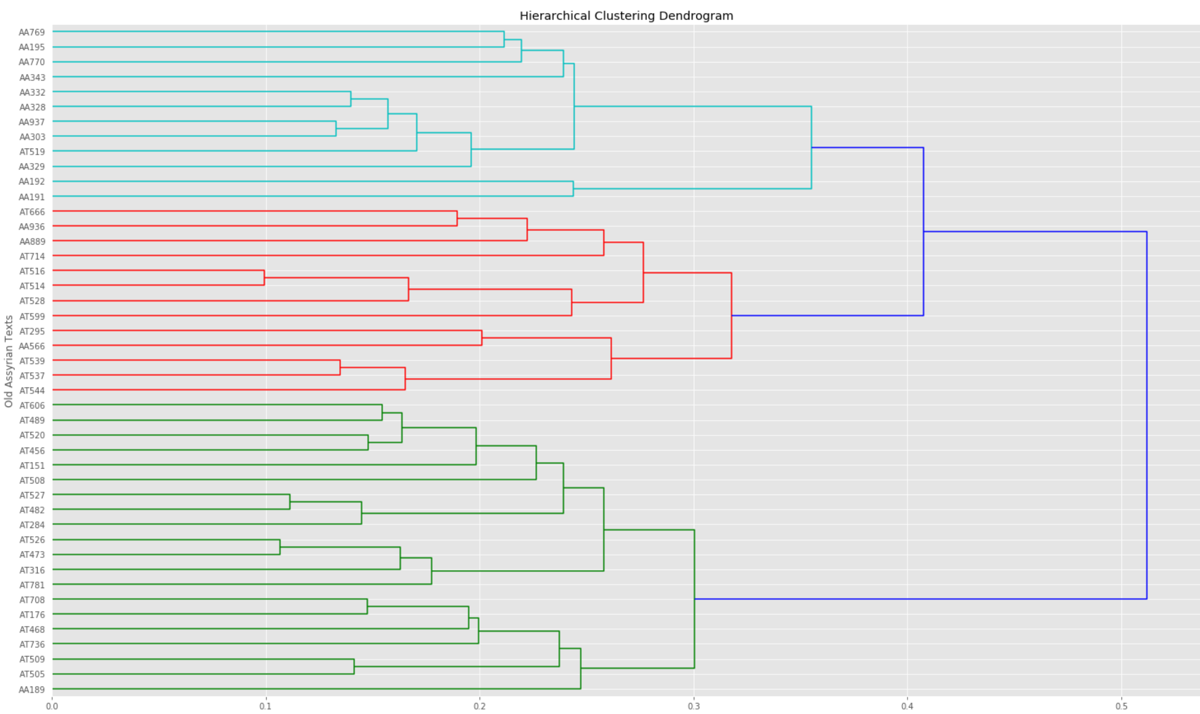


Fig. 248: The dendrogram of Ali-ahum's and Aššur-taklāku's data.

218 This method is basically the opposite of the agglomerative method. Here, the analysis begins with one large cluster which is then progressively divided to smaller clusters based on their similarities.

The example (fig. 248) is based on the data of the 15 letters of Ali-ahum, and the 30 letters of his son Aššur-taklāku. On the graph,[219] their abbreviations are written on the left side. Each of them is one object, and on the initial level, a cluster in itself. The algorithm then calculates which of the objects/clusters are the most similar, and links them like, in the red group, AT514 and AT516. Next, the algorithm calculates which cluster shares the most similarities with the newly formed cluster AT514-AT516, which is in this case AT528, and links them together. And so forth. After this, there are three clusters marked by different colours (light blue, red, and green). On the last level, the three groups are connected by a dark blue link. This connection, however, is formed with long distances between the sub-groupes, which implies a great decrease in similarities. Thus, the dark blue connection is formed on a very general level which hardly matters for a comparison. Furthermore, such a sudden enlargement of the distance between two clusters can also be noted in the light blue group. In such a case, the sub-clusters have to be analysed on the basis of the discriminating elements to learn more about the reasons.

5.1.2 Method 2: K-means Clustering

The second method is the so-called k-means clustering. As VanderPlas summarises it, "the k-means algorithm searches for a predetermined number of clusters within an unlabelled multidimensional dataset" (2016, 463). The initial point of the method are *k* random clusters. For each of them, one "centroid" is calculated (therefore the k-means clustering is also called a centroid model). The program then calculates the Euclidian distances of the objects of the dataset to the cluster centroids, and the objects are assigned to the cluster centroid to which they have the shortest distance. For k-means, the centroids of the clusters are the calculated means of the respective group. This calculation constitutes the advantage, but also the disadvantage of this method. The number of clusters has to be predetermined, and it is fixed while for the hierarchical clustering, the number of clusters changes from level to level. The number of the clusters can be changed. This results in a different centroid calculation, and therefore a different composition of the clusters. On the other hand, the assignment of the objects is not fixed, but rather flexible because every change of the data can entail a reassignment of the objects (Eckey et al. 2002, 255-260; http://www.statsoft.com/Textbook/Cluster-Analysis, keyword: k-means clustering, accessed

219 This graph, and all the following graphs displayed in this chapter can be found on the CD-ROM in the file *python-plots*. The ones for the 93/k-archive are saved with the attribute "93k", the plots for Elamma's family are saved with the attribute "91k", and Aššur-nādā's with "AN".

18.12.2018). Another disadvantage of the k-means clustering is that the centroids can be calculated differently for the same dataset every time the computational analysis is repeated. Consequently, the analysed objects can be clustered differently every time the analysis is repeated. Thus, the result of the k-means clustering is somewhat unreliable.

The result of the k-means clustering is presented in a so-called scatter plot. The analysed objects are displayed in a coordinate system as dots and named with their abbreviation (e.g. TA722). The clusters are coloured differently to mark their affiliation. The calculation of the clusters, i.e. the computation of the Euclidian distances happens on a multidimensional level, the plot however, is two-dimensional, and the multidimensional cluster has to be adapted to the two dimensions. Therefore, it happens that not all the dots of the same cluster are grouped together, but they can be scattered over the complete graph.

As an example, again the data of Ali-ahum and Aššur-taklāku was processed with the k-means method. To define *k* clusters, a so-called structure chart ("Struktogramm") was used, a chart that provides clues for the number of clusters of a set of objects (see fig. 249).

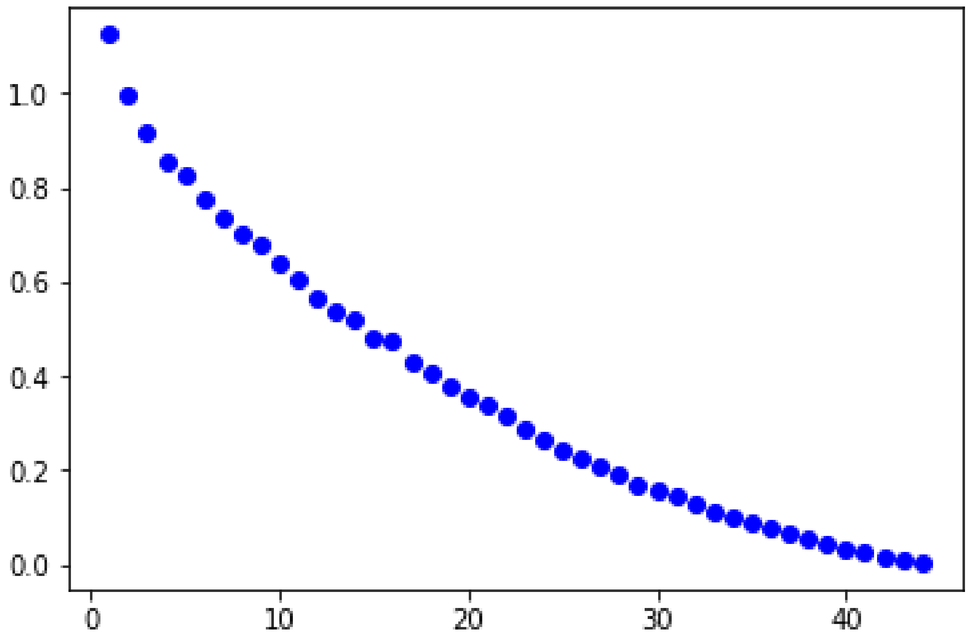


Fig. 249: The structure chart of Ali-ahum's and Aššur-taklāku's data.

On the abscissa (x-axis), the number of objects (= most basic clusters), in this case 45, are recorded. On the ordinate (y-axis), the degree of heterogeneity is recorded. The number of ideal clusters can usually be deducted from the point in the row of dots where it shows a strong kink, the so-called elbow (Müller 2015/2016, 23). As it can be seen in fig. 249, the elbow is not necessarily clearly determinable. In this case the distance between the dots changes significantly from the third to the fourth dot, therefore, and in comparison with the clusters of the hierarchical dendrogram (see above), the ideal number of clusters seems to be three.

Accordingly, the k-means clustering of Ali-ahum's and Aššur-taklāku's data was executed with three clusters. On the graph (fig. 250) the three clusters are marked again with the three colours: light blue, red, and green. The light blue group consists of 12 letters of Ali-ahum and three letters of Aššur-taklāku. The red group contains only one letter of Ali-ahum, the remaining ones are letters from his son. The green group contains two letters of the father, and the rest was sent by Aššur-taklāku.

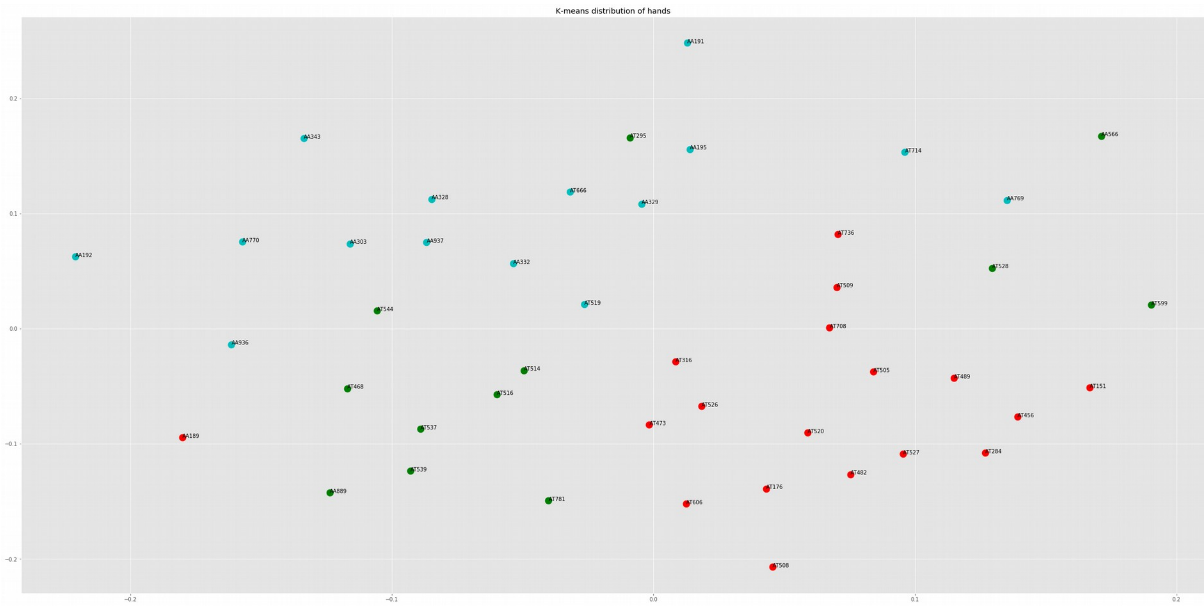


Fig. 250: The k-means cluster with 3k.

The identical colour set of the hierarchical dendrogram above, and the k-means clustering is based on the code, and does not necessarily reflect the similarity of the clusters of the two methods. Comparing the plots of the two methods, the results are very similar, even though the approaches are completely different. On both plots, the light blue cluster contains mainly tablets of Ali-ahum, and only very few of his son. On the k-means plot, the two tablets of Aššur-taklāku, AT666 and AT714, and Ali-ahum's AA936, are clustered to this group while in the dendrogram, the three tablets belong to the red group which contains mainly Aššur-taklāku's tablets. The red and green group of the dendrogram remained basically in the same constellation as on the k-means plot with only few changes, but the colours of the groups changed so that the green group of the dendrogram is marked red on the k-means plot, and vice versa. Here, only the two tablets AT468 and AT781 were changed to different clusters.

In comparison, both method show similar results. The hierarchical cluster is easier to understand and to handle since the number of clusters and their composition is clearly comprehensible. The k-means clustering, on the other hand, has the obvious disadvantage that the number of clusters has to be determined beforehand, and its process is rather unprecise. The advantage of this method is that the clusters are more flexible.

5.1.3 The Program

Downey defines a program as “a sequence of instructions that specifies how to perform a computation” (2012, 3). In the following, these instructions, the command lines of the code, will be explained briefly and section by section in the order as they are written in the program. The fields highlighted in grey are the sections of the code, the explanation of each of them follows underneath.

Some of the individual sections are written in this way for the sake of transparency only. The partly colourfully marked fonts indicate different internal commands of the code, which are not discussed further. The text after diamonds (in light blue-grey) are comments inserted into the code to explain the respective command line for the user/programmer of the code.

1.

```
import pandas as pd
import numpy as np
import matplotlib
from scipy.cluster.hierarchy import dendrogram, linkage, ward
from scipy.spatial.distance import pdist, squareform
%matplotlib inline
from matplotlib import pyplot as plt
np.set_printoptions(precision=5, suppress=True)  # suppress scientific float notation
```

In this initial section most of the necessary tools for the code and its execution are initiated. Pandas, NumPy, and Matplotlib are such tools. For example NumPy, an abbreviation of *Numerical Python* “provides an efficient interface to store and operate on dense data buffers” (VanderPlas 2016, 33), while Matplotlib is a necessary “tool for visualization in Python” (VanderPlas 2016, 217).

2.

```
df = pd.read_excel('../Dataset_AT_AA.xlsx', index_col=0, header=0)
df = df.fillna(0)    # if there is any missing value in the data, this line will fill it with 0
df = df.astype(int)  # changes all the data into the type integer
df
```

In this section, the dataset is uploaded in form of an excel chart, its name is marked in red. The following two lines adapt the dataset to prevent errors. Usually, a dataset cannot have any vacancies because the program is not able to interpret them, and would therefore give an error report. The second line of this section, however, tells the program to ignore any missing data. The abbreviation “df” represents the data frame and refers to the dataset.

3.-6.

```
df['di2~3+4'] = df['di2~3'] + df['di2~4']
# merges 2 columns and creates a new columns with the results, but does not replace them (and new column at the end)

df['ša~3+4'] = df['ša~3'] + df['ša~4']

df['šu~2+3'] = df['šu~2'] + df['šu~3']

df['im~2+3'] = df['im~2'] + df['im~3']

df2 = df.drop(['di2~3', 'di2~4', 'ša~3', 'ša~4', 'šu~2', 'šu~3', 'im~2', 'im~3'], axis=1)
# to drop the redundant columns which were merged with the code above

df2
```

```
columns = list(df2.columns.values) # creates a list
columns.sort() # puts the list/columns in their alphabetical order
df2 = df2[columns] # creates a new data frame in the new order of the list
df2
```

```
df2 = df
```

```
id_text = list(df2.index)  # creates a list of the index
```

This part of the program is supplementary. The first section enables the merging of the data of two columns of the dataset, to replace the originally merged columns by a new one with the new data without modifying the original dataset. The initial idea for this section was that some sign variations are very similar and partly alternately used on a tablet. This section would allow to experiment with their influence on the data evaluation without altering the original dataset. The following section answers the purpose to integrate the dataset with the altered columns into the program.

