

LATE URUK PERIOD CATTLE AND DAIRY PRODUCTS: EVIDENCE FROM PROTO-CUNEIFORM SOURCES

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Introduction

Of the two major uses of large cattle we may expect to find documented in proto-cuneiform sources, namely their exploitation as draft animals and as producers of meat and dairy fats, the former, in particular plowing, is not recognizable in its clear form known from administrative texts of the later third millennium. No texts known to me refer to numbers of oxen specifically assigned to plowing units, nor do the sources attest to the substantial costs—feed grain—known to arise with the use of oxen in plowing and seeding fields. Only several uncertain accounts register together the existence of both the plow represented by the sign APIN and oxen represented by the sign GU₄.¹ Whether oxen played a large role in field work in the Late Uruk period is thus a matter of conjecture. It seems unlikely that large cattle were widely exploited as producers of meat any more in the Late Uruk period than in later times.² As sources of dairy fats and cheese, however, cows were clearly prized and closely controlled. A relative abundance of documentation registers quantities of these products, from which herd sizes can be extrapolated that are comparable with those of the pre-Sargonic Lagash period, but that fall well short of the numbers of animals herded during the IIIrd Dynasty of Ur.³

Proto-cuneiform documentation of early cattle herding derives with few exceptions entirely from the large numbers of tablets and fragments unearthed during the German excavations of the southern settlement of Uruk.⁴ This Uruk documentation exhibits a clear dichotomy between texts dating to the Uruk IV (ca. 3200-3100 B.C.) and those dating to the Uruk III/Jemdet Nasr (ca. 3100-3000 B.C.) periods. The earliest texts record numbers of cattle apparently assigned named officials or institutions, to the near exclusion of records of dairy produce, whereas among the texts dating to the Uruk III period, exceedingly few accounts of groups of cattle are found, but large numbers of records of dairy fats and cheeses, complemented with the existence of an involved metrological system seemingly developed to afford greater control of these products.

Identification of proto-cuneiform signs representing cattle

Following the publication and analysis of a small number of Late Uruk documents between 1917 and 1927,⁵ S. Langdon's work on the Uruk III period proto-cuneiform tablets from Jemdet Nasr⁶ resulted in 1928 in the first identification of large numbers of archaic signs with apparent later forms. It was readily obvious that in the case of large cattle pictograms representing the animals' heads, and, *pars pro toto*, the animals themselves, were the precursors

of signs which in later periods represented animals differentiated according to sex and age using ideographic qualifications. Based on the primarily Uruk IV period texts excavated by German teams in Uruk in the years 1928-1931,⁷ A. Falkenstein noted in 1936 the paleographic development, beginning in the Uruk IV period, of the signs AB₂, GU₄ and AMAR.⁸ Recent considerations about the possible semantic significance of a small number of so-called tokens found both alone and in association with sealed clay bullae, dating to the Late Uruk period prior to the development of writing,⁹ may be considered highly speculative; one can only presume that there is no reason why such semiotic devices should not have been used together with tokens of obvious numerical significance, however the forms which were unearthed next to—none within—bullae in Uruk bear no more than a passing resemblance to the later signs GU₄ or possibly AMAR. The Late Uruk sign AB₂ depicted, seen from the front, the head of the domesticated female *Bos* with down-turned horns, the sign GU₄ the head of the bull or ox with horns upturned,¹⁰ and the sign AMAR the hornless calf with ears held upright. This latter sign, which otherwise did not indicate the sex of the animal, could be qualified in the second writing stage Uruk III with the signs SAL and KUR_a representing females and males, respectively.¹¹

