Sexagesimal calculations in ancient Sumer

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Abstract

This article discusses the reasons for the choice of the sexagesimal system by ancient Sumerians. It is shown that Sumerians chose this specific numeral system based on logical and practical reasons which enabled them to deal with big numbers easily and even perform the multiplications and divisions in this system. I shall also discuss how the Sumerians calculated the area of a large field and measured a large quantity of barley according to their seemingly complicated but really systematic methods.

1 The advent of the sexagesimal notation

By the 26th century BCE when historic times began, the Sumerians had invented the sexagesimal system based on their decimal system. At the latest in the 20th century BCE, they had completed the sexagesimal place value notation, which may have been the forerunner of our decimal system now in use, though having lacked symbols both for a “sexagesimal point” and for the number zero. In the measurement of angles in degrees, minutes, and seconds and of time in hours, minutes, and seconds we still use the sexagesimal notation, which is a legacy of Sumer. This fact may show us not only that old habits die hard but also that the sexagesimal system has certain advantages over the decimal system which only resulted from the number of fingers of a person or was a result of chance in a sense.

In Sumerian society it was necessary to count and record a large amount of farm and marine products and then to distribute the products to workers or soldiers according to some rule. This process necessitated the Sumerians developing a useful and efficient numeral system, that is, the sexagesimal numeral system. Thus, their system has two noticeable characteristics. First, it fits the expressing large numbers which occur in administrative documents. Generally speaking, a number of three figures composed of $60^2$, 60 and 1 seems to have been sufficient for their task. Secondly, in this system division is easy to carry out as compared with the decimal system because the base 60 is divisible by 2, 3, 4, 5, 6, 10, 12, 15, 20, and 30. Therefore, we can say that the sexagesimal numeral system was not a product of chance, but a deliberately devised system suited for economic activities in Sumer.

Through the two tablets written in the 26th century BCE, we can assume that the Sumerian scribes were able to perform multiplication and division easily.
WF No.2 (administrative tablet)  

4 yellow-donkeys for bundles of flax of Lumma (personal name). 5 yellow-donkeys for bundles of flax of Billum(?). 5 (yellow-donkeys for bundles of flax) of Lunumudae. 2,41,0 (= 2 × 60² + 41 × 60 = 9660 = 14 × 690). (In total) 14 (yellow)-donkeys for bundles of flax. As a consequence of the transport of bundles of flax by breeding female yellow-donkeys (see Figure 1). The scribe of this tablet must have calculated 14 × (11,30) = 2,41,0, which is the total number of bundles transported by 14 donkeys.

TSŠ No.50 (school tablet)

1 gur₇ (=5,20,0,0 sila, where 1 sila ≈ 1 liter) of barley. 7 sila (of barley each) one man received. (The number of) the men are 45,42,51 (= 45 × 60² + 42 × 60 + 51 = 164571). 3 sila of barley is repaid. It is evident that the Sumerian scribe of this tablet has carried out the following division: 5,20,0,0 = 7 × (45,42,51) + 3 (see Figures 2 and 3).
Figure 3: The assumed division process

2 Numerals

The Sumerian word li-mu-um “one thousand” was borrowed from the Akkadian limu\(^3\), and also the Sumerian word me-at “one hundred” is a loanword from the Akkadian me’atum\(^4\). Moreover, there was no single word in Sumer that designates a myriad “ten thousand” as well as in Babylonia proper. From these facts we may conclude that the Sumerians did not develop any elaborate decimal numeral system for large numbers and invented the sexagesimal system instead. The basic numerals of the Sumerian sexagesimal system, which must have been sufficient for their accounting, are as follows\(^5\):

| Sumerian | English |
|----------|---------|
| aš or diš = 1 | 1 |
| min = 2 | 2 |
| ešš = 3 | 3 |
| limmu = 4 | 4 |
| iá = 5 | 5 |
| àš = 6 (< iá+aš) | 6 |
| imin = 7 (< iá+min) | 7 |
| ussu = 8 | 8 |
| ilimmu = 9 (< iá+limmu) | 9 |
| u = 10 | 10 |
| niš = 20 | 20 |
| ūšu = 30 | 30 |
| nimin = 40 (< niš+min) | 40 |
| ninnu = 50 (< nimin+u) | 50 |
| gēš = 1,0 (= 60) | 60 |
| šár = 1,0,0 (= 60\(^2\)) | 3600 |
| šár-gal “big šár” or šár×gēš “sixty šár” = 1,0,0,0 (= 60\(^3\)) | 216000 |