Every single section of the program builds on all other sections and refers to previously mentioned information (e.g. “df” and “df2”). In order not to have to rewrite the code every time there are columns to merge (e.g. without merging “df” would be used, when merging columns “df2” would have to be written), the last two sections have been inserted so that the following sections do not have to be changed.

Each command line can be disregarded by the program when a diamond is placed at the beginning of the respective line. Thus, it is easy to switch from merging columns to not merging columns.

7.-9.

```
sums = df2.sum(axis=1)
# sums up the number of signs of each shape. This total will be used to divide the these numbers to normalise them
```

```
df2 = df2.div(sums, axis='index')    # normalisation of the data
```

```
X = df.values #array
```

The code of the two first sections would normalise the data in case it would be of different scales (see above). The third section creates an array of numbers out of the data. Thus, the data can be processed and analysed further on.

10.-11.

```
id_text2 = [id for id in id_text if id[:2] == "AI" or id[:2] == "AN" or id[2] == "AS" or id[:2] == "IA" or id[:2] == "II" or
# this line allows me to select all of the letter senders or only some of them, according to their first two initials.
# Might be complicated, but works good.

df3 = df2.ix[id_text2]
df3
```

```
X = df2.values
id_text = id_text2
```

This section allows to select specific senders of the dataset. As it was explained earlier, for a convenient identification of the letters and their senders, the name of each letter sender was abbreviated to its initials, and the excavation number was added (e.g. AT151 = Aššur-taklāku, letter kt 93/k 151). If only the data of certain individuals has to be analysed, then their initials can be inserted here (marked in red in the first line).

12.

```
from sklearn.cluster import KMeans

x = list(range(1, len(df2)))
y = []
for K in x:
    kmeans = KMeans(n_clusters=K)
    kmeans.fit(X)
    iner = kmeans.inertia_
    y.append(iner)
```

This section initiates the k-means clustering, and adds the data frame (“df2”).

13.

```
import matplotlib.pyplot as plt
plt.plot([x], [y], 'bo')    # to show the plot and to find the elbow, bo is for the blue dots
plt.show()
```

This part of the program creates the structure chart to identify the ideal number of clusters *k*.

14.-15.

```
from sklearn.manifold import MDS
dist = squareform(pdist(df2))
seed = 42
mds = MDS(n_components=2, max_iter=3000,
      random_state=seed, dissimilarity="precomputed", n_jobs=1)

pos = mds.fit(dist).embedding_
pos_x = [x for x, y in pos]
pos_y = [y for x, y in pos]
```

```
from matplotlib import style
style.use("ggplot")
#from sklearn.cluster import KMeans
kmeans = KMeans(n_clusters=4)        # the number of clusters
kmeans.fit(X)

centroids = kmeans.cluster_centers_
labels = kmeans.labels_
kmeans.inertia_
```

These two sections also contain necessary lines of code for the k-means clustering, and for its visualisation. In the second section, the number of clusters can be specified (here 4k).

16.

```
colors = ["g.","r.","c.","y.", "b.", "w.", "m.", "k.","g*","r*","c*","y*", "b*", "w*", "m*", "k*"]


plt.figure(figsize=(40,20))
for i in range(len(X)):
    print(id_text[i] + ':', "group:", labels[i])
    plt.plot(pos_x[i], pos_y[i], colors[labels[i]], markersize = 25)
    plt.annotate(id_text[i], (pos_x[i], pos_y[i]))
plt.title('K-means distribution of hands')
#plt.scatter(centroids[:, 0],centroids[:, 1], marker = "x", s=150, linewidths = 5, zorder = 10)

plt.show()
```

This part of the code initiates the visualisation of the k-means clustering. The first command line contains all the colours that can be used in the plot for the different clusters. The second command line outlines the dimensions of the graph. The following lines determine the visualisation as a scatter plot.

17.

```
Z = linkage(df2, 'ward')
# calculate full dendrogram

print(Z.shape)
print(len(id_text))

plt.figure(figsize=(25, 15))
plt.title('Hierarchical Clustering Dendrogram')
plt.xlabel('distance')
plt.ylabel('Old Assyrian Texts')
dendrogram(
        Z,
        labels = id_text,
        orientation = 'right',
#        leaf_rotation=90.,  # rotates the x axis labels
        leaf_font_size=10.,  # font size for the x axis labels
    )
plt.show()
```

The last section of the program contains the code for the hierarchical clustering and its visualisation as a dendrogram.

5.2 The Clustering of the Family Archives

In the following, both clustering methods are used for the three family archives. The plots are discussed and compared with the results of the individual studies (ch. 3 and 4). Finally, the complete dataset with the tablets of the three families is clustered and analysed.

5.2.1 The Family of the 93/k-Archive

In the individual analysis of the tablets, it has been established that the corpora of the three family members, or at least their largest part, were most likely each written by one writer. The used dataset for the computational comparison contains all the analysed tablets discussed in ch. 3, and consequently, also the two tablets AA199 and AA317. Earlier it was concluded that both do not show the same handwriting which is found on the other tablets of Ali-ahum. This led to their exclusion from earlier analyses. However, they are integrated in the clustering as a kind of control entity. Consequently, the corpus of the 93/k-family comprises 54 clay tablets.

The Hierarchical Clustering

The dendrogram shows four main clusters which, with a few exceptions, mainly contain texts from one letter sender each. Regarding the clustering of Ali-ahum's and Aššur-taklāku's corpora, the dendrogram shows mainly the same grouping as in the test example above. Thus, their tablets are mainly categorized into three clusters, here marked in purple, light blue, and green. The purple cluster contains most of Ali-ahum's tablets, except AA566, AA889, and AA936, which are in the light blue cluster, and AA189, which is in the green cluster. The light blue and the green cluster, on the other hand, consist mostly of Aššur-taklāku's corpus. The only exception is AT519, which is assigned to Ali-ahum's purple cluster. Regarding the light blue cluster, it is interesting that even though there are also several tablets of Ali-ahum, it contains seven of the nine very large tablets of Aššur-taklāku (see ch. 3). Thus, they seem to be specific enough to be recognized by the algorithm. On the other hand, two tablets of the group, AT519 and AT781, are clustered in other groups, which is not comprehensible in regard to the individual analysis.

Regarding the exceptions of Ali-ahum that are not assigned to the purple cluster but either to the light blue or the green one, it can be noted that three out of four (AA189, AA566, AA889) are marked as problematic in the individual analysis (ch. 3, Ali-ahum). The fourth tablet AA936, on the other hand, is separated from the main corpus of Ali-ahum in the cluster analysis, and assigned to the light blue group. In the individual analysis, it is part of the main group of handwriting. Thus, the individual analysis and the algorithm of the program show two different conclusions. Furthermore, regarding the purple cluster of Ali-ahum, it can be noted that the two tablets AA191 and AA192 are linked together, but on a rather high level. And even though they are also connected to the rest of the group, this link is established on a very high, i.e. a general level. Therefore, both tablets might show several similarities to the main group, but they nevertheless differ in various characteristics as well. In case of these two tablets it was also noticed that on both several diagnostic signs are missing so that only a rather small number of signs can be compared. Thus, the separation is comprehensible.

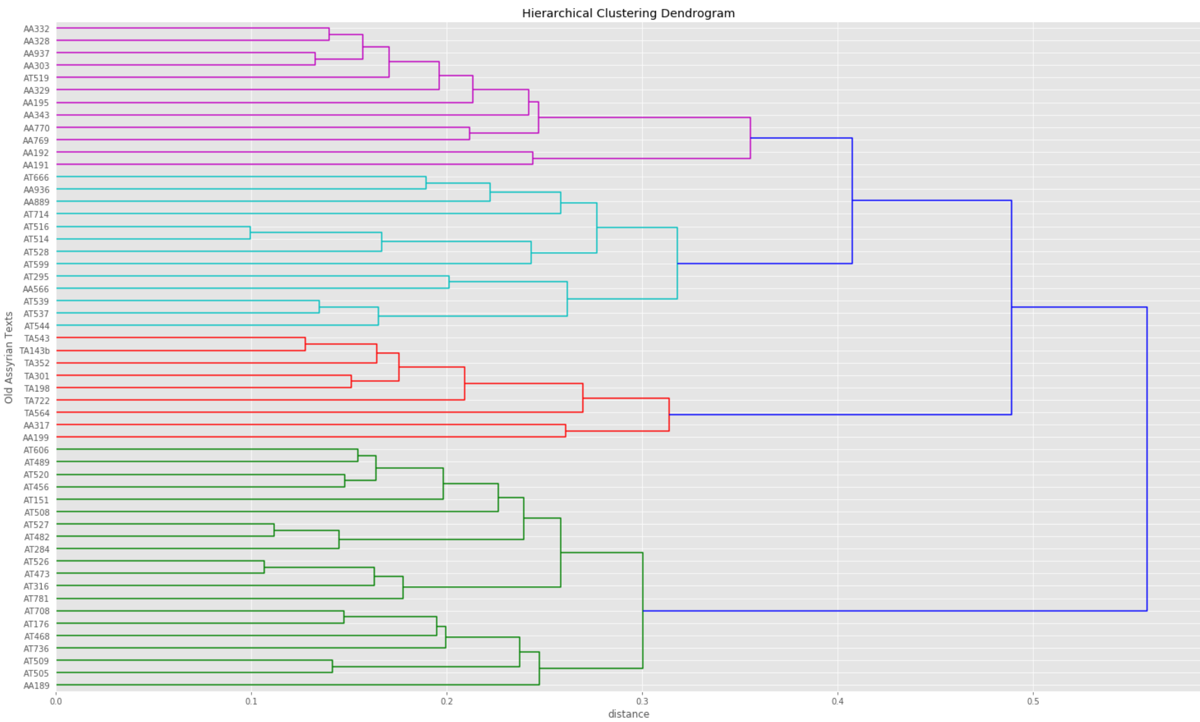


Fig. 251: The dendrogram of the family of the 93/k-archive.

The only exception of Aššur-taklāku's corpus is AT519, which is assigned to the purple cluster as against the classification of the individual analysis where this tablet is assumed to belong to the group of large tablets. On the other hand, the assignment of the two tablets AT468 and AT714 in the individual analysis was very questionable, but in the dendrogram, AT468 seems to have several conformities with AT176 and AT708 (here the green cluster). The second tablet, AT714, is linked to a cluster formed of the two exceptional tablets of Ali-ahum (AA889, AA936) and AT666 (here the light blue group).

Furthermore, the dendrogram contains a fourth red cluster. Remarkably, it consists of the seven tablets of Tariša, and the two tablets AA199 and AA317, which were sent by Ali-ahum, but not written by the same person as the rest of his corpus. Comparing the use of signs and the different variations, these two tablets are the only ones of Ali-ahum's tablet on which the sign LA is written, which is frequently used on Tariša's tablets. In addition, only on these tablets of Ali-ahum's corpus sign variations of AM, DÌ, and ŠA can be found that are commonly written on Tariša's tablets as well. On the other hand, AA199 and AA317 are only linked on a rather high level indicating that they are comparatively different. The combination of Tariša's corpus and the two tablets of her father in one cluster does not necessarily mean that they were written by the same hand. But they seem to have more discriminating elements in common with each other than with the other tablets.

The K-means Clustering

The structure chart for the k-means method of the 93/k-archive is not very clear (fig. 252). Between the first three dots, there are rather large gaps while the space suddenly becomes smaller between the third and the fourth dot. The sixth and the seventh dot are overlapping, and the latter stands out from the row of dots. After some space, the eighth to tenth dot are again very close and overlapping. And after a small kink, the row is more or less even from the eleventh dot onwards. Thus, the ideal number of clusters could be either 3, 4, 7, or 10.

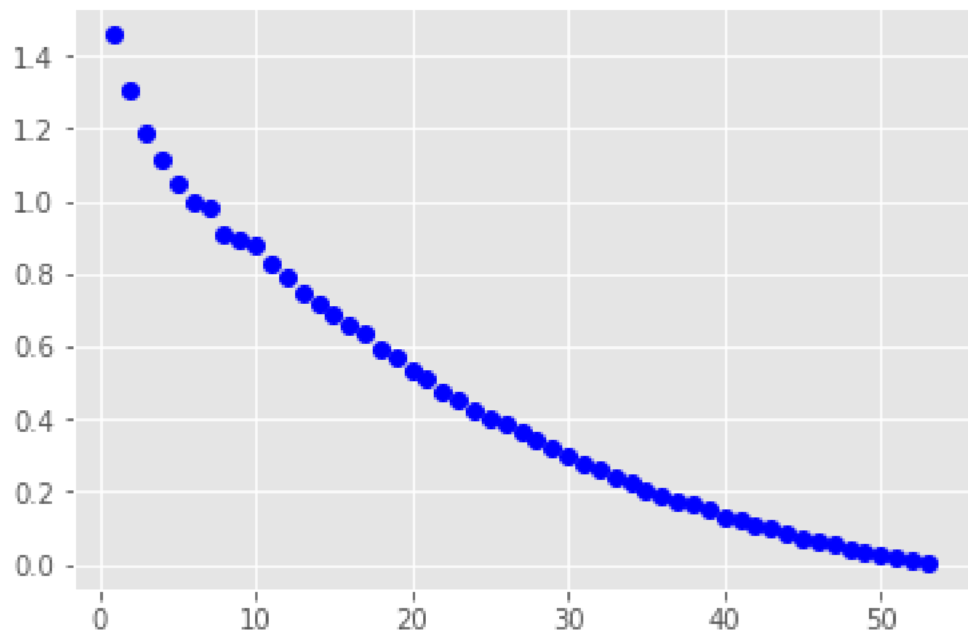


Fig. 252: The structure chart of the 93/k-archive.

The diversity of possible ideal clusters perfectly illustrates the disadvantage of the k-means clustering for this kind of analysis. Nevertheless, the method can certainly be used as a kind of control for the hierarchical clustering. Furthermore, a comparison of the plots with different clusters might give some insight into similar patterns like the different sub-levels of the hierarchical cluster do.

The most obvious number of *k* might be four since the dendrogram shows also four main groups. The clusters are marked with the colours light blue, yellow, green, and red. The red cluster contains all seven tablets of Tariša, and additionally four tablets of Ali-ahum, AA191, AA199, AA317, and AA566. Thereof, AA199 and AA317 are also assigned to Tariša's cluster in the dendrogram. But the additional tablet AA191 belongs to Ali-ahum's group in the dendrogram, and AA566 to one of Aššur-taklāku's clusters. Furthermore, three tablets of Aššur-taklāku are added to the red group of the k-means plot, namely AT295, AT537, and AT539. In the dendrogram the three tablets are clustered together with AA566 which is also assigned to Tariša's cluster here. Why these tablets are clustered together with Tariša's tablets is not clearly comprehensible. They neither show more similarities to her tablets than others, nor are particular sign variation used only on her tablets.