In the course of Uruk excavations following the publication of *ATU* 1 in 1936, a total of 24 Uruk III period fragments representing witnesses of an archaic lexical list dealing with large cattle were discovered and have been published in a volume containing all known archaic lexical material from Uruk and other sites.¹² Although in a very poor state of preservation, these witnesses did allow a sufficient reconstruction of the text to confirm early suspicions that it represented the original version of a list which in a possibly redacted form was part of the scholastic curriculum in Early Dynastic Fara, Abu Salabikh and Ebla.¹³ The compendium contained in its archaic form three clear sections dealing in turn with AB₂, GU₄ and AMAR; each section consisted of a canonized sequence of sign combinations beginning with entries recording 'stall', hide colors ('reddish', 'white', 'black') and other both standardized and specific characteristics of the respective animals concerning above all their hides. A fourth section partially preserved in only one text consists of animals represented by the sign AM_b (AMAR*gunû*), possibly corresponding to later am (GU₄+KUR), "wild bull".¹⁴

A section of the well preserved archaic 'tribute' list—in all likelihood an early form of folkloristic literature—contains among standardized sequences of animals and agricultural products the notations 1N₁₄ AB₂ / 1N₁ GU₄, "10 cows, 1 bull". The same relation of 10:1 is found in two following couplets of the text registering female and male sheep and goats, thus listing together the three major domestic animals in the early Babylonian economy.¹⁵


Records of heads of cattle

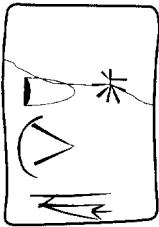
In general, accounts of numbers of large cattle are well represented in texts dating to the period Uruk IV,¹⁶ but are essentially unknown in texts from the following Uruk III period. The dairy products milk fat and cheese, on the other hand, are well attested in accounts from the latter period, whereas such accounts are seldom found in Uruk IV texts. Cattle as discrete objects were as a rule registered in proto-cuneiform texts in the sexagesimal system; the exceptional use of the sign N₈ in the Uruk IV period to designate immature animals is discussed below.

Small, characteristically pillow-shaped Uruk IV period tablets¹⁷ record the receipt by a named individual of one or as many as several head of cattle (see figure 1¹⁸). Inscriptions in these accounts consist of numerical notations employing the sexagesimal system, one or more signs representing heads of cattle and one or more signs which seem to represent receiving individuals or officials and possibly, for example, in the case of the signs ERIM_a and AL,¹⁹ the function of the animals.²⁰ Numerical notations representing numbers of both male and female animals were explicitly qualified by the sign combination GU₄ AB₂ as in later periods both for large cattle and, using a related sign combination, for sheep and goats.²¹ Reverse faces of the 'receipts' remained uninscribed.

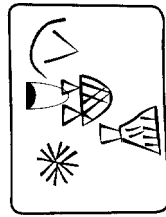
Simple records of single transactions were booked into larger accounts in a format represented by the two tablets W 9656, ev and W 7227, a in figure 2. Up to five columns on the obverse face of these texts contained from four to seven individual entries, each of which corresponded to one of the simple records discussed above. The numerical total of the cattle recorded in these entries was entered on the reverse face of the account (rotating the tablet around its 'horizontal' axis).²² This total was qualified with the ideograms GU₄ or GU₄ AB₂, respectively, representing cattle and, in the case of the former text depicted, with a further sign combination possibly recording the distributing organization (? NUN_a) and the purpose of the distribution (? 'GI' []). A third account in figure 2, W 9656, ex, demonstrates the use in the Uruk IV period of a bookkeeping mechanism which recorded an apparently complete herd of adult and young cattle probably separated according to the function of the individual animals. Employing the principle of listing most to least valuable, the text registers numbers of oxen, followed by counted cows and calves (AMAR), in some cases assigned named individuals. In accounts from the Uruk IV period, the calves could, just as is true of lambs and the children of dependent laborers who were probably too young to be put to work, be qualified using the sign N₈ (𐎠, that is, the basic sign N₁ turned 90° clockwise) which in sexagesimal notations generally designated "1/2" of a discrete unit.²³ Thus the fourth case of the text's second obverse column contains a notation 'N₁' N₈ representing one cow and one calf; the latter animal was included on the text reverse, column 1, case 3, among a group of four animals qualified as AMAR.