In combination with these numerals, the Sumerian scribes seem to have been able to pronounce any whole number smaller than 60\(^4\), for example:

- gešta-u (< gēš-ta u) “ten after sixty” = 1,10 (= 70),
- gēš-u “ten sixties” = 10,0 (= 600),
Although the largest numeral attested so far is 60⁴, it is obvious that this number word was not used in everyday life:
šárgal šu-nu-ta-ga “big šár that is not touched”.⁶
As to šár and šár×géš, they were borrowed into Akkadian as šar (60²) and šuššár (60³) respectively.

A few words about the origin of the Akkadian numeral nēr “10,0”, which was adopted by the Greeks as neros, should be given. It seems that the Babylonians did not use the Sumerian numeral géš-u “ten-sixty” as it was. Instead they coined the nēr because they had already used the Akkadian word giššu “hip”. Since giš- (giš) = nīrum “yoke”, they used the new word nēr for “10,0” and ignored its original meaning.

3 Number signs

Although the number signs used in sexagesimal notation vary in shape depending on when and where they had been written down, we would recognize two basic types of them, that is, round-shaped number signs and wedge-shaped ones (see Figure 4). The former was used mainly in Early Dynastic Period III (EDIII 2600-2340 BCE) and the latter was used from the 24th century BCE onward. Naturally, there are many cuneiform tablets in which both signs occur side by side, and also some tablets of EDIII in which only wedge-shaped number signs occur.

| Third digits | Second digits | First digits |
|--------------|---------------|--------------|
| 10,0,0       | 1,0,0         | 10,1         |
| 10,0,0       | 1,0,0         | 10,1         |

For larger numbers, the sign gal “big” is appended:

\[ \begin{array}{c}
\circ \\
\circ \\
\circ \\
\end{array} \quad = 40,0,0,0 \]

Figure 4: Number signs

With these number signs the Sumerian scribes recorded their results of sexagesimal calculations just as the Japanese who still sometimes write down the results of calculations, especially the sum of money, with Chinese numerals instead of Hindu-Arabic numerals.

4 Regular numbers

It is most probable that the Sumerians already knew from experience that the numbers 2, 3, and 5 are regular to the base 60, because they especially called the numbers a-ra-
gub-ba “regular factors”.[7] In other words, they knew that the reciprocal of a number of the form \(2^\alpha \times 3^\beta \times 5^\gamma\) (\(\alpha, \beta, \gamma\): integers) can be obtained by a finite sexagesimal expansion.

Compared with the decimal system, the existence of the regular number 3 in the sexagesimal system made it easier to calculate the result of a division whose divisor is a multiple of 3, which contributed to the development of mathematics after all. The most striking example would be \((\frac{4}{3})^7 \approx 7;30\), which we can confirm in a passage of Enmetena’s foundation cone written around 2400 BCE.[8] The Sumerian scribe must have calculated as follows:

\[
\left(\frac{4}{3}\right)^7 = (1;20)^7
\]
\[
= (1;20) \times (1;20) \times (1;20)^5
\]
\[
= (1;46,40) \times (1;20)^5
\]
\[
= \cdots
\]
\[
= 7;29,29,32,50,22,13,20
\]
\[
\approx 7;30.
\]

It is impossible to imagine that he obtained the result by using decimal system in his calculations because it is difficult for him to round up \((\frac{4}{3})^7\) to 7.5:

\[
\left(\frac{4}{3}\right)^7 \approx (1.3)^7 = 6.2748\cdots,
\]
\[
\left(\frac{4}{3}\right)^7 \approx (1.33)^7 = 7.3614\cdots,
\]
\[
\left(\frac{4}{3}\right)^7 \approx (1.333)^7 = 7.4784\cdots.
\]

Neither did he use a fraction such as

\[
\left(\frac{4}{3}\right)^7 = \frac{16384}{2187} = 7 + \frac{1075}{2187} = 7.491\cdots,
\]

which is out of Sumerian numeral system.

The Sumerian word a-rá-gub-ba had been passed on to Babylonian mathematics (2000-1600 BCE) as aragubbûm or a-rá-kayyamânum[9] with the same meaning.