The light blue cluster of the scatter plot contains nine tablets, eight of them from Ali-ahum (representing almost the complete purple cluster of the dendrogram, but without AA191, AA192, and AA329) and one from Aššur-taklāku AT544. In the dendrogram, this tablet was clustered together with AT295, AT537, AT539, and AA544 which are here grouped together with Tariša's tablets.

The yellow cluster consists of 14 tablets, nine sent by Aššur-taklāku, five by his father. The constellation predominantly matches parts of the light blue cluster of the dendrogram. The cluster of the dendrogram, however, is larger. The missing tablets are mainly assigned to Tariša's red cluster of the k-means plot. The green cluster contains 17 tablets of Aššur-taklāku. All of them were in the green cluster of the dendrogram as well. From the latter, four tablets were clustered to the yellow group by the k-means program.

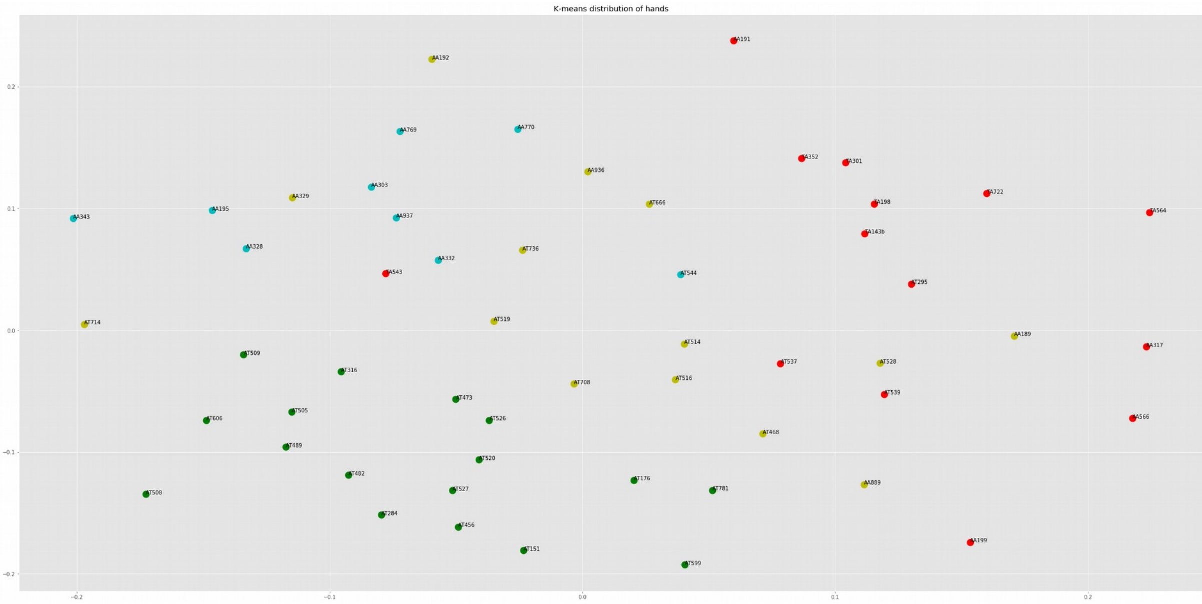


Fig. 253: The k-means clustering of the 93/k-archive with four clusters.

The comparison shows that the basic groups are the same, but several tablets were clustered differently by the k-means method. Thus, the number of clusters was probably not the right one.

The structure chart also shows a kink between the seventh and eighth dot, therefore, *k* could also be 7. In the plot, the seven clusters are marked with the colours green, yellow, dark blue, light blue, red, purple, and white. The light blue cluster contains Tariša's seven tablets, the usual exceptions of Ali-ahum, AA199 and AA317, and additionally AA566.

The white cluster contains the two tablets AA191 and AA192. In the dendrogram both were part of the purple cluster, but the two were only connected on a very high/general level, and to the rest of the purple cluster, the connection was on an even more general level. So, their separation here is not very surprising.

Another very small cluster is the yellow one. The three tablets AA189, AT468, and AT714 are grouped together. This is rather surprising because in the dendrogram, these tablets are neither paired, nor even close to each other. And usually, they are also mostly well integrated in their respective structure. On the other hand, the individual analysis has also shown that especially AT468 and AT714 do not match very well with the rest of Aššur-taklāku's tablets.

The red and purple cluster contain only Aššur-taklāku's tablets, and equate in their composition mainly to the green cluster of the dendrogram (and the green cluster of the k-means with 4 *k*).

The green group of this plot contains nine tablets of Ali-ahum, and two tablets of his son. The cluster matches mostly with the purple cluster of the dendrogram. But here, AA191 and AA192 are separated into the white cluster, and AT544 is added.

Finally, the dark blue cluster consists of ten tablets of Aššur-taklāku, and two tablets of his father (AA889, AA936). The cluster contains tablets of the light blue and green group of the dendrogram.

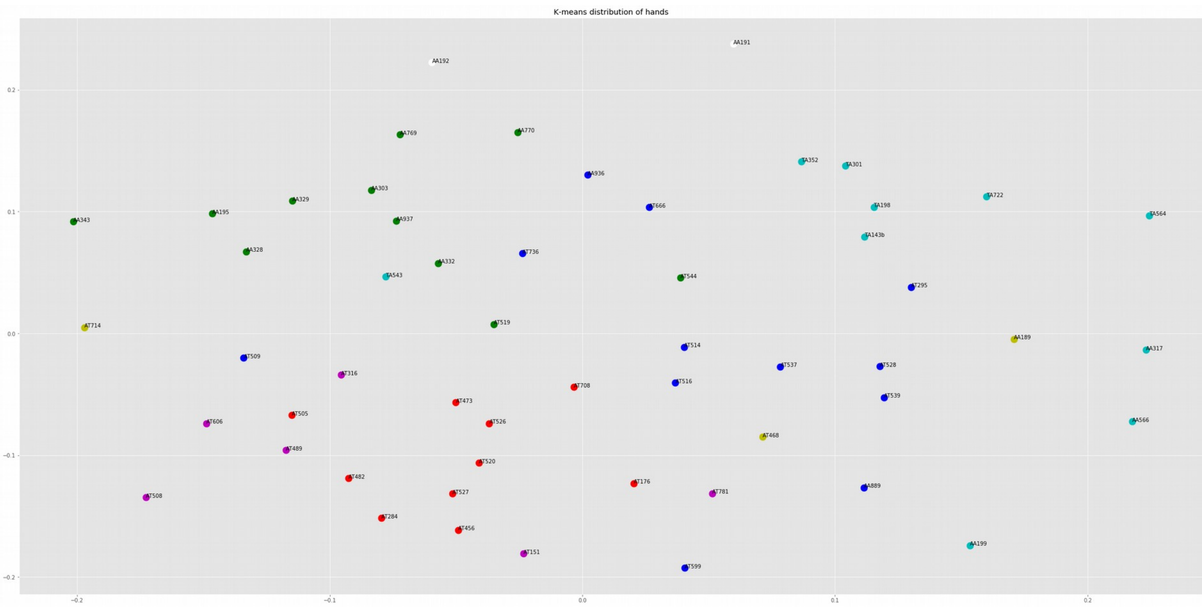


Fig. 254: The k-means plot with seven clusters.

Even though the number of clusters is higher than in the dendrogram, the cluster compositions seem to show more consensus with both the dendrogram and the individual analysis. Nevertheless, it is problematic that the clustering process cannot be retraced so that an overall uncertainty in regard of the reliance of the clusters remains.

On the other hand, even though the clusters of k-means are neither matching with the dendrogram, nor are they stable, the advantage of this method is that the data can be analysed with different numbers of clusters. By analysing plots with different numbers of clusters, group cores of tablets can be noted which are always clustered together, at least in a certain frame[220].

The following table (table 44) includes all the tablets of the family of the 93/k-archive, each column represents the clustering of the k-means method with different *k* clusters, including 3, 4, 6, 7, 8, and 10 clusters. The numbers in the columns name the cluster to which the

220 Of course, when the number of clusters is too high, then every unit can be resolved.

respective tablet was assigned according to the calculation of the program. For example in the k-means analysis with three clusters (3 k), the tablet TA143 was assigned to cluster 1, tablet AA195 was assigned to cluster 0. In the k-means analysis with four clusters, TA143 was assigned to cluster 2, and AA195 was assigned to 0, and so forth. The tablets which are assigned to the same group are marked with the same colour. A few exceptions were made. In case of the purple group, TA722 and AA317 are both grouped differently once. Nevertheless, both tablets were mostly clustered to the same group.

Eight tablets of Ali-ahum (marked red) are always clustered together. Two other tablets, marked orange, are mostly assigned to the same cluster. Only once they are grouped differently. The rest of the tablets of Ali-ahum is frequently combined in different ways.

In case of Aššur-taklāku, seven tablets are always grouped together (marked in light blue). Six additional tablets are mostly grouped together with the first group. Only in the k-means analysis with ten clusters, these six tablets are assigned to another group. A few other tablets are also always clustered together. It is notable that the light green group contains six tablets of the very large tablets of this sender. A difference to the dendrogram is that AT544 is hardly clustered together with the rest of the tablets, while in the dendrogram, they are assigned to one group. The other groups, however, are much smaller (coloured in light green, yellow, and dark green).

It is notable that these core groups in the table consist hardly of tablets from different senders. One exception is the purple group which contains mostly Tariša's tablets, and in addition AA317. Another one is the dark green group. Here, two tablets of Aššur-taklāku and one of Ali-ahum are usually grouped together (again only in the k-means analysis with ten clusters, it is classified differently).

Tablet	3 k	4 k	6 k	7 k	8 k	10 k
TA143	1	2	4	2	0	2
TA198	1	2	4	2	0	2
TA301	1	2	4	2	0	2
TA352	1	2	4	2	0	2
TA543	1	2	4	2	0	2
TA564	1	2	4	2	0	2
TA722	1	2	5	2	0	2
AA317	1	2	4	2	0	8

AA195	0	0	3	4	2	0
AA303	0	0	3	4	2	0
AA328	0	0	3	4	2	0
AA329	0	0	3	4	2	0
AA332	0	0	3	4	2	0
AA343	0	0	3	4	2	0
AA769	0	0	3	4	2	0
AA937	0	0	3	4	2	0
AA191	0	0	0	5	5	4
AA192	0	0	3	5	5	4
AA199	1	2	5	0	7	7
AA566	1	2	5	3	0	2
AA770	0	0	2	3	2	0
AA889	2	3	2	6	1	3
AA936	0	3	2	6	3	3
AT151	2	1	1	1	4	5
AT284	2	1	1	1	4	5
AT456	2	1	1	1	4	5
AT489	2	1	1	1	4	5
AT505	2	1	1	1	4	5
AT508	2	1	1	1	4	5
AT606	2	1	1	1	4	5
AT316	2	1	1	1	4	6
AT473	2	1	1	1	4	6
AT482	2	1	1	1	4	6
AT520	2	1	1	1	4	6
AT526	2	1	1	1	4	6
AT527	2	1	1	1	4	6
AT514	2	3	2	6	1	3
AT516	2	3	2	6	1	3
AT528	1	3	2	6	1	3

AT537	1	3	2	6	1	3
AT539	1	3	2	6	1	3
AT295	1	3	2	3	1	3
AT176	2	1	1	1	6	9
AT708	2	1	1	1	6	9
AA189	2	1	1	1	6	1
AT468	2	1	2	1	6	1
AT509	2	1	2	1	6	3
AT736	2	1	2	1	6	9
AT599	2	1	2	1	1	5
AT519	0	0	2	6	2	0
AT544	0	0	3	6	1	0
AT666	0	1	2	6	3	3
AT714	0	1	2	2	3	1
AT781	2	3	1	1	1	6

Table 44: K-means with different k *clusters.*

Summary for the 93/k-archive

As the previous discussion has shown, the outcomes of the two computational analysis methods show similar results, which are also comparable to the individual analysis from ch. 3. Thus, especially Tariša's tablets are clearly distinguished from the tablets of her father and brother, and also the corpora of the two male family members are mostly separated. In the individual analysis of Aššur-taklāku's corpus, a group of nine tablets was outstanding because certain sign forms were only written on them. In the hierarchical clustering most of them are also grouped together, but with several other tablets as well as several tablets of his father. Thus, the few characteristics which separated these large tablets of Aššur-taklāku from the rest of the corpus in the individual analysis were not crucial for the algorithm calculating their similarities.

Even though each main cluster contains especially the tablets of one letter sender, there are also some exceptions clustered to the letters of another person. These exceptions, however, are in most cases comprehensible because in the individual analyses, they are mainly marked as rather different as well. In this regard, the computational analysis can actually be a strong support for rather uncertain cases of the individual analysis. While the individual analysis of the dataset depends on the analyser, the result of the computational analysis is based on objective calculations.[221]

However, the analysis has also shown some problems of the computational approach. Problematic for the hierarchical clustering is the calculation itself. The only unbiased calculation is the one of the first level where the Euclidian distances of two tablets are computed. From this level onwards, however, the calculations of the distances base at least partly on the mean values of the already linked tablets of the initial level. Consequently, the ensuing calculations, and therefore also the whole structure of such a tree diagram is partial, and certain connecting factors, like the specific sign variations of Aššur-taklāku's group of nine tablets, seem to be not included into the analysis.

Even more problematic is the k-means method. While the hierarchical approach is at least partly comprehensible, the clustering of k-means is not understandable. Furthermore, finding *k* is very problematic, at least with the data at hand. This uncertainty is intensified by the fact that the method is continuously re-calculating and evaluating the data, usually with slightly different results. Thus, it is hardly reliable. On the other hand, the k-means clustering has the advantage, as mentioned before, that there is no hierarchical clustering as for the dendrogram, but all the objects, i.e. the tablets, are equally compared to the centroids. Therefore, all the discriminating elements are included into the computation.

The first impression of both computational methods is therefore, that the results are kind of accurate. They reflect mainly the results of the individual analysis, and in a few cases, especially for a few questionable tablets of Aššur-taklāku and Ali-ahum, they support a specific interpretation, i.e. their identification as written by someone else than the main writer of the respective corpus. On the other hand, especially because of the problematic calculations of both, it would be difficult to use both without an additional individual analysis. Thus, they are certainly a useful support to confirm, or reinforce an observation, but they cannot replace an individual analysis.

221 It refers to the analysis of the dataset. The data itself is not objective since the material is evaluated manually by the analyser.

5.2.2 The Family of Elamma

The Hierarchical Clustering

The plot shows four main clusters marked with light blue, dark blue, red, and green. Ennam-Aššur's tablets are grouped together and marked with light blue. UI165, the coarsely written tablet sent by his sister, is linked to Ennam-Aššur's cluster, but it is marked with dark blue. In addition, the two clusters are connected on a higher level. It indicates that even though they show several similarities, UI165 is nevertheless too different from the other three tablets.

The tablets of Elamma are grouped in basically three sub-groups. The four tablets EL030, EL079, EL080, and EL082 are grouped together (in the red coloured cluster). Tablet EL017 forms an individual cluster. And the remaining two tablets of Elamma, EL016 and EL081, are grouped together with UI206. The connection of the latter is, however, also on a very high level.

