An Akkadian Text about Metrics and Sizes

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Introduction

Among the many confiscated cuneiform tablets in the Iraqi Museum from unknown provenance, the tablet IM. 204709 has been selected for this study. The reason for selecting this tablet is its rare subject matter on providing numerical data for the digging of irrigation canals. The paleography and writing style suggests that this text, as well as the other texts in the collection, date to the Akkadian Dynasty (ca. 2371-2255 BCE), and derived from illegal excavations at the ancient city of Umma (modern Jokha) in southern Iraq (Foster 1982). The tablet is rectangular in shape and measures 6 x 4 cm, and it has five lines in the obverse (fig.1) and two lines in the reverse (fig.2); these two lines are distributed above and below the tablet, while the lower part of the tablet was missing.

The text deals with the event of digging canals of different sizes. It seems that these four canals which its measurers mentioned in the text represented sub-canals probably bug from the main canal which not mentioned in this text. Perhaps, the differences of volumes of these canals depend on the adjacency and distance of the agriculture lands from the presumable main canal. Probably these sub-canals were officially planned by authorities which tried to control the rations of the water and the agriculture lands as apart of irrigation system which was common in the Akkadian period (Powell 1987). It appears that the canal mentioned in the first line is the main canal, because its length is considerable longer than the rest of the canals mentions in the texts. This being said, the width and depth of the canal mentioned

in the first line is considerable less than the others (e.g. 0.5m depth versus 3m depth of canal mentioned in line o.3). These sub-canals are related to the main canal. The fifth line provides the total of the volume of excavated earth of all sub-canals. The date formula at the end of the texts indicates that we are dealing with an official document (Foster 1979).

The text (IM. 204709)

Transliteration:

Obv.

1. 34 ½ ninda-du gid_2
   2 $kuš_3$ dagal 1 $kuš_3$ tul_2

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2. 14 ninda gid_2 3 $kuš_3$ dagal
   2 $kuš_3$ tul_2

---

3. 8 ninda gid_2 3 $kuš_3$ dagal
   4 $kuš_3$ tul_2

---

4. 8 ninda gid_2 3 $kuš_3$ dagal
   3 $kuš_3$ tul_2

   Space

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5. [x - x] 5 2/3 sar ⌜ 5 ⌝
   [x] [g]an_2

Rev.

6. [x xx] [x] ⌜ x dagal 1 x ⌝
   Space
7. [x] mu 1 iti

Translation:

Obv.

1. 34, 2/1 sticks length, 2 arms width, and one arm depth.
2. 14 sticks length, 3 arms width, and 2 arms depth.
3. 8 sticks length, 3 arms width, and 4 arms depth.
4. 8 sticks length, 3 arms width, and 3 arms depth.
5. ..... 3/2, 5 Sar (and) 5 shekels.

Rev.

6. .....width 1.....
7. Year ( ), the first month.

Commentary

The first four lines provide all three dimensions of the canals in question: length (gid_2), width (dagal), and a third dimension tul_2, which can be interpreted as a "depth" (in fact, the sign "tul_2" often reads "digging", "trench", "canal", or "well" CITATION. There is no doubt that the last sign is tul_2 (or pu_2) that I understand as a channel, or the depth of a channel. In the fallowing resources the sign "tul_2" (or pu_2) has been attested with different meanings as I have mentioned previously.

tul_2 / pu_2

tul_2 / pu_2 in lexical lists

(http://psd.museum.upenn.edu/PSD/html/uniss/UI/oindex.html):

EA I, 51-55 (MSL 14, 178)

51.	(pu_2:)	pu-u_2	LAGAB×U	*bu-ur-tu*
52.	(tul_2:)	tu-ul	LAGAB×U	*is-su-u2*
53.	(ub_4:)	ub	LAGAB×U	*up-pu*
54.	(hab_2:)	ha-ab	LAGAB×U	*bu-šu*
55.	($kala_3$:)	ka-la_2	LAGAB×U	*ka-lak-ku*

Aa ½, 148-196 (MSL 14, 212)

148-159.	(pu2:)	pu u2	LAGAB×U	*bur-tum, šit-pu, is-*[*su-u*], *a-sur-rum, šu-up-*[*lu*], *šu-up-pu-lu, šu-*⌈*x*⌉-[...], *şip-pa-tum, pi-ir-*[*x*], *pu-u* *ša2* ŠE, *ša* GIŠ.TA.LAGAB×U ⌈*x*⌉-[...]
160-168.	(tul2:)	tu ul	LAGAB×U	*bur-tum, is-su-u, mi-ih-şu, lah-tum, tu-ul-tum, šid-*⌈*du?*⌉, *hi-ri-tum, ka-lak-ku, šu-up-lu*
169-177.	(ub4:)	ub	LAGAB×U	*bur-tum, mi-ih-şu, lah-tum, up-pu, hu-up-pu, hu* *bal-lum, šu-up-lu, šu-ut-ta-tu, ha-ap-pu*
178-195.	(hab2:)	ha ab	LAGAB×U	*bu-šu,* ⌈*bi*⌉*-i-šu2, bu-ša2-nu, şe-e-nu, eg-rum, ha* *tu-u2, ha-ap-pu,* [*i*]*s?-hap-pu, tu-ru-u, šup-*⌈*x*⌉*-lum, ba?-la-şu, uk-ku-lu, e-ke-lu, ša2* I3.LAGAB ⌈*i*⌉*-ku-ku, ša2* šIM.LAGAB *tu-ru-u, ša2*

GIŠ.LAGAB *is-hap-pu ;* ⌈*ku*⌉-*ku-bu, ša*$_2$
IM.TA.LAGAB *ru-šum-ti*

196. (gala$_3$/kala$_3$:) ga la$_2$ LAGAB×U *ka-lak-ku*

tul$_2$ / pu$_2$ in e-psd (http://psd.museum.upenn.edu/epsd1/nepsd-frame.html):

Akk. būrtu "cistern, well"; hirītu "ditch, channel"; kalakku "excavation, trench".