5 Number signs for area

Since the units of area and capacity vary in different places and at different historic periods, we had better confine ourselves in this discussion to those units appearing in the texts excavated from Fara, the ancient city Šuruppak in the 26th century BCE. It is a fact, however, that the metrology of Fara in this historical period provided a framework for the metrology of later periods.
The basic unit of length is ninda-DU ($\approx 6m$), in which the cuneiform sign DU is appended probably to distinguish it from the ninda “bread”. In later periods, the sign DU was almost omitted. The basic unit of area is squared ninda-DU, or sar, from which three larger units are derived:

$$1 \text{ iku} = 1, 40 \text{ sar} (= 100 \text{ sar}),$$
$$1 \text{ b\u{u}r} = 18 \text{ iku},$$
$$1 \text{ s\u{a}r} = 1, 0 \text{ b\u{u}r} (= 60 \text{ b\u{u}r}).$$

Although the number signs for area units are similar to those used in sexagesimal notation,\[^{[10]}\] we hardly mix them up if we pay close attention to the cuneiform sign g\u{a}n “a field”, which is usually written down at the first line of a tablet concerning the area calculations (see Figure 5).

![Figure 5: Number signs for area](image)

| Sign | Interpretation |
|------|----------------|
| 🟨🟨🟨🟨🟨 | = g\u{a}n “a field” |
| Ⓟ | = 1 (s\u{a}r × u) = 10 (s\u{a}r) |
| Ⓠ | = 1 (s\u{a}r) = 1,0 (b\u{u}r) |
| Ⓟ | = 10 (b\u{u}r) |
| Ⓟ | = 1 (b\u{u}r) = 18 (iku) |
| Ⓟ | = 1 (iku) = 1,40 (sar) |
| Ⓟ | = $\frac{1}{2}$ (iku) = 50 (sar) |
| Ⓟ | = $\frac{1}{4}$ (iku) = 25 (sar) |

6 The area of a large square field

On the school tablet **SF No. 82** published by A. Deimel in 1923,\[^{[11]}\] the areas of squares whose sides decrease from 10,0 ninda ($\approx 3600m$) to 5 ninda ($\approx 30m$) are tabulated,
which may seem to be complicated at first sight. In order to analyze the calculation method, especially for large squares, ten lines on the obverse of this tablet are given in the following (see Figure 6). Line 1, which consists of three blocks, reads as follows:

The side is 10,000 ninda. (The other side) is 10,000 ninda equally. 3 (šár) 20 (būr) is the area.

Figure 6: Obverse of School tablet SF No. 82

The calculation process would be as follows:

\[10,0 \times 10,0 \text{ (ninda}^2 = \text{sar)} = 1,0 \times 1,0 \text{ (ēš}^2 = \text{iku), where } 1 \text{ ēš} = 10 \text{ ninda}
\]

\[= 1,0 \times 1,0 \times \frac{1}{18} \text{ (būr), where } 1 \text{ būr} = 18 \text{ iku}
\]

\[= 3,20 \text{ (būr), where } \frac{1}{18} = 0; 3,20
\]

\[= 3 \text{ (šár) 20 (būr).}
\]
Systematically changing the area units, the Sumerian scribe has obtained the result correctly. Similarly, we can explain the following lines.

**Line 2:**

\[9,0 \times 9,0 \text{ (sar)} = 54 \times 54 \text{ (iku)}\]
\[= 54 \times 54 \times \frac{1}{18} \text{ (b\`ur)}\]
\[= 2,42 \text{ (b\`ur)}\]
\[= 2 \text{ (\`s\`ar)} 42 \text{ (b\`ur)}.

**Line 3:**

\[8,0 \times 8,0 \text{ (sar)} = 48 \times 48 \text{ (iku)}\]
\[= 48 \times 48 \times \frac{1}{18} \text{ (b\`ur)}\]
\[= 2,8 \text{ (b\`ur)}\]
\[= 2 \text{ (\`s\`ar)} 8 \text{ (b\`ur)}.

**Line 4:**

\[7,0 \times 7,0 \text{ (sar)} = 42 \times 42 \text{ (iku)}\]
\[= 42 \times 42 \times \frac{1}{18} \text{ (b\`ur)}\]
\[= 1,38 \text{ (b\`ur)}\]
\[= 1 \text{ (\`s\`ar)} 38 \text{ (b\`ur)}.