Uruk III period accounts of herds of large cattle are very rare and register only modest numbers of animals. The preserved sections of text W 14275 in figure 2 contain notations representing just 8 head; it is just the same an interesting example of the correspondence in the archaic period between designations attested in the lexical cattle list and those attested in administrative documents. The sign combinations AB₂ NE_a (obv. i 1), AB₂ U₄ (i 2), AB₂ ŠU (ii 1), AB₂ GI₆ (ii 2) and GU₄ 'NE_a' (ii 4) in this account, all known from the canonized lexical text ATU 3, 89-93,²⁴ are found neither in accounts from the preceding Uruk IV period, nor in the administrative corpus of the following Early Dynastic period, including the age represented in the SIS 4-8 texts from Ur,²⁵ during which the lexical list in its archaic form was part of scribal curriculum. Recorded categorization of animals according to age seems to have been more developed in the Uruk III period as well; the text W 14361 (figure 2, bottom right) registers in three cases of its second column notations representing oxen in their fifth, fourth and second years, respectively (sign combinations U₄+5N₅₇, U₄+4N₅₇ and U₄+2N₅₇ GU₄).²⁶ These oxen were apparently in the charge of an official called GAL_a UTUL_a (obv. iii 2), "head cowherder".

Examples of receipts (?) for one cow (sign )



W 9123,b




W 9123,c

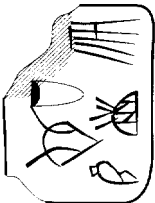


W 9169,f



W 9579,cz

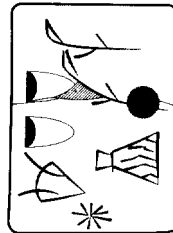
Examples of receipts (?) for one or at most several bulls/oxen (sign )



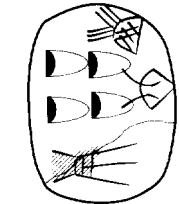
W 9579,dd





W 9579,av

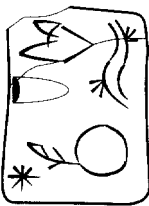


W 9123,e

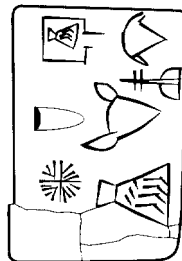


W 9656,ak

Examples of receipts (?) for one calf (sign ) and for mixed cattle (?; sign combination )



W 9579,da

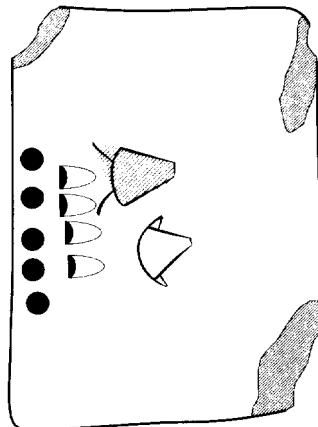
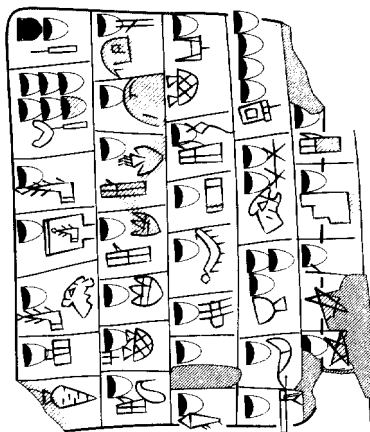
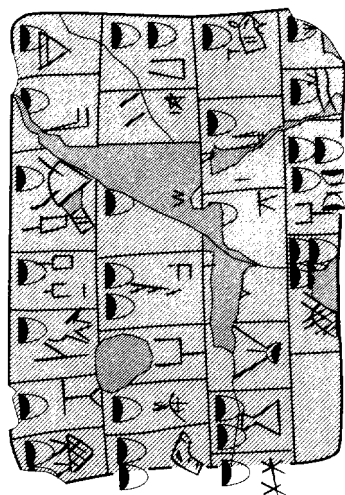