Bibliography provided by e-psd: [2002] J. Hoyrup, Lengths Widths Surfaces 36; [1972] M. Powell, ZA 62 210-211 n128. tul$_2$ / pu$_2$ in CAD

CAD 8, 62, kalakku: excavation, sometimes written tul2-(la2), equivalent to the term ki-la2 used for excavations in OB mathematical texts. CAD 6, 198, hirītu: ditch, canal (there is no mention of the writing tul$_2$). CAD 2, 335, būrtu: well, cistern, sometimes written pu$_2$.

The scribe used the term (ninda-du) as a unit of length in the first line, while the term (ninda) is used for the same purpose in lines 2-4, and it is understood that the latter is the abbreviation of (ninda-du). The fifth line provided us with the terms (SAR) and (GIN$_2$) as a measuring unit for the area or the size of the total surface of the all sub-canals, or it represents the total extracted soil to dig of the sub-canals. The beginning of the fifth line is missings, and what is remaining of the sign can be read as "5", but can also be read 6, 7, 8 or 9.

The data this text provides are of great importance, as it is an evidence that the metrological system of sizes may have been invented during the Akkadian period in the context of reforms undertaken by the royal family of Sargon (Powell 1987-90, § III). This notion is supported by an Akkadian administrative text from Girsu (Thureau-Dangin 1903, RTC 137=AO 31261). It is noted that in some pre-Sargonic texts, the size of the extracted soil is estimated by measuring the canal's length (Powell 1987-90, § III). However, in one of the texts (DP 654 = AO 13863), dating to the Early Dynastic IIIb, the size is measured by the length, width and depth of the canal (De la Füye 1912).

Finally, according to Cristine Proust (personal communication), this text appears to be one of the earliest evidence of the metrology system. The text is also of significant importance for the study of the history of mathematics and metrology.

Acknowledgment

I extend my thanks and appreciation to Benjamin Foster and Cristine Proust for their valuable comments and advice.

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Section	Length	Breadth	Depth	Base	Volume
1	34 ½ ninda	2 kuš	1 kuš	5 2/3 *sar* 5 *gin*	5 2/3 *sar* 5 *gin*
2	14 ninda	3 kuš	2 kuš	3 1/2 sar	7 sar
3	8 ninda	3 kuš	4 kuš	2 sar	8 sar
4	8 ninda	3 kuš	3 kuš	2 sar	6 sar
Total (calculated)				13 *sar* 15 *gin*	26 2/3 *sar* 5 *gin* (= 1/4 gan 1 2/3 sar 5 gin)

Table 1: Showing the size of the excavated land per canal and the total size of the excavated land for all canals.

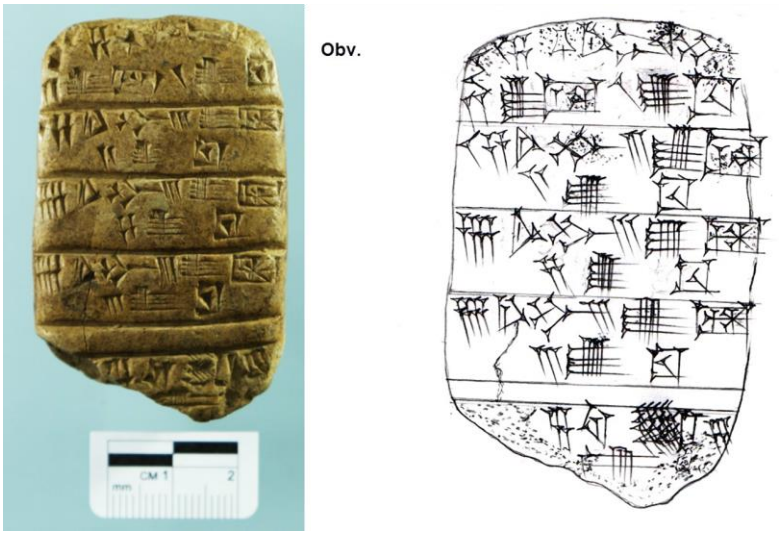

Fig. 1: Tablet IM. 204709, obvers.

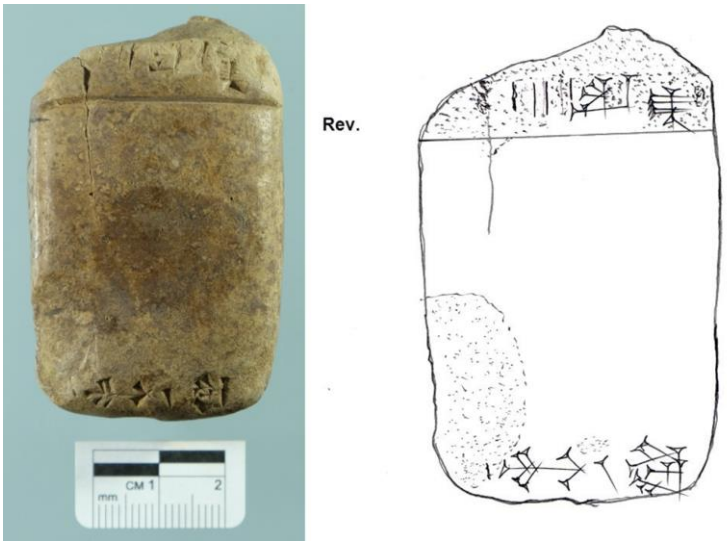

Fig. 2: Tablet IM. 204709, reverse.