**Line 5:**

\[6,0 \times 6,0 \text{ (sar)} = 36 \times 36 \text{ (iku)}\]
\[= 36 \times 36 \times \frac{1}{18} \text{ (b\`ur)}\]
\[= 1,12 \text{ (b\`ur)}\]
\[= 1 \text{ (\`s\`ar)} 12 \text{ (b\`ur)}.

**Line 6:**

\[5,0 \times 5,0 \text{ (sar)} = 30 \times 30 \text{ (iku)}\]
\[= 30 \times 30 \times \frac{1}{18} \text{ (b\`ur)}\]
\[= 50 \text{ (b\`ur)}.

**Line 7:**

\[4,0 \times 4,0 \text{ (sar)} = 24 \times 24 \text{ (iku)}\]
\[= 24 \times 24 \times \frac{1}{18} \text{ (b\`ur)}\]
\[= 32 \text{ (b\`ur)}.

Line 8:

\[
3,0 \times 3,0 \text{ (sar)} = 18 \times 18 \text{ (iku)} \\
= 18 \times 18 \times \frac{1}{18} \text{ (bûr)} \\
= 18 \text{ (bûr)}.
\]

Line 9:

\[
2,0 \times 2,0 \text{ (sar)} = 12 \times 12 \text{ (iku)} \\
= 12 \times 12 \times \frac{1}{18} \text{ (bûr)} \\
= 8 \text{ (bûr)}.
\]

Line 10:

\[
1,0 \times 1,0 \text{ (sar)} = 6 \times 6 \text{ (iku)} \\
= 6 \times 6 \times \frac{1}{18} \text{ (bûr)} \\
= 2 \text{ (bûr)}.
\]

For comparison, I take up another interpretation of the numbers listed in the table, which seems to have been supported by many Sumerologists:\[12\]

\[
(60 \times 9)(60 \times 9) = 1080 \times 2 + 180 \times 4 + 18 \times 2 \\
= 2916 \text{ (iku)}.
\]

Also, see Line 2 above.

We can immediately realize that this calculation is not the one performed by the Sumerians but a modern one forced by decimal calculations, because they had no means to record the result of \((60 \times 9)(60 \times 9)\) decimally and their purpose was to represent the area of a large land not by unit \text{iku} but by unit \text{bûr}. In ancient times, Sumerian framers used to sow a field with barley, a certain unit of barley \((\approx 240 \text{ liters})\) per 1 \text{bûr}.

7 Incorrect result

Another school tablet \textbf{TSŠ No. 188}[\textsuperscript{13}] also calculates the area of a vast square field, whose side is definitely an imaginary one, that is, 50,0 \text{ninda} \((\approx 18 \text{km})\). Line 1 of the tablet consisting of two blocks simply reads (see Figure 7):

The field. 50,0 \text{ (ninda)}. 50,0 \text{ (ninda)} equally.
If we follow the Sumerian calculation method discussed above, we can obtain the area easily:

\[
50,0 \times 50,0 \text{ (sar)} = 5,0 \times 5,0 \text{ (iku)} \\
= 5,0 \times 5,0 \times \frac{1}{18} \text{ (bûr)} \\
= 25,0,0 \times 0;3,20 \text{ (bûr)} \\
= 1,23,20 \text{ (bûr)} \\
= 1 \text{ (šár-gal)23 (šár)20 (bûr)}
\]

where 1 šár-gal is 1,0,0 bûr, and it was never used in everyday life. But the answer in lines 2 and 3 is a bit larger:

\[
1 \text{ (šár-gal) 27 (šár) 30 (bûr)} = 1,27,30 \text{ (bûr)}. 
\]
In addition, the cuneiform sign ĕš and the area number \(2 + \frac{1}{4} (iku)\) are inserted in line 3, which are seemingly unnecessary but may explain the cause of an error in calculation. The sign ĕš would emphasize that the length unit in the area unit of iku is not ninda but ĕš. As to \(2 + \frac{1}{4} (iku)\), the scribe of this tablet must have used the relation

\[
2 + \frac{1}{4} (iku) = 225 (sar) = 15^2 (sar)
\]

to change the unit sar to iku, but he has made a great mistake in changing iku to bûr:

