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Mathematical tablets in the Emory collection

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Among the 326 tablets from the Michael C. Carlos Museum (Emory University, Atlanta, Georgia, USA) posted on CDLI in 2013, three (perhaps four) contain mathematical texts. They are the following:

- X.3.294 (P433266) multiplication table
- X.3.156 (P433130) exercise of multiplication
- X.3.116 (P433100) calculation
- X.3.124 (P433106) metrological list or table?

The types of the tablets, the content and the paleography (eg 19 written 20-1 in X.3.294) are that of school material from the Old Babylonian period.

X.3.294 (P 433266)

X.3.294 is a type III tablet (elongated single column school tablet), without colophon. It contains a multiplication table by 18 written in a terse style, ending with the product of 18 by 50 (no square, no reciprocal of 18, as often in multiplication tables), and a final horizontal line. The multiplication table by 18 belongs to the elementary mathematical curriculum as attested in Nippur and in most of the sites where schools tablets were found. (Veldhuis 1997, Robson 2002, Proust 2007).

Obverse

18	18
2	36
3	54
4	1.2 ^{sic} (1.12 expected)
5	1.12 ^{sic} (1.30 expected)
6	1.48
7	2.6
8	2.24
9	2#.42
10	3
11	3.[18]
12	3.[36]
13	3.[54]
[14	4.12]
[15	4.30]

Reverse

16#	[4.48]
17#	[5.6]
18#	[5.24]
20-1#	5.42#
20	6
30	9
40	12
50	15

X.3.156 (P 433130)

X.3.156 is a square type IV tablet (type IV are round or square tablets for school exercises). The obverse contains numbers displayed in two rows and two columns separated by horizontal and vertical lines. The reverse is damaged, and seems to be uninscribed.

Obverse

1.20	1.46#.40#
1.20	
1.30	2.15#
1.30	

Commentary:

$$1.20 \times 1.20 = 1.46.40$$

$$1.30 \times 1.30 = 2.15$$

This is an extract of the table of squares (entries 1.20 and 1.30), but the layout looks like an exercise of multiplication of the genre that were carried out during the intermediate level of mathematical education in Nippur and probably elsewhere (Robson 2002, Proust 2007)

X.3.116 (P433100)

X.3.116 is a lenticular type IV tablet. Both sides contain numbers in sexagesimal place value notation displayed in a way which reflects the implementation of an algorithm. Other specimen of type IV tablets containing traces of numerical algorithm were found in several places, mainly in Nippur (Proust 2007: §6.3.2), but also in Mari, Ur (Friberg 2000), Uruk and elsewhere. When the algorithm is elucidated, its goal is the most often an extraction of reciprocal or square root by means of factorization (see more details on these algorithms in Proust 2012). Here, the algorithm is not clear. The strings of digits which compose the numbers are difficult to identify because the cuneiform notation does not indicate how the digits compose numbers. Moreover, it is not clear if the text is written in one, two or three columns. The transliteration which follows is based on the hypothesis that the text is written in two columns.

Obverse

1.	10	33.50
2.	20	x
3.	40	1.57.22.30
4.	44	
5.	6	8.45 [?] .4+
6.	x	

Reverse

1.	45	41.30
2.	30	
3.	6	10 ² +
4.	3	20.11 [?]
5.	30	21.30
6.		2.15

Discussion

Another hypothesis would be that lines 1 and 2 are written in one column. This hypothesis is based on the observation that the square of 25.10.33.47 is 10.33.50.0.44.41.18.19 (according to Mesocalc <http://baptiste.meles.free.fr/site/mesocalc.html>)

Possible transliteration of lines 1 and 2:

1.	10.33.50
2.	2[5.10.3]3#

In this case, line 2 would contain a very good approximation of the square root of 10.33.50.

In favor of this hypothesis is the fact that the end of line 2 exhibits erased and damaged signs. In this case, a large space would separate the digit 20 (first sign, clearly visible on the left of line 2) and the digit 5 (second possible sign, not visible in the erased portion). This kind of justification (first sign to the left, last sign to the right, and large space in the middle if necessary) is a common practice in Old Babylonian mathematical exercises texts. The traces do not exclude signs 5, 10 and 30 in the erased portion, and 3 at the end of the line.

Against this hypothesis is the fact that these numbers are not regular (they do not admit a finite reciprocal in base 60). Moreover, the rest of the text does not seem to exhibit similar relations.

X.3.124 (P433106)

X.3.124 is type III tablet very damaged. Traces of ruling (several horizontal lines and one vertical line) and some erased signs are visible on the obverse. The reverse is blank. The tablet seems to have been erased when still fresh, perhaps for recycling. The signs on the obverse may be metrological (a possible sign gin_2 is visible on the third line) and numerical (a sign 6 or 9 is recognizable on the fourth line). The tablet may have contained a metrological list or table before being erased.

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