W 9656,jn

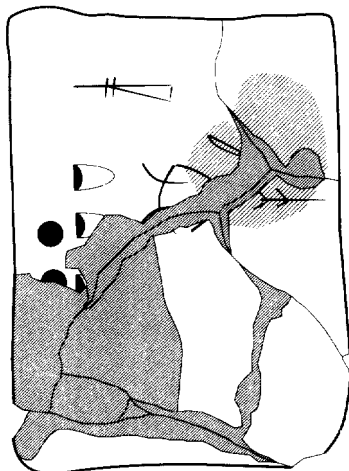


W 9335,c

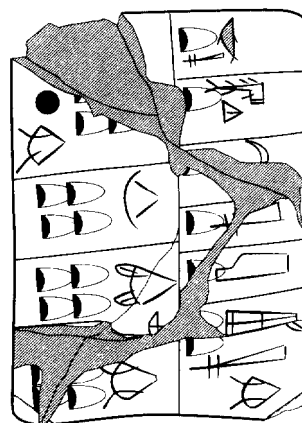
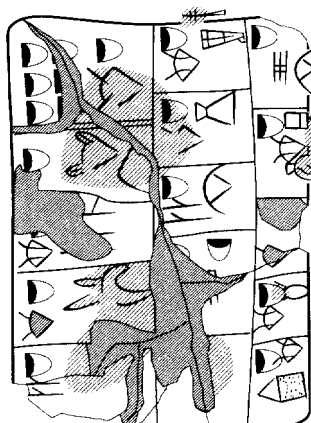
Figure 1: Examples of receipts (?) for one or at most several cattle (all copies from R. Englund, ATU 5).



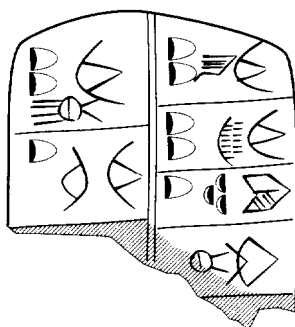
W 7227,a



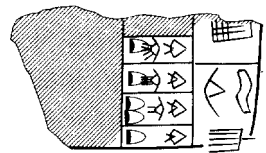
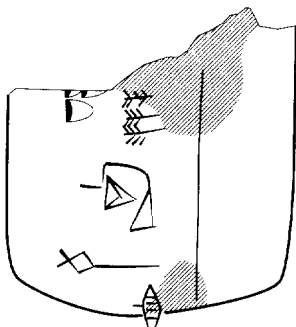
W 9656,ev



W 9656,ex



W 14275



W 14361

Figure 2: Examples of complex accounts of cattle. The upper three texts (copies from R. Englund, ATU 5) date to the Uruk IV period and register numbers of animals totaled on the texts' reverse faces; W 7227,a books a total of 54 cows and bulls. The lower two Uruk III period texts contain accounts of small numbers of cattle qualified with signs known from the lexical list ATU 3, pp. 89-93 (W 14275), and with sign combinations known to represent the animals' ages (W 14361; first published in ATU 2, pl. 60).