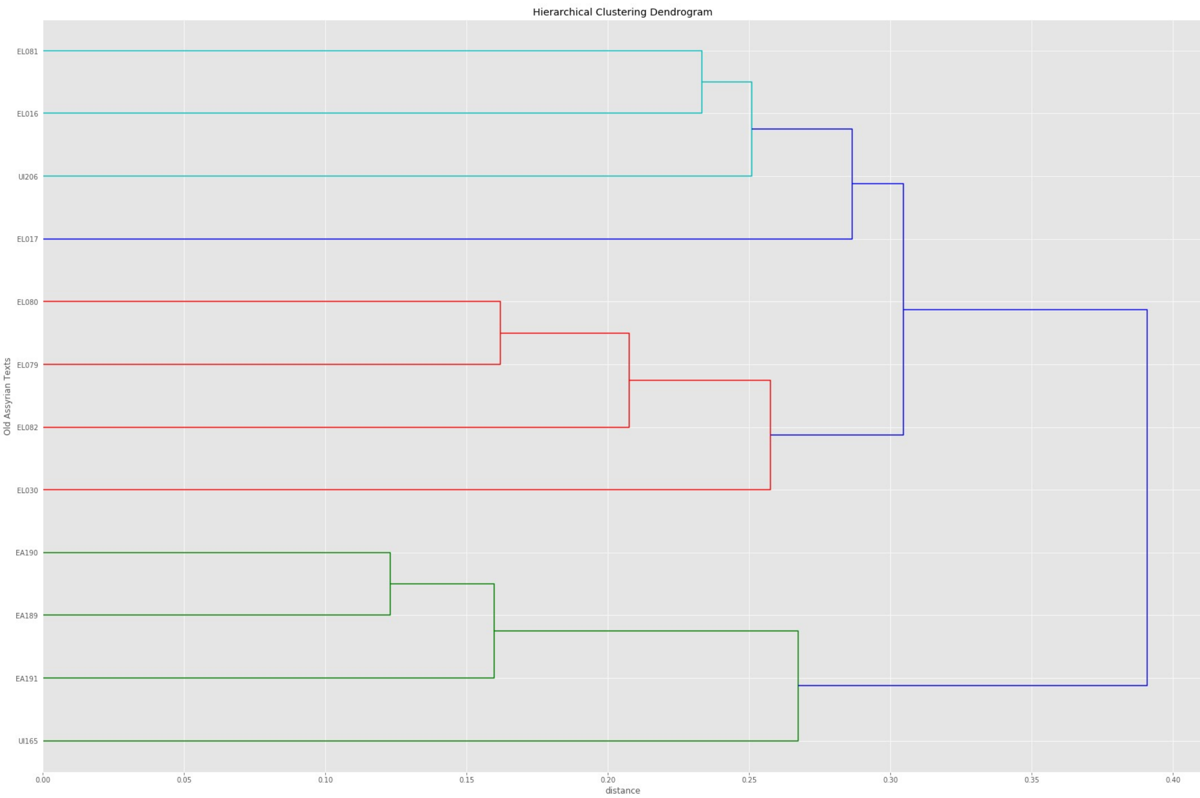


Fig. 255: The hierarchical cluster analysis of the data of Elamma's family.

The hierarchical clustering of Elamma's family reflects most of the observation of the individual analysis. The similarity of Ennam-Aššur's tablets and UI165 is especially visible, as well as the three tablets EL079, EL080, and EL082 sent by Elamma. In the latter case, the adding of EL030 is interesting because the earlier observations have shown that the tablet displays several similarities, but also several differences. Therefore, it could not be assigned to any specific group. If the result of this computational analysis was completely reliable, and if EL030 was indeed written by the same person as the three other tablets, it would help to identify Elamma as the writer of these letters.

The K-means Clustering

The analysis of the structure chart shows again a rather inconclusive result for k – or maybe a most precise one which is, however, unexpected, because the only identifiable irregularity of the row of dots is a larger gap between the first and the second one. It indicates that the ideal number of clusters for this corpus is two.

Defining two clusters for the k-means analysis, the program divides the tablets according to their senders. One group, on the plot marked with green, consists of all the tablets of Elamma. Furthermore, the neatly written tablet sent by his daughter, UI206, is added to his cluster. The red marked dots are the three tablets of Ennam-Aššur as well as UI165, the coarsely written tablet of his sister Ummī-Išhara.

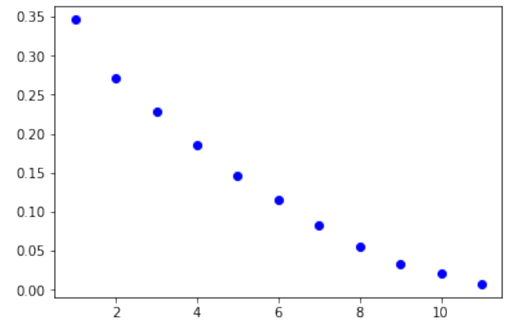


Fig. 256: The structure chart of Elamma's family.

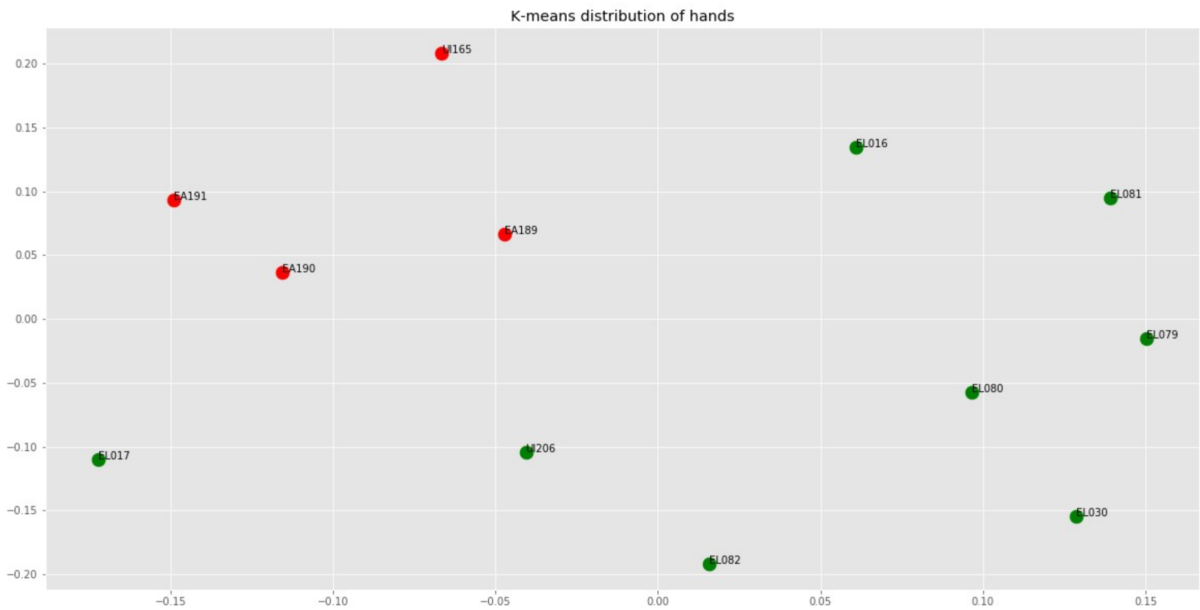


Fig. 257: The k-means analysis with two clusters.

Experimenting with different numbers of clusters (see for the analysis with different cluster numbers table 45), it is noticeable that two core groups of tablets are always clustered together. One of them contains the three tablets of Ennam-Aššur and UI165, the other one consists of the tablet trio of Elamma, EL079, E080, and EL082. The other four tablets are mostly clustered in diverse combinations and together with, or separated from Elamma's tablet trio. The same applies to UI206. In the different k-means analyses, it is not consistently clustered with any of her father's tablets, and twice, it is also assigned to no other group, but forms its own.

Tablet	k 2	k 3	k 4	k 5
EL016	0	0	2	1
EL017	0	0	3	4
EL030	0	1	0	3
EL081	0	0	0	3
EL079	0	1	3	2
EL080	0	1	3	2
EL082	0	1	3	2
EA189	1	2	1	1
EA190	1	2	1	1
EA191	1	2	1	1
UI165	1	2	1	1
UI206	0	1	2	0

Table 45: K-means with different k *clusters.*

Both computational methods reflect greatly the observations of the individual analysis, especially in regard of Ennam-Aššur's tablets and UI165, as well as the tablet trio of Elamma. Furthermore, the analysis of different cluster numbers of the k-means analysis strongly reflects the diversity of the four additional tablets of Elamma, which can hardly be grouped together because of too many different variations.

A problematic case is again EL030. In the hierarchical cluster, it is added to the consistent tablet trio of Elamma, but in the k-means analyses, it is only clustered to them in case of two or three clusters. Therefore, once again no conclusive answer can be given.

5.2.3 The Family of Aššur-idī

The Hierarchical Clustering

For this part of the analysis, the four tablets of the grandson Iddin-Ištar are excluded because of their inconsistent handwriting. Thus, the analysis comprises only data of Aššur-idī and his three sons Aššur-nādā, Ilī-ālum, and Aššur-taklāku (AS).

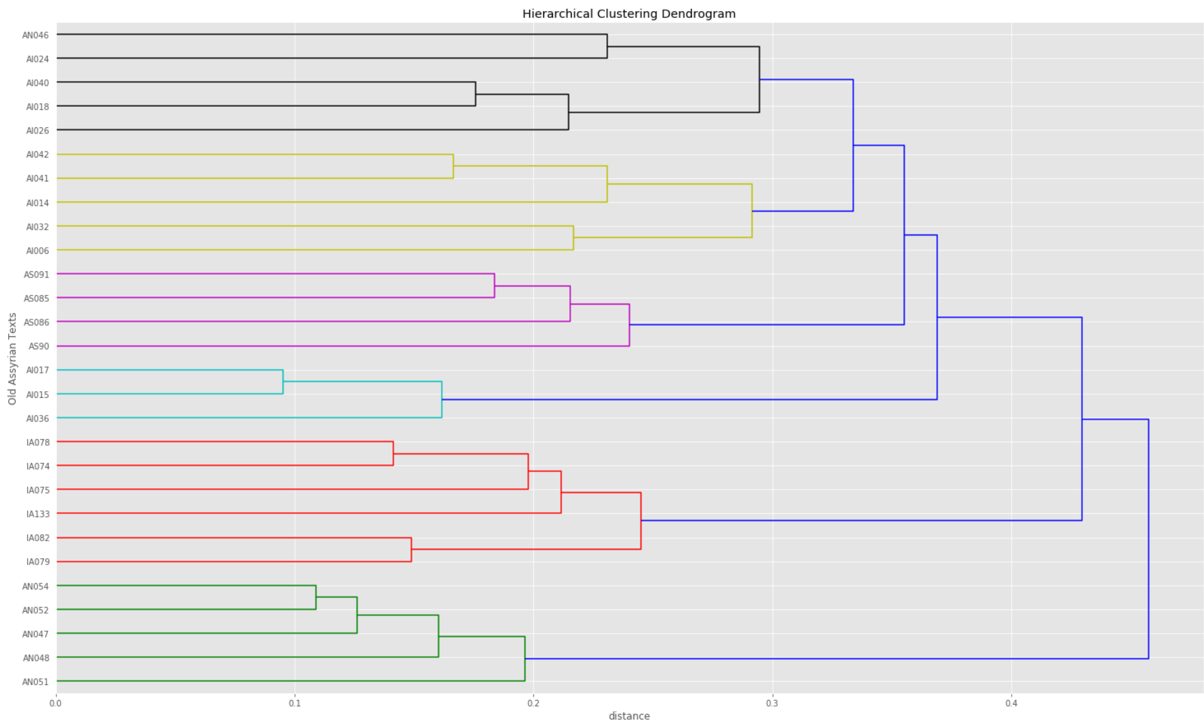


Fig. 258: The dendrogram is clustered into six clusters.

The dendrogram of the hierarchical clustering shows six main clusters, marked with different colours. Five of them contain only tablets from one sender each. The red group comprises all six tablets of Ilī-ālum, the purple cluster all four tablets of Aššur-taklāku (AS). The green group contains only the five tablets written by Aššur-nādā. The blue and yellow group cover the largest part of Aššur-idī's corpus. The black group consists of four tablets of Aššur-idī and AN046, the tablet of Aššur-nādā which was sent, but not written by him. Its classification to Aššur-idī's tablets does not necessarily mean that they were written by the same hand, but they display several similar sign forms like DÍ, KI, and MA that are not written on Aššur-nādā's other tablets. The dendrogram shows a very clear separation of the individual corpora. In case of Aššur-nādā and Ilī-ālum it was to be expected in view of the outcome of the individual analysis. The clear partition of Aššur-taklāku (AS) and his father, on the other hand, is a bit surprising since the individual analysis has shown that Aššur-taklāku's handwriting shows several overlaps with the writing on his father's tablets.

Furthermore, the connections of the tablets in several clusters are at a rather low level, especially in the case of the three brothers. It means that the similarities of these tablets can be found on a more detailed level. Only the black and yellow cluster of Aššur-idī show some rather large distances between connections as well as some links on a more general level. This is, however, not surprising because the individual analysis has shown that there are indeed some notable differences.

The K-means Clustering

The structure chart of the data of Aššur-idī's family shows more irregularities than the one of Elamma's family. For example the gap between the third and the fourth dot is smaller; the fifth dot is slightly shifted to the right, and the gap to the sixth dot is again slightly larger. A similar observation can be made for the eighth and ninth dot. Consequently, 4, 5, 6, 8, and 9 cluster for the k-means analysis might be interesting.

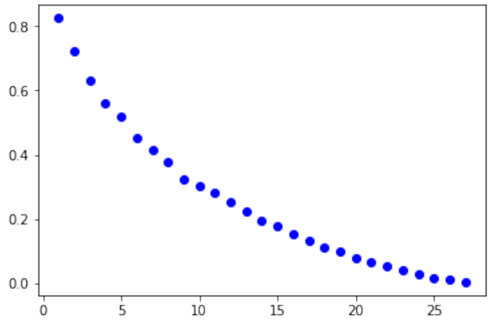


Fig. 259: The structure chart of Aššur-nādā's family.