\[
50,0 \times 50,0 (sar) = \frac{1}{4} \times \left( \frac{50,0}{15} \right)^2 (iku)
\]

\[
= \frac{1}{4} \times (3,20)^2 (iku)
\]

\[
= \frac{1}{4} \times (11,6,40) (iku)
\]

\[
= \frac{1}{4} \times (11,6,40) \times \frac{1}{18} (bûr)
\]

\[
= \frac{1}{4} \times (11,6,40) \times (0;3,30) (bûr)
\]

\[
= \frac{1}{4} \times (38,53;20) (bûr)
\]

\[
= 1,17,46;40 + 9,43;20 (bûr)
\]

\[
= 1,27,30 (bûr)
\]

\[
= 1 (šár-gal)27 (šár)30 (bûr).
\]

In the division by 18, if the dividend is not a simple multiple of 18, the division must have been replaced by the multiplication by 0;3,20 as in later periods.

After all, the scribe’s idea to use the relation

\[
2 + \frac{1}{4} (iku) = 225 (sar) = 15^2 (sar)
\]

for the conversion of units was a failure, although the idea itself was mathematically correct.

8 Capacity units

The basic capacity unit in Fara was sila (≈ 1 liter), from which larger units bán, nigida, and líd-ga were derived:

- 1 bán = 10 sila,
- 1 nigida = 6 bán = 1, 0 sila,
- 1 líd-ga = 4 nigida = 24 bán = 4, 0 sila.

An administrative tablet of this period TSSŠ No. 81 confirms the application of these units:
40 young bricklayers were hired. (Each of them) received 2 (bán) of flour. (The total amount of) flour is 3 (líd-ga) 1 (nigida) 2 (bán).

Since
\[
40 \times 2 \text{ (bán)} = 1,20 \text{ (bán)}
= 3 \times 24 + 6 + 2 \text{ (bán)}
= 3 \text{ (líd-ga)} 1 \text{ (nigida) 2 (bán)}
\]

the result given by the scribe is correct (see Figure 8). Note that two words hun “to hire” and ži “flour” are written with the same cuneiform sign ėš “a unit of length”.

![Figure 8: Obverse and reverse of administrative tablet TSS No. 81](image)

There was another large unit next to the líd-ga, which, strangely enough, has been overlooked by scholars for almost one hundred years:

1 gur (or the like) = 5,0 sīla (= 300 sīla).

An evidence for the use of this large unit is given in the fragmentary administrative tablet TSS No. 882:

2 (nigida) of barley and 2 (nigida) of emmer wheat have been received as a monthly food. 1 (nigida) of barley and 1 (nigida) of emmer wheat (as a food for a half of) the ... month. \(3 + \frac{1}{2}\) months. In total, 1 (gur) 2 (nigida) of barley in (gur-mah) unit. 1 (gur) 2 (nigida) of emmer wheat. The house of gods eats (these).
Thus, the total amount of barley or emmer wheat is

\[(3 \times 2 + 1) \text{(nigida)} = (5 + 2) \text{(nigida)} = 1 \text{(gur)} 2 \text{(nigida)},\]

which clearly shows that

\[1 \text{(gur)} = 5 \text{(nigida)} = 5, 0 \text{(sila)}.
\]

For more attestations of this capacity unit, see WF No. 1 and WF No. 7[14] in the following section.

9 Barley distributed to donkeys

There exists a group of tablets excavated in Fara in which the total amount of barely distributed to anše-apin “plow-donkeys” is recorded with the number of donkeys and the names of their owners. It seems that 1 (nigida) of barely was assigned to one donkey probably for sowing a field, and therefore the formula for calculating the total amount of barley would be:

the number of donkeys divided by 4 in the case of líd-ga (= 4 nigida), or
the number of donkeys divided by 5 in the case of gur (= 5 nigida).

In the following, several examples of these types from WF, TSŠ and NTSŠ[15] are given:

WF No. 1:

\[
1, 26 \div 5 = 17 + \frac{1}{5} \text{(gur)} = 17 \text{(gur)} 1 \text{(nigida)}
\]

where the number in boldface represents the head of plow-donkeys, as above.