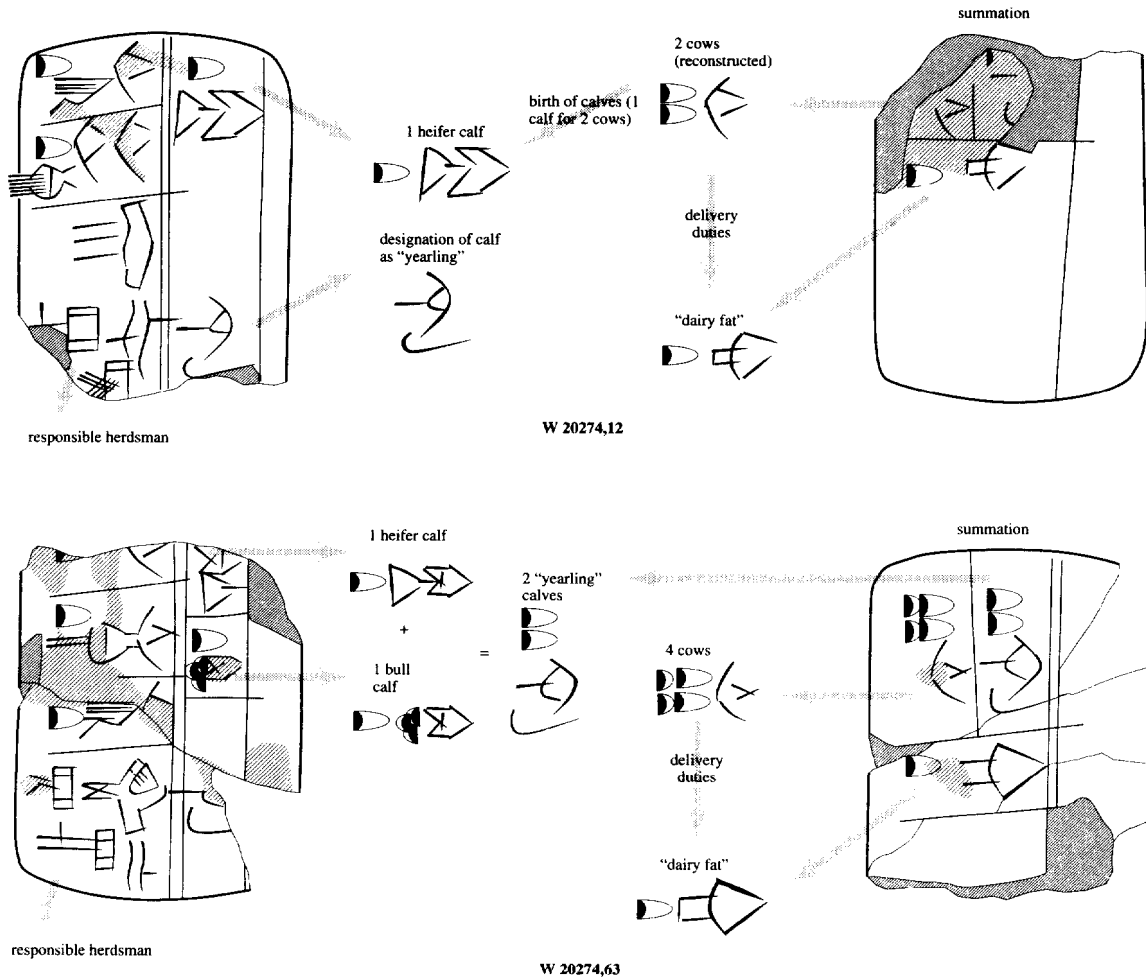


Figure 3: Two Uruk III accounts of small herds of milk cows. The sign combinations in the lower left case of each account represent the herders responsible for the cows.

Records of archaic dairy products

Related herding accounts from the Uruk III period, of which only two are preserved well enough to permit a reconstruction of their contents,²⁷ record small numbers of cows together with their offspring, qualified SAL+AMAR and KUR_a+AMAR ('heifer calf' and 'bull calf'), from the accounting year of the text. Both texts record a ratio of two adult cows per recorded calf.²⁸ The two accounts depicted in figure 3 further serve as examples of the greater accounting effort invested in the dairy production of cows in the Uruk III period. In a fashion parallel to that employed in recording the amount of dairy fat to be delivered by herders of sheep or goats,²⁹ the accounts book in the totals on their reverse faces one jar of dairy fat