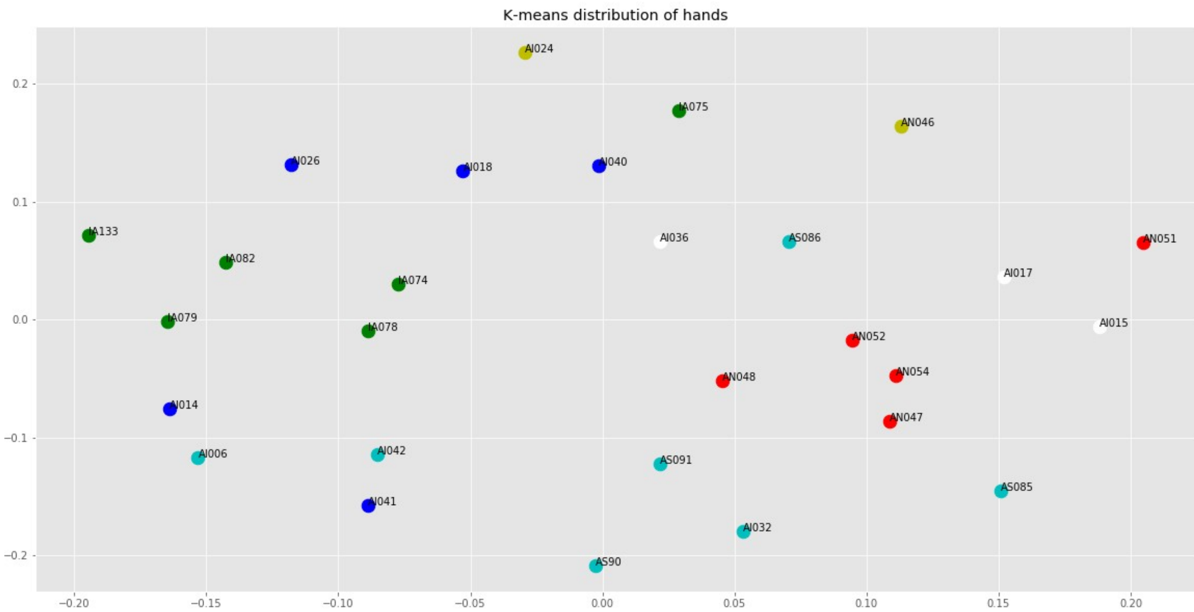


Fig. 260: The k-means cluster with six clusters.

Comparing the k-means (k6) analysis with six clusters with the dendrogram, it can be observed that the separation of the senders is not as clear as on the other plot (see above fig.

258). All tablets of Ilī-ālum and Aššur-nādā (except AN046) form their respective clusters (the green or the red cluster, respectively). But the four tablets of Aššur-taklāku (AS) are grouped together with three tablets of his father (AI006, AI032, AI042) into the light blue group. The rest of Aššur-idī's tablets are clustered into the dark blue and the white group. His tablet AI024 and Aššur-nādā's AN046 are clustered together as in the dendrogram. Comparing the k-means analyses with different numbers of clusters (see table 46) it appears that the complete corpora of the three sons are always grouped together (except Aššur-nādā's AN046). But in some of the plots, they are partly clustered with some of Aššur-idī's tablets in various ways. For example on the scatter plot with four clusters (4 k), AI032 is added to Aššur-nādā's tablets, and AI075 (and AN046) are assigned to Ilī-ālum's group. Aššur-taklāku's (AS) cluster also contains AI018 and AI024. However, while in the plot described above each of the brothers' clusters also contains some of their father's tablets, in the plot of the five-cluster analysis only the group of Ilī-ālum was assigned several tablets of their father, while the clusters of his brothers contain only their own.

The general overview of the core groups shows that only three tablets of Aššur-idī are always clustered together in the respective tests (marked with light blue), while the other small groups (marked with orange, yellow, and green) usually contain one exception per tablet that was once clustered differently. The overview of the core groups therefore actually gives a better impression of the various sign variations than the rather neat hierarchical clustering.

The consistent clustering of Aššur-taklāku (AS) is a bit surprising. Both methods grouped his four texts together even though the individual analysis has shown that at least AS086 contains several different sign variations. This classification can probably be explained by the way how the two methods work: In both cases, the clusters are formed on the basis of the similarities of objects. AS086 might be rather different than the other three tablets sent by Aššur-taklāku (AS), but it probably shows even more differences to tablets of other senders. Therefore, it is rather clustered with the three tablets of Aššur-taklāku, where there are still some similarities.

Both methods generally reflect the result of the individual analysis.

Tablet	k 4	k 5	k 6	k 8	k 9
AI015	0	4	5	1	4
AI017	0	4	5	1	4
AI036	0	4	5	1	4

AI018	2	4	4	6	2
AI026	0	4	4	6	7
AI040	0	4	4	6	2
AI024	2	3	3	4	8
AN046	1	3	3	4	8
AI041	0	1	4	3	3
AI042	0	1	2	3	3
AI006	1	1	2	3	6
AI014	0	4	4	7	3
AI032	3	4	2	5	6
AN047	3	2	1	5	1
AN048	3	2	1	5	1
AN051	3	2	1	5	1
AN052	3	2	1	5	1
AN054	3	2	1	5	1
IA074	1	1	0	0	0
IA075	1	1	0	0	0
IA078	1	1	0	0	0
IA079	1	1	0	0	0
IA082	1	1	0	0	0
IA133	1	1	0	0	0
AS085	2	0	2	2	5
AS086	2	0	2	2	5
AS090	2	0	2	2	5
AS091	2	0	2	2	5

Table 46: The data of Aššur-idī and his three sons.

5.2.4 The Computational Analysis of the three Families

In the following, 93 tablets, the letters of the ten people, are analysed with both computational methods, the hierarchical clustering and the k-means clustering.

The Hierarchical Clustering

The tablets are clustered into six main groups marked with different colours. Since the clusters contain many tablets and are complex in their composition, an image of the respective dendrogram section is attached to the discussion for better understanding. The complete dendrogram follows at the end of the analysis.

The black cluster contains all six tablets sent by Ilī-ālum, the yellow one the five tablets written by his brother Aššur-nādā. Thus, even among this large group of tablets, the brothers have a unique combination of sign variations that separates them from the rest.

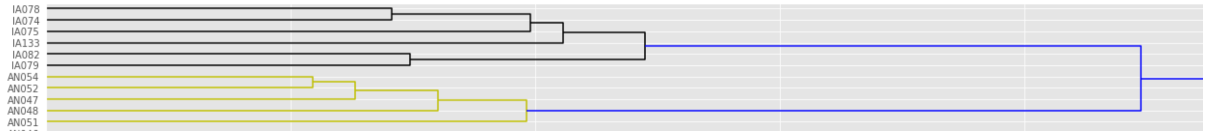


Fig. 261: The two cluster parts comprising Aššur-nādā's and Ilī-ālum's tablets.

The same observation can be made for the green cluster. It contains the seven tablets sent by Tariša and the two tablets AA199 and AA317. As in the hierarchical analysis of the 93/k-archive above, these nine tablets are clustered together, and here too the two tablets of Ali-ahum form an additional sub-cluster that is connected to Tariša's tablets only at a higher, and thus more general, level. Nevertheless, in comparison to the rest of the whole dendrogram, these tablets seem to have a distinct combination of sign variations, too, that separates them from the other corpora.

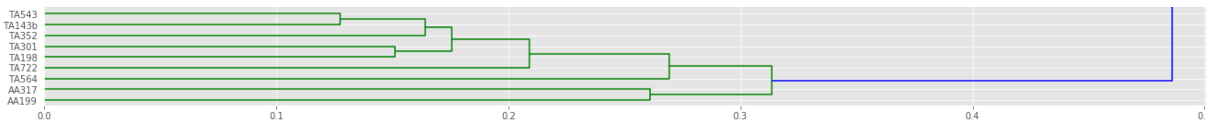


Fig. 262: Tariša's cluster, including AA199 and AA317.

The red and the light blue cluster contain almost exclusively, and furthermore, almost all the tablets sent by Ali-ahum and his son Aššur-taklāku. Only one exception can be found in the red cluster: a letter of Aššur-taklāku, son of Aššur-idī (AS091). In both clusters, both senders are represented. But in the light blue one, 19 tablets of Aššur-taklāku can be found, and only one from his father Ali-ahum (AA189) which was in all previous analyses assigned to the cluster(s) of Aššur-taklāku.

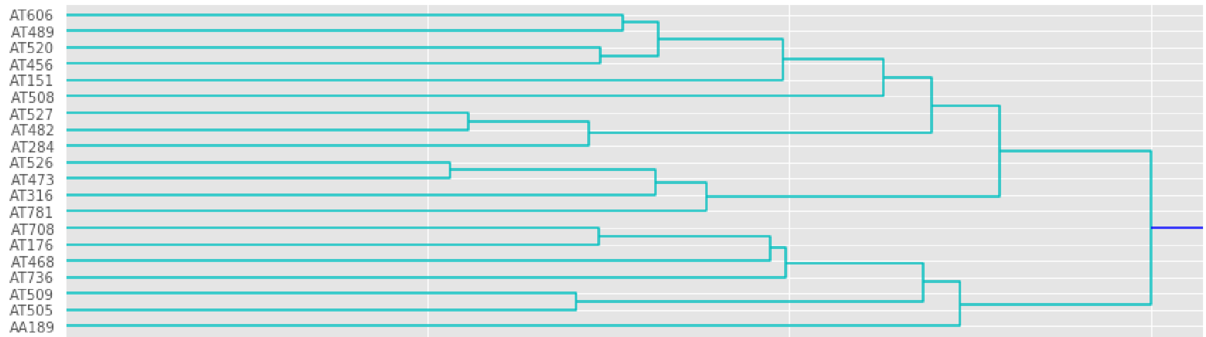


Fig. 263: The light blue cluster contains mainly tablets of Aššur-taklāku.

The red cluster can be divided into two parts. Studying the listed tablets, it can be noted that in the upper part, more tablets of Ali-ahum can be found, while in the lower part, more tablets of his son are listed. This observation is supported by the structure of the dendrogram. When "cutting" the upper most connection of the red cluster, two sub-clusters are created (see fig. 264, "cut 1". For a better differentiation of the sub-clusters, a thin black line was also drawn on the left side of the graph to separate the tablet names).

The upper sub-group of the red cluster compiles eleven tablets of Ali-ahum, three tablets of his son Aššur-taklāku (AT519, AT666, AT714), and the mentioned tablet of the latter's namesake, the son of Aššur-idī (AS091). Regarding AT519, it can be noted that also in the cluster analysis of the 93/k-archive, this tablet was usually assigned to the group with mainly tablets of Ali-ahum. The other tablet, AT714, was in the former computation not assigned to a stable group but changed frequently.

The lower sub-group contains eight tablets of Aššur-taklāku and only one tablet of his father (AA566). In the former cluster analyses of the 93/k-archive, this tablet was usually assigned to the cluster(s) of Aššur-taklāku. The constellation of Aššur-taklāku's tablets is remarkable. Here, seven of the eight very large tablets are united in one group (in the analysis of the 93/k-archive, two tablets were assigned elsewhere).

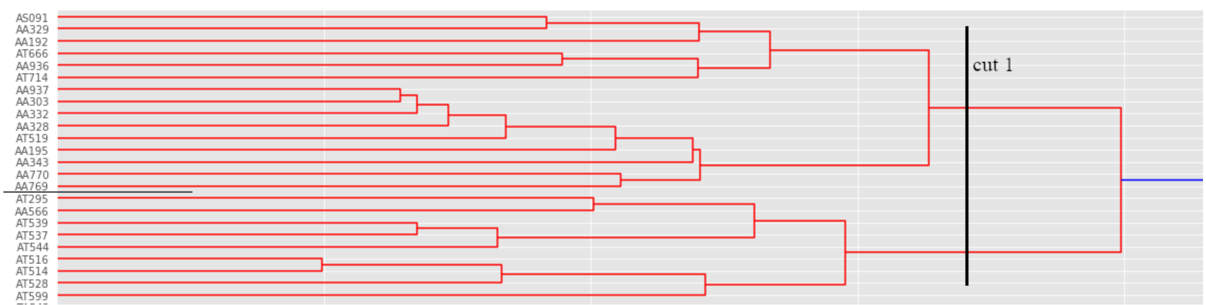


Fig. 264: The two sub-groups of the red cluster.

The composition of the red and light blue cluster as well as the distribution of the tablets indicate that father and son seem to have a similar handwriting as could already be observed in the individual analysis. But furthermore, their handwriting style is distinguishable from the writing styles of the other families. The only exception is the tablet of Aššur-taklāku (AS), son of Aššur-idī. His tablets, however, are generally more scattered in this dendrogram, as will be discussed below.

The largest cluster of the dendrogram is the purple one. It comprises the tablets of Aššur-idī and his son Aššur-taklāku (AS) as well as of Elamma and his two children Ennam-Aššur and Ummī-Išhara, two tablets of Ali-ahum, and one tablet of Aššur-nādā. While the cluster is generally very diverse, this one can be divided into several sub-clusters (fig. 265, "cut 1").

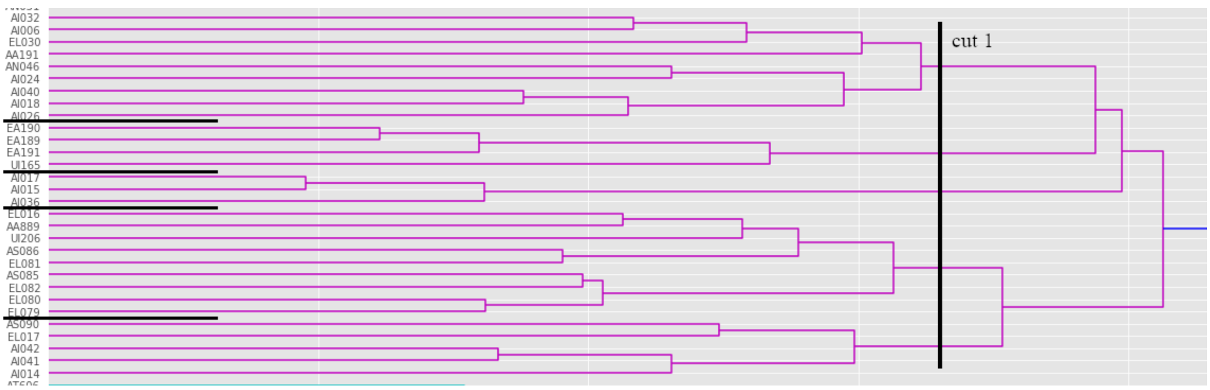


Fig. 265: The purple cluster comprises the tablets of six senders.

Some of them are the same as in the earlier analyses. For instance the second sub-group from the top contains the three tablets of Ennam-Aššur and UI165. It is notable that the connection of the three tablets of the brother to the one of his sister is established with a long distance in-between that implies a strong decrease of similar elements.