WF No. 7:

\[
6, 23 \div 5 = 1, 16 + \frac{3}{5} \text{(gur)} = 1, 16 \text{(gur)} 3 \text{(nigida)}.
\]

WF No. 14:

\[
11 \div 4 = 2 + \frac{3}{4} \text{(líd-ga)} = 2 \text{(líd-ga)} 3 \text{(nigida)}.
\]

TSŠ No. 115:

\[
1, 17 \div 4 = 20 - \frac{3}{4} \text{(líd-ga)} = 20 \text{(líd-ga)} - 3 \text{(nigida)}.
\]

NTŠŠ No. 211:

\[
42 \div 4 = 10 + \frac{2}{4} \text{(líd-ga)} = 10 \text{(líd-ga)} 2 \text{(nigida)}.
\]

These formulas are very simple and practical, however it is really regrettable that most Sumerologists have not noticed their existence yet.
10  Conclusion

Up to the present, most Sumerologists have transcribed the Sumerian sexagesimal numbers to our decimal numbers, both in papers and in books,[16] misleading the general readers and perhaps themselves to the assumption that the Sumerians calculated decimally and wrote down only the results in the sexagesimal numeral notation. It is, however, against the facts as we have seen above. From the beginning they calculated in the sexagesimal numeral system and recorded the results according to their weights and measures which were rather complicated.

Moreover, the Sumerians had established the reasonable and convenient systems of area and capacity measures based on their sexagesimal numeral system, which seem to have made it possible to manage farm work efficiently. By analyzing the data recorded by the Sumerians, we can clearly recognize how they had calculated a large area of a field and a large amount of barley necessary for sowing a field. However, we must be very cautious about transcribing the sexagesimal numbers occurred in their documents to our decimal numbers, because such a transcription tends to obscure the calculation process involved and may mislead us about the nature of Sumerians’ mathematics.

I would like to admire the calculation ability of the Sumerian scribes that must have been acquired after long and strict education.

Notes

[1] A. Deimel, Wirtschaftstexte aus Fara (= WF), 1924, p.1. Deimel erroneously interprets the number 9660 as the number of donkeys. See p.10∗. The translation is mine.

[2] R. Jestin, Tablettes sumériennes de Šuruppak, 1937, no.50. For the transliteration and translation, see my paper: K. Muroi, The Origin of the Mystical Number Seven in Mesopotamian Culture: Division by Seven in the sexagesimal Number System, 2014, arXiv: 1407.6247 [math.HO].

[3] The Assyrian Dictionary of the Oriental Institute of the University of Chicago (= CAD), vol.9, L, 1973, p.197.

[4] CAD, vol.10, M part two, 1977, p.1.

[5] M. L. Thomsen, The Sumerian Language, 1984, §139.

[6] H. V. Hilprecht, Mathematical, Metrological and Chronological Tablets from the Temple Library of Nippur, 1906, text 29, obverse col.4, line 9.

[7] K. Muroi, Studies in Babylonian Mathematics No.3, 2007, pp. 6-7.

[8] K. Muroi, The oldest example of compound interest in Sumer: Seventh power of four-thirds, 2015, arXiv: 1510.00330 [math.HO].
[9] In the Susa mathematical texts. A new edition of the Susa mathematical texts in a new book (Elamite Mathematics) is being prepared for publication by the present author and N. Heydari who is a mathematician from modern Susa.

[10] K. Muroi, Sexagesimal calculations in ancient Sumer, 2022, arXiv: 2207.12102 [math.HO], 6 pages: https://arxiv.org/abs/2207.12102.

[11] A. Deimel, Schultexte aus Fara (=SF), J. C. Hinrichs’ sche Buchhandlung, 1923.

[12] S. N. Kramer, The Sumerians, University of Chicago Press, 1963, p. 94.

[13] R. Jestin, Tabletes sumériennes de Šuruppak (=TSŠ), E. de Boccard, 1937, No. 188.

[14] A. Deimel, Wirtshafts texte aus Fara (=WF), J.C. Hinrichs, Leipzig, 1924.

[15] R. Jestin, Nouvelles Tabletes sumériennes de Šuruppak (=NTSŠ), A. Maison-neuve, Paris, 1957.

  Further examples are given in WF No. 9, WF No. 16, WF No. 17, WF No. 19, WF No. 22, WF No. 25, WF No. 26, WF No. 28, TSŠ No. 106, TSŠ No. 107, and NTSŠ No. 244.

[16] For example, S. N. Kramer, The Sumerians, 1963, p. 92.