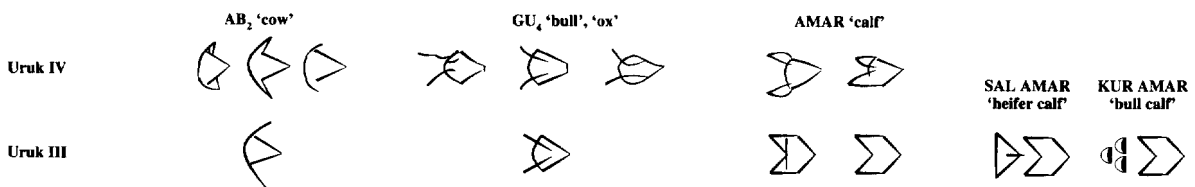


Figure 4: Proto-cuneiform signs representing cattle.

(sign DUG_b) per two (W 20274,12) or four (W 20274,63) milk cows. We may compare these relationships with the amount of the dairy fat required as a yearly delivery of herders from the pre-Sargonic Lagash (ca. 2400-2300 B.C.) and the Ur III (ca. 2100-2000 B.C.) periods. Numerous accounts from the earlier period set this quota at 10 Old Sumerian šila or ca. 15 liters, accounts from the later period on the other hand assume a yearly delivery of just 5 neo-Sumerian šila or ca. 5 liters. If we assume a yearly milk production of reasonably well fed cows kept in semi-arid climates of between 700 and 800 liters, of which about half will have been given to their calves, the remaining milk with a fat content of ca. 4% would result in ca.