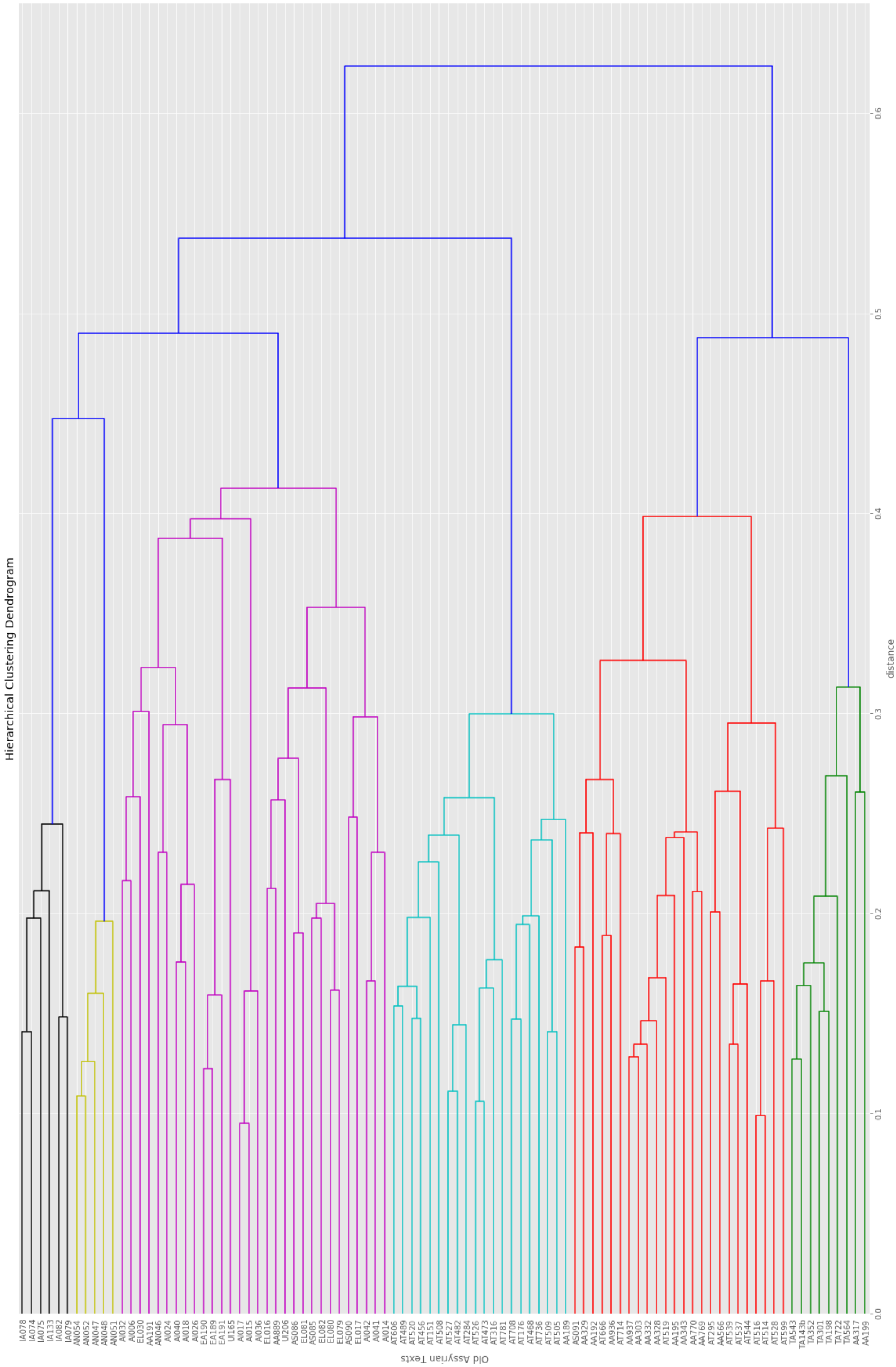
The second group from the bottom is rather mixed and contains five tablets of Elamma, the second tablet of Ummī-Išhara, UI206, two tablets of Aššur-taklāku (AS085 and AS086), and Ali-ahum's AA889. Regarding the combination of the individual tablets, however, it can be noted that again Elamma's tablets EL079, EL080, and EL082 are grouped together – this confirms the observation of the individual analysis. The addition of AA085 is rather unexpected, but it can probably be explained in terms of several corresponding sign forms, including specific variations of BA, DÍ, DU, KÀ, LI, MA, ŠA, TIM, Ù, and ZI. However, it cannot be explained why several other tablets with matching sign variations are not in this cluster. For example, AS091 has at least nine matching sign variants, but is clustered in a different group. The remaining five tablets of this sub-cluster were sent from five different individuals.

The other three sub-groups of the purple cluster contain mainly the 12 tablets of Aššur-idī, and additionally the five tablets that are hardly assignable to any writer's hand or style, i.e. AA191, AN046, AS090, EL017, and EL030.

Regarding the complete dendrogram of the hierarchical clustering, the following observations can be made: The data of most of the individuals included in this study seem to be so distinct that the algorithm groups them separately, especially the tablets of the two brothers Aššur-nādā and Ilī-ālum as well as those of the family of the 93/k-archive.

The family of Elamma, and Aššur-idī and his youngest son Aššur-taklāku (AS) seem not to have such a unique sign form combination so that all of them are basically clustered together in one large group. Nevertheless, some sub-groups can be noted, especially the tablets of Ennam-Aššur and UI165. On the other hand, already in the individual analysis, the tablets of the three senders, Elamma, Aššur-idī, and Aššur-taklāku (AS) have shown very inconsistent handwritings so that the rather scattered tablets of Aššur-taklāku (AS), and the mixed sub-clusters of the two fathers are understandable.

All in all, the hierarchical clustering reflects most observations made in the individual analyses. Furthermore, it also clarifies some uncertain observations of the latter. For example, in case of Ali-ahum and his son Aššur-taklāku, especially AT714 should be excluded from Aššur-taklāku's corpus because it is consistently assigned to his father's corpus. And the same goes for several tablets of his father, including AA189 and AA566.


Hierarchical Clustering Dendrogram
distance
Old Assyrian Texts
0.0
0.1
0.2
0.3
0.4
0.5
0.6
IA078
IA074
IA075
IA133
IA082
IA079
AN054
AN052
AN047
AN048
AN051
AI032
AI006
EL030
AA191
AN046
AI024
AI040
AI018
AI026
EA190
EA189
EA191
UI165
AI017
AI015
AI036
EL016
AA889
UI206
AS086
EL081
AS085
EL082
EL080
EL079
AS090
EL017
AI042
AI041
AI014
AT606
AT489
AT520
AT456
AT151
AT508
AT527
AT482
AT284
AT526
AT473
AT316
AT781
AT708
AT176
AT468
AT736
AT509
AT505
AA189
AS091
AA329
AA192
AT666
AA936
AT714
AA937
AA303
AA332
AA328
AT519
AA195
AA343
AA770
AA769
AT295
AA566
AT539
AT537
AT544
AT516
AT514
AT528
AT599
TA543
TA143b
TA352
TA301
TA198
TA722
TA564
AA317
AA199

The K-means Clustering

On the structure chart several small irregularities can be noticed. From the beginning, the gaps between the dots are getting smaller. The fifth dot is slightly shifted to the right as well as the eighth one, which also overlaps the seventh dot. The same phenomenon can be observed for the tenth and twelfth dot. Accordingly, the k-means clustering should be performed with 8, 9, 11, 12, and 13; 5 k is excluded because certainly more than five writers were involved in the production of these tablets. Instead, also 6 k should be analysed because the hierarchical clustering divided the corpus in six main clusters. And also 10 k might be an interesting number for the analysis because there are ten letter senders involved.

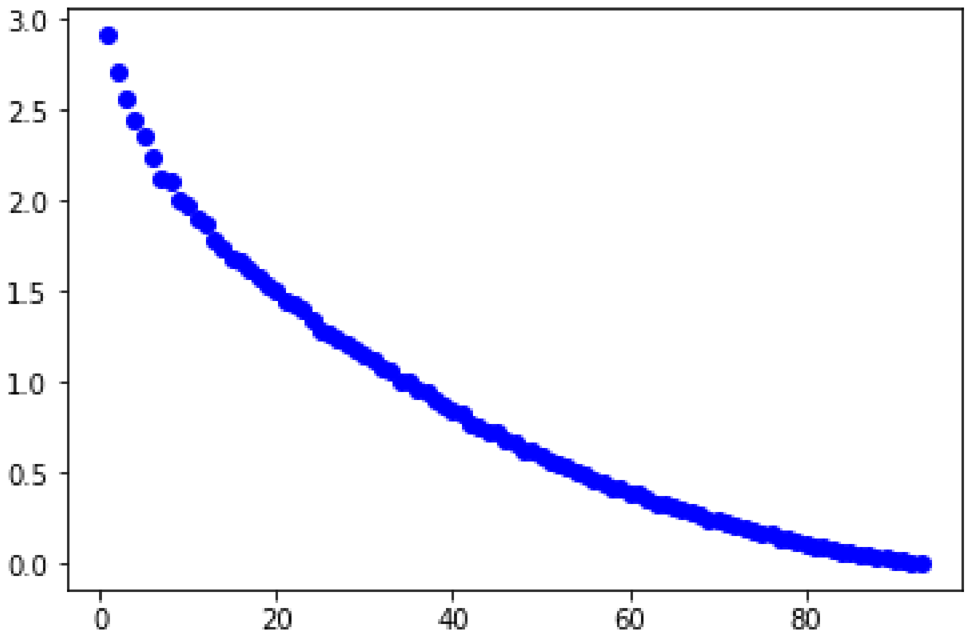


Fig. 266: The structure chart of the 94 letter corpus.

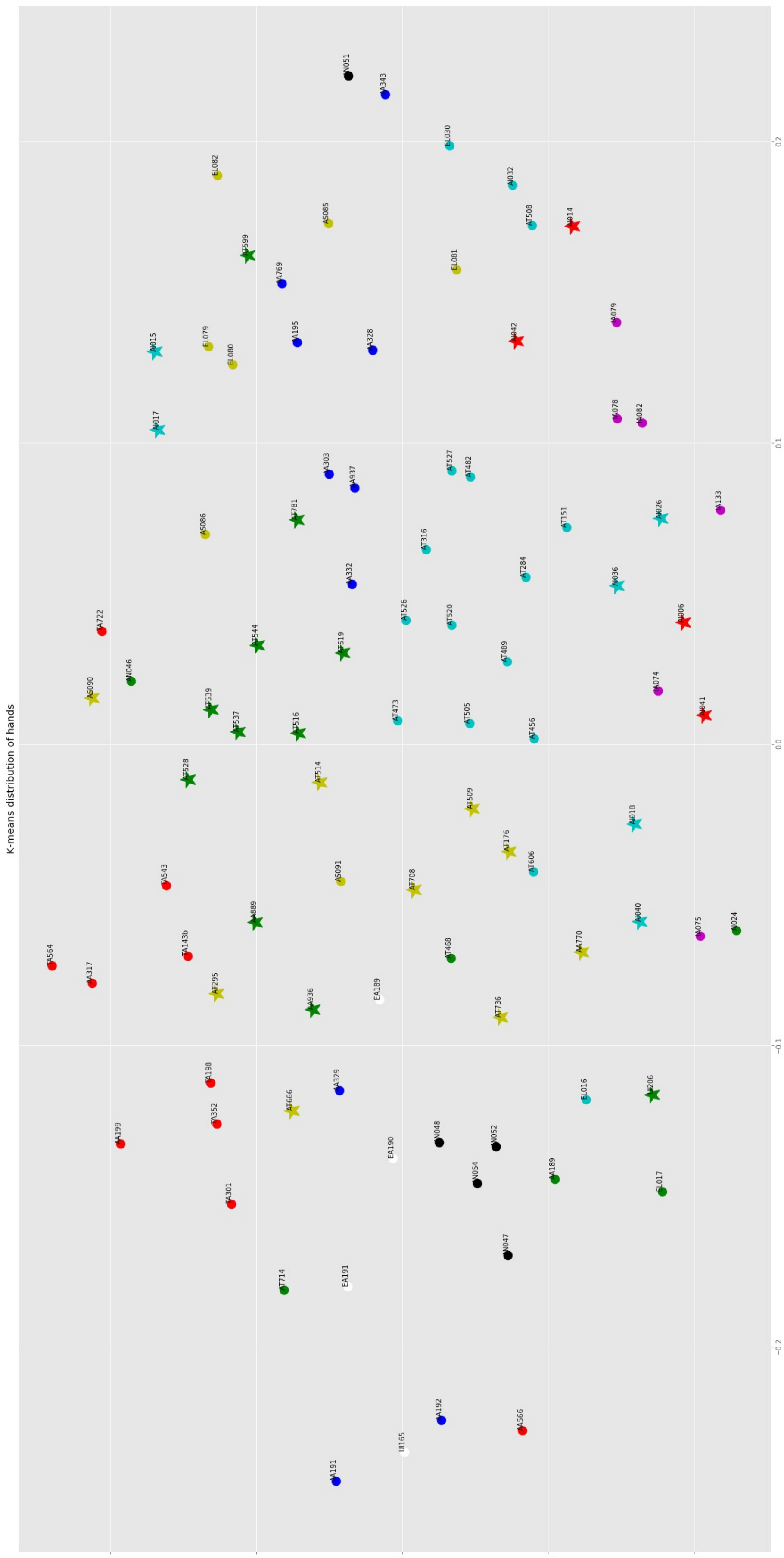
Because of the irregularities, it is difficult to define the right number of clusters. In addition, such a scatter plot which is produced by the k-means method might be clear with a smaller number of objects. But the number of 94 letters makes it even more difficult to classify the cluster quality and reliability. The previous analyses have shown that there are four groups of texts that stand out from the other tablets because of their uniqueness. These groups are the corpora of Aššur-nādā and his brother Ilī-ālum, the tablet group of Ennam-Aššur and UI165, and of Tariša's tablets combined with AA199 and AA317. Observing the k-means analyses with the above mentioned numbers of clusters, only the analysis with 12 clusters separates these four groups almost completely from the rest of the corpus while in the analyses with other cluster numbers, the constellations are different. For example, in the plot of ten clusters, Ilī-ālum's tablets are grouped with some of Aššur-idī's text, and to Ennam-Aššur's cluster is added the tablet of his brother Aššur-taklāku (AS086). In the analysis with 12 clusters, the only exception is the group of Tariša. Here, AA566 is added to the usual tablet constellation. Hence, the most promising cluster number for the k-means analysis seems to be 12 k.

Four of the twelve clusters are the stable groups discussed above. Four additional clusters contain mainly the texts of Ali-ahum and his son Aššur-taklāku. The dark blue group comprises the largest part of Ali-ahum's corpus with ten tablets. The main part of Aššur-taklāku's corpus is spread over the yellow and the green star-shaped as well as the light blue group. In the yellow star-shaped cluster, seven of his tablets are grouped together with AA770 and AS090. The cluster with the green star-shaped marks comprises nine of his tablets together with AA189, AA889, and UI206. Here, especially the latter is rather surprising. On the other hand, in the dendrogram, UI206 is also paired with AA889. But there they are grouped together in the very diverse purple cluster, while in this k-means plot they are clustered together with tablets of Aššur-taklāku. So the calculation of the similarities must have been very different. Regarding the distribution of Aššur-taklāku's tablets, 13 of his tablets are grouped together in the light blue cluster together with AI032, EL016, and EL030. Compared to the dendrogram, most og the exceptions mentioned above (such as AA770, AA189, etc.) are actually exceptions in this k-means plot, whereas in the dendrogram they are grouped with other tablets of their sender. Only AA189 and AA889 are constantly separated from the rest of their sender's corpus.

Aššur-idī's tablets are mainly distributed to the two clusters with the light blue and red star-shaped marks. Elamma's remaining four tablets – the tablet trio and EL081 – and three of Aššur-taklāku (AS), son of Aššur-idī's tablets are clustered together in the yellow group.

Finally, the green coloured cluster comprises the four tablets that often stand out from the other groups, i.e. AT714, AN046, AA189, and AI024.

With regard to the composition of the mixed clusters, it should be noted that they are rather unusual compared to previous analyses, for instance the assignment of UI206 to Aššur-taklāku's tablets or the constellation of the light blue group.


K-means distribution of hands

The k-means scatter plot with 12 *k* seems almost ideal because most of the clusters contain mainly tablets of one sender. Only the yellow one and the green groups are without preference. In addition, the number of clusters is appropriate for the ten letter senders in comparison to the earlier analyses. For example Aššur-taklāku's corpus is usually divided into at least two parts. Here, it is divided into three groups. The green, star-shaped cluster additionally contains some other tablets, but also seven of his nine very large tablets. It is notable, however, that while in the analysis of the 93/k-cluster AT519 and AT544 are assigned differently (in the k-means clustering), in this computation of the whole corpus it is AT514 and AT295 that are grouped differently.

As mentioned before, the structure chart of the whole dataset did not show a clear *k* so that several analyses with different *k* should be conducted. They are also recorded in table 47.

Regarding the consistency of the group constellations, it can be noted that most of the core clusters of each sender remain the same as in the previous family-based analyses. In the case of Elamma, Aššur-nādā and Ilī-ālum, the core groups of tablets are consistent in both the k-means analyses of the families, and the ones of the whole corpus of this study. This does not mean that these core groups are not also grouped with other tablets. Instead, these tablets have very similar characteristics, so that the algorithm always clusters them together, regardless of the number of tablets and the resulting new possibilities for calculation. These core groups are also clustered together in the dendrogram, but there they are usually combined with other tablets as well. In case of Aššur-taklāku of the 93/k-archive, the large core group of 13 tablets is basically the same as in the earlier analysis. Of the core group of large tablets, only five out of nine tablets are grouped together here. The other four tablets, AT295, AT519, AT544, and A781 are assigned to other clusters.

Tablet	k 6	k 8	k 9	k 10	k 11	k 12	k 13
TA143	0	7	5	9	3	1	2
TA198	0	7	5	9	3	1	2
TA301	0	7	5	9	3	1	2
TA352	0	7	5	9	3	1	2
TA543	0	7	5	9	3	1	2
TA564	0	7	5	9	3	1	2
TA722	0	7	5	9	3	1	2
AA192	5	6	1	6	5	4	0

AA195	4	6	1	6	5	4	0
AA303	4	6	1	6	5	4	0
AA328	4	6	1	6	5	4	0
AA329	4	6	1	6	5	4	0
AA332	4	6	1	6	5	4	0
AA343	4	6	1	6	5	4	0
AA937	4	6	1	6	5	4	0
AA189	1	0	1	5	1	0	3
AA191	5	6	7	5	4	4	1
AA199	4	7	5	6	3	1	12
AA317	4	7	3	9	3	1	2
AA566	0	1	2	2	3	1	2
AA769	4	6	2	6	2	4	0
AA770	4	1	1	2	5	11	0
AA889	4	1	3	2	9	8	8
AA936	4	1	1	2	9	8	5
AT151	1	4	4	1	1	2	4
AT284	1	4	4	1	1	2	4
AT316	1	4	4	1	1	2	4
AT456	1	4	4	1	1	2	4
AT473	1	4	4	1	1	2	4
AT482	1	4	4	1	1	2	4
AT489	1	4	4	1	1	2	4
AT505	1	4	4	1	1	2	4
AT508	1	4	4	1	1	2	4
AT520	1	4	4	1	1	2	4
AT526	1	4	4	1	1	2	4
AT527	1	4	4	1	1	2	4
AT606	1	4	4	1	1	2	4
AT514	4	1	2	2	9	11	8
AT516	4	1	2	2	9	8	8
AT528	4	1	2	2	9	8	8
AT537	4	1	2	2	2	8	8
AT539	4	1	2	2	2	8	8

AT176	1	4	4	5	1	11	3
AT708	1	4	4	5	1	11	3
AT509	1	4	4	5	1	11	8
AT295	0	1	2	2	2	11	8
AT468	5	1	4	5	1	0	3
AT519	4	1	1	2	2	8	0
AT666	4	1	1	2	5	11	8
AT544	4	6	2	2	2	8	0
AT599	4	1	4	2	1	8	3
AT714	4	1	5	2	2	0	2
AT736	1	1	1	5	5	11	8
AT781	4	1	4	1	1	8	4
EL079	4	2	3	0	8	3	7
EL080	4	2	3	0	8	3	7
EL082	4	2	3	0	8	3	7
EL016	4	1	3	8	0	2	5
EL017	1	4	0	0	1	0	3
EL030	1	4	4	0	1	2	4
EL081	3	1	4	8	1	3	5
EA189	5	6	1	8	10	5	5
EA190	5	6	1	8	10	5	5
EA191	5	6	1	8	10	5	5
UI165	5	0	1	8	10	5	10
UI206	4	1	3	2	0	8	5
AI015	3	3	6	4	7	10	6
AI017	3	3	6	4	7	10	6
AI036	3	3	6	4	7	10	6
AI018	3	3	0	5	7	10	6
AI026	3	3	0	3	7	10	6

AI040	3	3	6	5	7	10	6
AI006	3	3	4	3	6	9	9
AI014	3	3	0	4	1	9	11
AI024	5	3	6	5	7	0	6
AI032	1	1	4	1	4	2	1
AI041	3	3	0	3	6	9	11
AI042	4	1	0	2	6	9	11
AN046	3	1	8	5	6	0	9
AN047	2	5	7	7	4	7	1
AN048	2	5	7	7	4	7	1
AN051	2	5	7	7	4	7	1
AN052	2	5	7	7	4	7	1
AN054	2	5	7	7	4	7	1
IA074	3	3	8	3	6	6	9
IA075	3	0	8	3	6	6	9
IA078	3	3	8	3	6	6	9
IA079	3	3	8	3	6	6	9
IA082	3	3	8	3	6	6	9
IA133	3	3	8	3	6	6	9
AS086	3	2	3	8	8	3	5
AS090	4	2	3	0	8	11	7
AS085	4	2	3	0	8	3	7
AS091	4	2	3	0	8	3	7

Table 47: Different k for the complete corpus.

However, the consistency of the core groups of the k-means analysis for the whole dataset also schow some differences from the family based analysis. For example, Tariša's seven tablets are always grouped together, but AA317, which is consistently assigned to her group in the family based analyses (and the dendrogram), is assigned to a different cluster several times in the analysis of the whole corpus. The same applies to the grouping of Ennam-Aššur's tablets and UI165. While the four tablets are always clustered together in the family based analysis (and the dendrogram), in the analysis of the complete corpus, UI165 is frequently assigned to different groups.

By comparing the cluster compositions, it has to be taken into account that the numbers of clusters (e.g. 4 k, 6 k, 10 k, etc.) of the complete corpus are partly different from those of the family-based analyses (e.g. the computational analysis of the family of the 93/k-archive, or Elamma's family). Especially for the k-means method a different number of centroids leads to a different calculation. Furthermore, the dataset here is much larger, containing far more objects than before. Thus, both the different cluster numbers as well as the changed number of objects influence the analysis. Therefore, the relatively stable results are very interesting and show the neat computation of the algorithm.

Summary for the whole Corpus

As presented above, both the hierarchical clustering as well as the k-means analysis show interesting results, which are partly comparable with the individual analyses from ch. 3 and 4. But new observation can also be made. One main point that was not very obvious from the previous comparison is the clear distinction between the tablets of Ali-ahum and the corpora of Elamma and Aššur-idī. When the three men were compared before, there seemed to be no particular difference between their handwritings. However, the hierarchical clustering separates almost all tablets from Ali-ahum, while the ones of Elamma and Aššur-idī are grouped together. Furthermore, both methods emphasise the peculiar and consistent combinations of sign variations on the tablets of Aššur-nādā, Ilī-ālum, and Tariša.

The tablets that are not assigned to an otherwise rather consistent group are also interesting. Some of them always, or at least quite often, seem to be separated from the other tablets of their respective senders. In the case of Ali-ahum, in addition to AA199 and AA317, tablets AA189 and AA566 are frequently separated from the rest of his corpus. Of his son, Aššur-taklāku, tablet AT714 is frequently separated from the rest of his corpus, especially in the computational analysis of the whole corpus. A very diverse clustering can also be observed for AT519. Of the other families, the most noeworthy is AN046, which is never grouped with the other five tablets of this sender. In general, however, very few tablets are consistently separated from the rest of their senders' corpora. Thus, it is rather difficult to handle these exceptions without further individual analysis.

5.3 Pro and Con of a Computational Analysis and possible Improvements

The analyses of the different clusterings of the families and the whole corpus have shown the advantages, but also the disadvantages of both clustering methods as well as the flaws of the current program. In general, it could be observed that such a computer-based analysis is a helpful tool for a large number of texts, and it can also support an individual analysis. For example, both methods visualised clearly the similarity of Ennam-Aššur's tablets and UI165. Furthermore, the computational analysis may clarify the affiliation (or non-affiliation) of a tablet to a particular group, namely the group of the sender, where the result of the individual analysis is inconclusive. For example, in the case of AT714 or AA189, both tablets are frequently assigned to a different cluster that contains hardly any tablets of their sender. Therefore, it is justified to exclude them from the respective corpus.

The hierarchical clustering seems to be a very useful method for the analysis of the dataset on handwriting variants. An advantage of the dendrogram is that the composition of each cluster can be tracked by tracing the links and sub-clusters. Furthermore, the hierarchical clustering produces stable results, i.e. the dendrogram does not change consistently like the scatter plot of the k-means analysis. However, also the hierarchical clustering is based on the computation of distances from one object to another. Therefore, the result of an analysis might be the same when the dataset remains the same. But the complete calculation, and therefore the outcome, might change as soon as data is added, or excluded. It might not change the complete tree diagram, but such a change of a dataset can lead to a different classification of individual tablets, usually the ones that are in fact difficult to place.

As mentioned above, on the other hand this inflexibility can also cause inaccuracies in the computation of the data. This is because from the second level of the clustering, only the mean values of the involved sub-clusters are used for the next comparison of similarities. Consequently, several and possibly important discriminating elements can be omitted.

The k-means clustering is probably not very suitable for such a kind of dataset. As mentioned before, a major disadvantage is the basic element of this method that the number of clusters must be predefined. In a handwriting analysis, however, the number of writers is the real question one hopes to answer, or at least that the program should suggest. The determination of *k* clusters with the aid of the structure chart is insufficient for the used dataset. None of the analyses showed a clear result, so that the k-means analyses based on them were rather experiments with therefore questionable results.

The k-means clustering itself is also not satisfying. One problem is that the clustering process is not traceable and one can only accept the scatter plot as it is, without a possibility to somehow verify the composition, as it is at least partly possible for the hierarchical clustering. Even more problematic is the inconsistency of the results. Every time the program is restarted, the dataset is analysed again and distances are recalculated. However, the results are not stable. Hence, the composition of the clusters can change even if the dataset remains the same.

However, the basic computation of the k-means method with the centroids is probably very well suitable for handwriting analysis because the different objects (tablets) enter the calculation equally, i.e. all discriminating elements are included and compared, and not only their means.

Not only the two methods need to be improved or changed for an adequate analysis of the dataset, but the program itself is also still at an early stage. Probably its most critical deficiency is that all the data, i.e. every sign variant, is treated and computed in the same way. For example, the code does not differentiate between the signs KI and ŠA. For an accurate analysis and interpretation of the data, however, it might be better if the computation is performed in two steps: The first one would calculate the similarities of the tablets on the basis of the individual signs and their variations. The second step then would process and compare the results from the first step. This two-step process would probably lead to more stable and accurate results.

5.4 Summary

The comparison of the different computational analyses, the different methods, but also the comparison with the individual analyses from ch. 3 and 4, have shown that, all in all, both methods work well and cluster the data accordingly. This result, however, can only be drawn because of the extensive analysis of the material before. Consequently, the results of hierarchical and k-means clustering were mostly not surprising.

But, as outlined above, both methods have their flaws. One method only works with the mean values of the discriminating elements, the other is generally based on assumptions and it is also not consistent. Even though the results are mostly accurate, some tablets seem to be randomly clustered without the possibility to comprehend the underlying calculation. Furthermore, this kind of “random” assignment could only be detected by comparing the plots of the different methods. And it could only be (partly) understood if one also consulted the individual analyses.

Moreover, the datase, as it is so far can hardly contain complex information such as tablet shape, the writing style or other discriminating elements that can be better described with words than with numbers. And especially these elements are usually crucial for an accurate identification of a writer, his education, and expertise. Therefore, neither the dataset nor this preliminary program can replace the individual analysis at the moment. But it can be used as a helpful supplement with which the analysis of large datasets can be prepared. For a future improvement, also other methods should be considered, for example one that visualises possible connections of different clusters by including their overlaps (e.g. Elamma and Aššur-idī’s corpora vs. Ali-ahum and son). In addition, one should also consider other types of data and datasets that are probably including all the variations used on each tablets and their number of occurrences or different diagnostic signs and discriminating elements.

Chapter 6: Conclusion

The aim of this study was the development of a method for a reliable identification of cuneiform handwriting, connected with the question of the identity of the writer. It was conducted on the basis of Old Assyrian letters and focused primarily on a family archive excavated in Kaneš in 1993. The corpora of three family members were examined with regard to a selection of discriminating elements based on the findings of modern forensic handwriting analysis. Furthermore, the material from the 93/k-archive and the letter corpora of two other families were examined and compared to gain more insights into educational practices.

The initial point for cuneiform handwriting analysis was the adaption of modern handwriting analysis to the ancient script. The developed approach combines the comparison of three different feature groups: form, movement, and spatial relationships. A forth group, wich includes all individual elements that do not fit into any of the aforementioned groups, plays only a minor role in the present study. The main reason is that the study mainly focused on elements that can be statistically evaluated. Very individual traits are characterised by the fact that they are peculiar and probably unique. They can be described subjectively, but hardly captured objectively.

The main feature of a comparison of handwriting is the individual form of the cuneiform signs. Each one has a particular shape that is formed with different wedge types. Some signs consist of a fixed number of wedges with a defined arrangement. For a handwriting analysis, not only very obvious differences in script and script arrangement are important, but also the subtleties of the writing and, in the case of cuneiform, the exact positioning of the individual wedges. Such observations can be made especially in a fixed frame provided, which these signs with fixed construction can provide. With other signs, it is rather the general form of the sign that is important for identification, while the number of wedges and their exact position in the sign allow a lot of leeway. In this case, it could also be noticed that here the consistent or inconsistent execution of a sign and the wedge number strongly depend on the writer. Some individuals prefer a very specific number of wedges, while others tend to arrange them in a particular shape, and the number of wedges in such cases depends partly on the space available and the writing material rather than on any particular preferences of the writer. The study of the sign forms, however, is not only useful for a handwriting identification, but can also give some information on the background of the person. What was not investigated in the present study was the origin of the sign forms and whether their shape is based on certain traditions or schools. This topic has hardly been studied so far. Therefore, a possibly broader study focusing on palaeography, i.e. script evolution, is needed to classify the different sign forms. In this regard, also the stroke order of the wedges needs to be mentioned, a topic that was hardly touched. First of all, it is an important discriminating element. But as mentioned at the beginning, its determination is generally difficult already because there is often no clear indication of the order of the wedge impressions on the original tablets. The present study was mainly conducted on the basis of photographs, which complicates the situation. While in some cases parts of the sequence can be observed, especially with more complex signs like AM or signs with stacked horizontals, the entire sequence can hardly be determined. In addition to its significance as a discriminating element, the stroke order is linked to the sign form in terms of the relation of the different wedges and their visual arrangement. Therefore, it is partly responsible for the appearance of a sign. Moreover, different stroke orders can also indicate different schools, which in turn can point to different traditions.