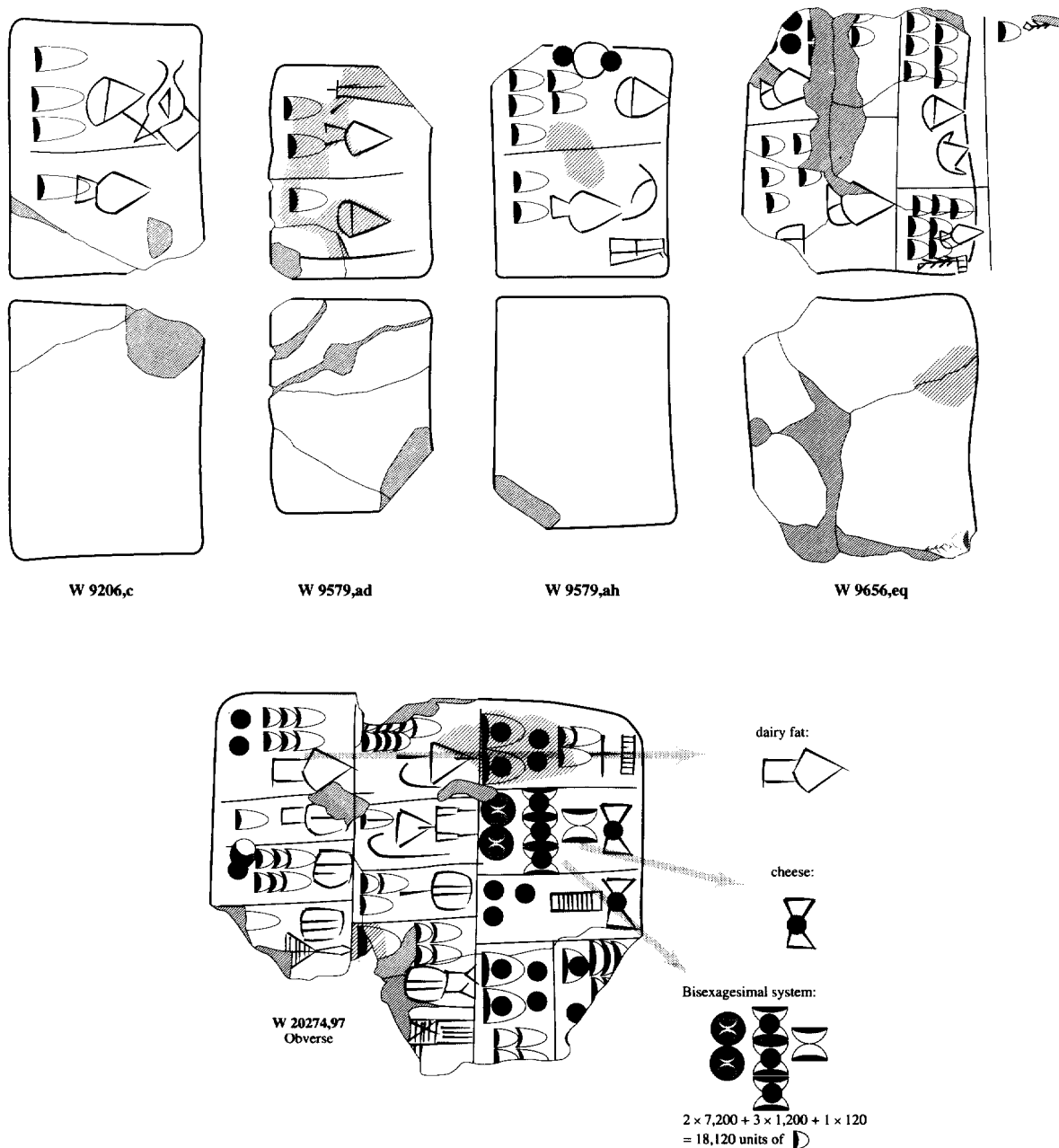


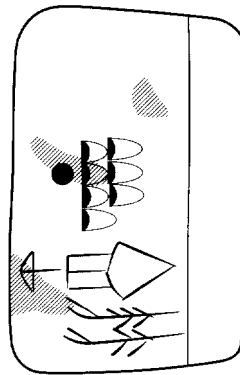
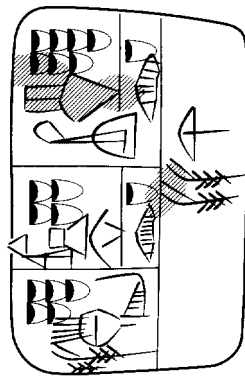
Figure 5: Simple accounts of dairy products from the Uruk IV period (above; copies from R. Englund, ATU 5) and a large account from the Uruk III period (below; see ATU 2, pl. 55, and Archaic Bookkeeping, p. 94) of products from animal husbandry, including the signs for dairy fat (DUG_b) and cheese (GA'AR).

15 liters of dairy fat ('clarified butter', 'ghee'). This suggests that the pre-Sargonic Lagash herders delivered all the produce of their cows, the Ur III herders in contrast perhaps a third. Since, moreover, the archaic sign DUG_b seems to have represented a ceramic jar no larger than ca. 10 liters (see below), it may be proposed that the archaic herders delivered dairy produce at a rate comparable to that of the Ur III period and were thus akin to contract herders who kept a percentage of the produce of their herds in lieu of other compensation for their labor.