For the present study, a selection of 16 of the most common cuneiform signs on Old Assyrian letters suitable for a comparison forms the core of the handwriting analysis. The signs were classified into variations based on their formation and wedge number. The handwriting identification was then conducted by comparing the use of the different sign variations. The analysis aimed for an objective approach, i.e. even though the encountered signs and individual habits were discussed in detail, the focus of the final evaluation was based on the general shape of the sign and the composition of the wedges. This approach offers the advantage of a comparison on a general basis without too many individual details. The disadvantage, of course, is that many details that can reveal more about the writer's background are omitted.

However, the selection of the 16 diagnostic signs is also problematic when additional text material is added. It appears that the sign repertoire of different text genres varies considerably as it was shown in case of Ali-ahum and Aššur-taklāku of the 93/k-archive. A handwriting analysis of legal texts on the basis of the same selection of diagnostic signs was not possible because several of these signs were rarely written on them. It shows that even though the approach of this study is promising, for a comprehensive method, the selection of signs, and possibly additional necessary discriminating elements, needs to be adapted and improved. A first step would therefore be an analysis of the use of signs in the Old Assyrian period in general, including the different text genres. A further question is whether this selection of signs can also be used for the textual material of other areas and places. Cuneiform script and its use were constantly changing, and common signs in the Old Assyrian period were no longer in use only a few centuries later. Consequently, the method of handwriting analysis introduced would need to be constantly adapted. On the other hand, there are signs that were used consistently, e.g. because they have no homophone equivalent.

In this context, for a future improvement of the method, it has to be asked whether the selection of 16 diagnostic signs is necessary for the statistical approach or whether adequate results can also be achieved with less data, i.e. fewer signs. For such a reduction, however, the significance of the individual diagnostic signs needs to be evaluated. This evaluation process could probably be performed manually. It would be based on the discriminability of the sign variation, and their frequency. While such an analysis was conducted in the present study to evaluate the suitability of the diagnostic signs in general, reducing their number would probably require testing different sign combinations. The process is complex and inaccurate, but a positive result might enable the method to be more flexible in use, regarding text genre, time, and area.

Further elements of the handwriting analysis comprise the use of signs as well as the tablet shape and layout. The analysis of the use of signs reflects, on a general level, the observation on the size of the sign repertoire. In the analysed letter corpora of the eleven letter senders, an average of 90 to 110 different signs were used. These figures, however, include the entire sign repertoire written on the respective corpora. The number of different signs on a tablet is often much less.[222] An survey has shown that mostly between 50 and 70 different signs are used. Even in case of Aššur-taklāku's (AT) large tablets mainly between 70 and 80 different signs can be found. Only in rare cases are the average numbers higher, as in case of Ennam-Aššur. Here, in two of three cases, the number of used signs is above 80. However, in his case, there are only three tablets, so the statistical value of his use of signs is slim. On the other hand, the findings also suggest that the use of signs in general is very circumstantial. It does not necessarily reflect their reading and writing capabilities, but rather their current situation and needs.

222 Of cours, the numbers depend strongly on the length of the text and also on the writer. In part, the material is also very limited. The numbers here include all the letters of one person, i.e. also texts that come from another writer.

Another part of the analysis of the use of signs was performed with a selection of signs representing specific phonetic values. Discriminating elements were i.a. their consistent and/or distinctive use. The analysis, however, has shown that a general comparison of the use of signs leads only in rare cases to a satisfying result and strongly depends on the individual writer. In most cases, the use of signs was rather inconsistent and indecisive. On the other hand, some writers also displayed a very particular use of certain signs, perhaps related to their educational background.

Not reflected in the analysed material was Kryszat's observation of two different writing traditions represented by the use of different signs for the same phonetic values. The reason for this could be that the senders of the present study come from two generations. So they are not too far apart in time and a similar use of signs is not surprising. As mentioned above, the distinctive use of signs for particular phonetic values seems to depend more on the sender than on their termporal sequence. With regard to a "generational difference", however, a decrease in the variety of sign variations could be observed. The parent generation displays a more diverse and inconsistent handwriting, while the younger generation shows less variation. This topic, however, needs much more research, with additional earlier and later material.

The shape of the tablet, especially the form of the edges and the corners, is another important discriminating element for a handwriting analysis. While the use of signs can be recorded statistically, tablet shapes are too complex and inconsistent to fit them into inflexible standard forms. Nevertheless, this discriminating element is particularly valuable for a preliminary (or final) classification.

The same applies to the two other feature groups movement and spatial relationships. Both are difficult to record statistically when the comparison is based on individual, and therefore subjective, observations. Still, both groups comprise important features of handwriting, and their analysis conveys an overall impression of the script and the typeface by comprising elements of the general writing performance and the arrangement of the script. Thus, they give a kind of "feeling" for the handwriting of a person. Because of the importance of both groups, for future studies different, probably computer- and 3D-based methods need to be developed for a further, more accurate and objective evaluation.

On the basis of these three feature groups, the three corpora of the family members of the 93/k-archive were analysed. One main challenge for the analyser of handwriting is to constantly weigh the importance of script details, and to classify them as habit or natural variation. Because it is a manual task, the writing changes continuously. Furthermore, the analysis of the 93/k-archive has shown that it also strongly depends on the writer. While the tablets of Tariša are written in a basically uniform hand, the tablets of Aššur-taklāku display a varied handwriting. Nevertheless, specific handwritings could be identified on the tablets of the three corpora.

The analysis does not reveal the identity of the writer. Therefore, other methods have to be applied. One method, and probably the most convincing one, is the identification of the place of the letter dispatch. The sending of two tablets with the same handwriting from different places most likely indicates that the tablets were written by the same person. The problem with this approach is that very often there are no indication of the place of dispatch. Or all texts were sent from the same place. Another method is to add more letters authored by more than one person, as suggested by Stratford. His two-tiered approach can be convincing in case that the letters were not sent from the same place. In the case of Tariša's tablets, for example, all letters were sent from Aššur. And even though some texts were authored by her and others by a group of people, the two-tiered approach did not lead to a clear identification of the writer, because professional scribes certainly lived in Aššur all the time. On the other hand, the same approach is more convincing when the letters were sent from somewhere in Anatolia. Even if the exact whereabouts of the sender(s) is unknown, it is rather unlikely that they were travelling together throughout. The third approach is best combined with the second. It involved additional texts, but instead of more letters, it involves other text documents such as contracts and private notes associated with the writer in question. An identification of the same handwriting on these additional tablets points with some probability to the writer. It has to be noted that for all these approaches the potential writer has to be known, they only serve as a confirmation of his handwriting. In the case of the 93/k-archive, Ali-ahum and Aššur-taklāku could be identified as the writers of most of their texts, while this was not possible for Tariša.

In the second part of the study, a new approach to education and literacy in the Old Assyrian period was proposed. Therefore, the corpora of two other families were introduced and analysed with the same method as the 93/k-archive. However, the material here was very limited and therefore identification was mostly not possible. Only in the case of the two brothers Aššur-nādā and Ilī-ālum could both be identified as the writers of their letters.

Furthermore, in case of the siblings Ennam-Aššur and Ummī-Išhara, it is also very likely that he wrote all three of his letters and she wrote one of hers (UI165). The advantage of the handwriting comparison of family members is that it also reveals common traits and habits that may have been taught in the family. In the case of these two pairs of siblings in particular, it was found that their tablets share many similar sign variations, some of which are unique to their corpora, but that they do not share many similarities with their father's tablets.[223] This observation indicates that they did not learn from their father, but from someone else. On the other hand, the tablets of the third and youngest brother of Aššur-nādā and Ilī-ālum, Aššur-taklāku (AS), shows a very different handwriting, which is quite similar to the writing on the tablets of their father Aššur-idī. A similar observation could be made for the three members of the 93/k-archive. Here, the comparison revealed that Ali-ahum's and Aššur-taklāku's letters, both written by them, show more similarities than the tablets authored by Tariša who could not be proven as the writer of her letters. Thus, the evidence points towards an education in the family, from father to son. Accordingly, both educational methods, teaching from father to son and outside the family, seem to have been taken place.

Another peculiarity was especially noticeable on some of the tablets of Aššur-idī and his youngest son, as well as on most of the tablets of the two older brothers: very peculiar sign variations are written on them, which can hardly be found in any other analysed material. For one thing, this points to specific traits that were taught in the family. And for another, even though the two older brothers did not learn the art of writing from their father, they probably learned it from another family member who was also familiar with these specific traits.

These studies are only preliminary and need to be expanded and developed in the future. Nevertheless, they prove that palaeographic studies can help to learn more about the educational system. Moreover, the observations not only prove the literacy of individual members of the merchant society, but also hint at its widespread distribution in the families. Not only was one member literate, but it seems that most of them could usually write, including the women (even though their abilities might have been at different levels).

The last part of the study comprised a computational evaluation of the statistical data. Two methods were introduced, the hierarchical clustering analysis and the k-means analysis. Both showed similar results, and they strongly reflected the observations made in the precedent individual analysis. Furthermore, both methods consistently showed that several letter senders

223 However, both fathers could not be identified with certainty as the writers of their texts.

in the analysed corpus have very distinct handwriting (e.g. Tariša, Aššur-nādā, Ilī-ālum), but also families can be separated from the rest on the basis of their distinctive handwriting (Ali-ahum and Aššur-taklāku vs. Elamma's and Aššur-idī's families). Although both methods are only partly suitable for this kind of data analysis, their results are promising. In general, the study shows that such a computer-based analysis is quite useful to support and confirm a manual analysis by mirroring its results. In addition, large datasets can be better processed and analysed with such a tool. Therefore, other methods, and also other datasets need to be tested in the future.

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Abbreviations

AoF	Altorientalische Forschungen (Berlin)
CM	Cuneiform Monographs (Groningen)
HdO	Handbook of Oriental Studies / Handbuch der Orientalistik
KB	KÙ.BABBAR
KIM	Kültepe International Meetings
OA	Old Assyrian
OAA	Old Assyrian Archives (Leiden)
OAAS	Old Assyrian Archives. Studies (Leiden)
OBO	Orbis Biblicus et Orientalis (Freiburg/Göttingen)
PIHANS	Publications de l'Institut historique-archéologique néerlandais de Stamboul
REL	Revised Eponym List (see Barjamovic, Hertel, Larsen 2012)
SANER	Studies in Ancient Near Eastern Records

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Abstract

In the present thesis, a method is developed to identify cuneiform handwriting, and to ascertain the identity of the writer. It is based on modern forensic handwriting analysis, and combines statistical and individual approaches. The comparison focuses mainly on discriminating elements of script and character shape. Adapted to cuneiform, especially the number and position of the individual elements of the cuneiform signs, i.e. the wedges, are decisive. The method is established on the basis of Old Assyrian letters. The main case study includes the corpora of three family members of an archive excavated in 1993. From the observations, it can be concluded that most of the texts in the three corpora were written by one writer each. This answer results on the great similarity of used sign variations, tablet shape, typeface, and use of signs on the analysed material. The case studies also show that the identity of the writer can be ascertained by means of palaeographical observations, but the analysed material needs to be as various as possible (e.g. different text genres, letters sent from different places, letters authored by one person vs. several individuals) so that the observations of the handwriting comparison can be combined with further information.

Connected to the general question of cuneiform handwriting identification is the question of a computational analysis. Thousands of cuneiform texts of different genres are anonymously written, and therefore, they are hardly assignable. In this study, a preliminary tool is introduced to process large datasets. It calculates the similarities of objects, i.e. in the present case the cuneiform letters, and clusters them accordingly. While the two methods used are not ideal for this kind of analysis, the general computational approach on the subject seems promising.

Furthermore, the palaeographic study sheds light into the educational practises of the Old Assyrian period. The comparison of the handwriting of three families shows that children did not necessarily learn from their parents as it was assumed. Instead, in two out of three cases, siblings share similar traits, while their fathers' writing displays different habits. This phenomenon might reflect the typical situation of these people, i.e. the fathers were mostly travelling merchants and often far away from home while the children grew up. However, on the other hand, common characteristics can also be noted on the documents of all generations of one family. These findings indicate nevertheless a certain family tradition. And consequently, the children were possibly not taught by their father, but another family member with the same educational background.

Abstract

In der vorliegenden Arbeit wird eine Methode entwickelt, um Keilschrift zu identifizieren und um die Identität des Schreibers zu ermitteln. Sie basiert auf moderner forensischer Handschriftenanalyse und verbindet statistische und individuelle Ansätze. Der Vergleich konzentriert sich hauptsächlich auf Unterscheidungsmerkmale der Schrift- und Zeichenformen. Es sind insbesondere die Anzahl und Position der einzelnen Elemente der Keilschriftzeichen, d.h. der Keile, entscheidend. Die Methode wird auf der Grundlage altassyrischer Briefe entwickelt. Die Hauptfallstudie umfasst die Korpora von drei Familienmitgliedern eines 1993 ausgegrabenen Archivs. Aus den Beobachtungen lässt sich schließen, dass die meisten Texte der drei Korpora von je einem Schreiber verfasst wurden. Dieses Ergebnis resultiert aus der großen Ähnlichkeit verwendeter Zeichenversionen, Tafelform, Schriftbild und dem Gebrauch bestimmter Zeichen auf dem analysierten Material. Die Fallstudien zeigen ebenfalls, dass die Identität eines Schreibers durch paläographische Analyse ermittelt werden kann, aber in diesem Fall muss das analysierte Material so unterschiedlich wie möglich sein (z.B. verschiedene Textgenres, Briefe von verschiedenen Orten, Briefe die von einer Person und Briefe die von mehreren Personen verfasst wurden), damit die Beobachtungen des Handschriftenvergleichs mit weiteren Informationen kombiniert werden können.

Im Zusammenhang mit der allgemeinen Frage der Identifikation von Keilschrift-Handschriften steht die Frage einer computerbasierten Analyse. Tausende von Keilschrifttexten verschiedener Genres sind anonym geschrieben und daher kaum zuzuordnen. In der vorliegenden Arbeit wird ein vorläufiges Tool zur Verarbeitung großer Datensätze vorgestellt. Es berechnet die Ähnlichkeiten von Objekten, d.h. im vorliegenden Fall die Keilschriftbriefe, und gruppiert sie entsprechend. Obwohl die beiden verwendeten Methoden für diese Art der Analyse nicht ideal sind, erscheint der computerbasierte Ansatz für diese Art von Studie vielversprechend.

Darüber hinaus erlaubt die paläographische Studie einen Blick in die Bildungspraxis der altassyrischen Zeit. Der Vergleich der Handschrift von drei Familien zeigt, dass Kinder nicht unbedingt von ihren Eltern gelernt haben, wie angenommen. Stattdessen teilen Geschwister in zwei von drei Fällen ähnliche Schriftmerkmale, während die Schrift ihrer Väter andere

Merkmale aufweist. Dieses Phänomen könnte die typische Situation dieser Menschen widerspiegeln, d.h. die Väter waren meist reisende Kaufleute und oft fern von zu Hause, während die Kinder aufwuchsen. Andererseits lassen sich aber auch auf den Tafeln mehrerer Generationen einer Familie gemeinsame Merkmale feststellen, was auf eine gewisse Familientradition hindeutet. Und somit ist es auch möglich, dass die Kinder möglicherweise nicht von ihrem Vater, sondern von einem anderen Familienmitglied mit gleicher Ausbildung unterrichtet wurden.