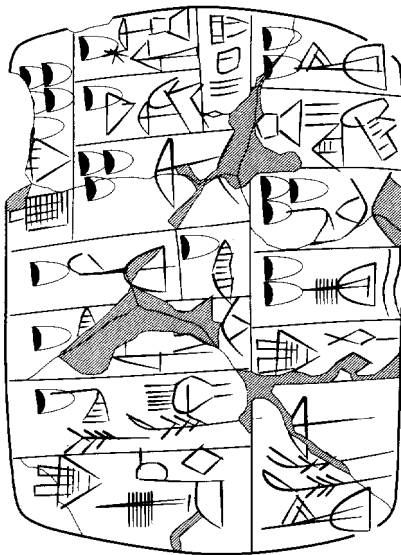
The first eight lines of the archaic lexical list 'Vessels,' one of several compendia for which precursors from the Uruk IV period are known, in fact consist of entries with the signs DUG_b , $KISIM_{a/b}$ and other signs which represent containers of fats used in the administration of archaic dairies.³⁰ These signs, including NI_a , DUG_c and $UKKIN_b+NI_a$,³¹ are often found inscribed together in administrative documents beginning in the Uruk IV period (see figures 5-8). In particular, the association of the sign NI_a with DUG_b in such documents as W 9206,c, W 9579,ad and W 9579,ah, and of NI_a in the same case with AB_2 and with DUG_c in the account W 9656,eq (all figure 5) demonstrate that this sign should represent a container of dairy fat from its first use in the Uruk IV period. The sign, the real referent of which is unknown, is in later cuneiform documents the general designation of fats of all kinds. Only indirectly associated with the sign representing dairy fat, DUG_b , is on the other hand the sign GA^2AR in such texts as W 20274,97 (figure 5). This sign, found as a general object designation in a section of the archaic vessels list following a long section on containers of fats and other products,³² is, as a clear precursor of the Fara and pre-Sargonic Lagash sign $LAK 490$ —itself replaced in Ur III documents by the sign combination $ga.HAR/UDgunû$ —, posited to represent a unit of cheese (Sumerian reading possibly /ga²ara/ or /gamur/). Whereas oil vessels were counted with the sexagesimal system, GA^2AR was reckoned in discrete units using the so-called bisexagesimal (120-base) system and so may be associated with the products GAR (dry grain products) and KU_6 (fresh? fish). We consider such objects to have formed a part of the archaic rationing system.³³ Unfortunately, no archaic texts known to me document the arithmetical relationship between dairy fat and cheese well attested in pre-Sargonic Lagash and Ur III accounts.³⁴

Containers of dairy fat and other liquids were not only as discrete objects counted using the sexagesimal system, but were also as members of a liquid capacity metrological system divided into smaller units using one of three numerical conventions. In the first place, the sign N_8 (𒀭), discussed above as a designation of immature cattle in the sexagesimal system, as a rule qualified $1/2$ of some discrete unit, above all the contents of vessels and baskets, including those represented by the signs DUG_a and $KAŠ_a$ (beer), $KISIM_{a/b}$, DUG_b , DUG_c and $DUG+AŠ_c$ (fats) and $GA_{2a}+HI$ (a fish product).³⁵ Notations in a number of Uruk IV period texts suggest that the sign N_8 in the sexagesimal system could also represent a smaller fraction than $1/2$ of an object, possibly $1/10$; the objects so qualified in these notations are, unfortunately, not always clear, although DUG_c seems attested in at least two of the accounts.³⁶

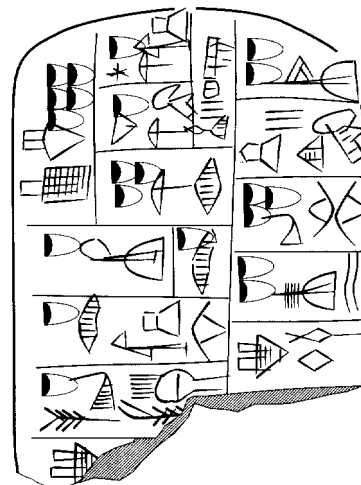
A second, Uruk III period convention used explicitly and alone for dairy fats seems on its surface substantially more complex, yet shares the basic structure of $1/2$ and $1/10$ of the unit 'container.' A large number of accounts, of which nearly all derive from the same locus W 20274 as the herding texts described in figure 3 above, contain notations in this metrolo-



W 20274,6



W 20274,33



W 20274,89

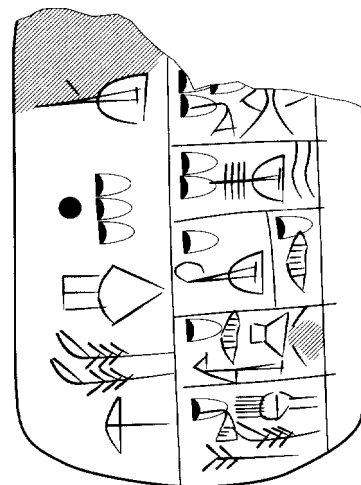
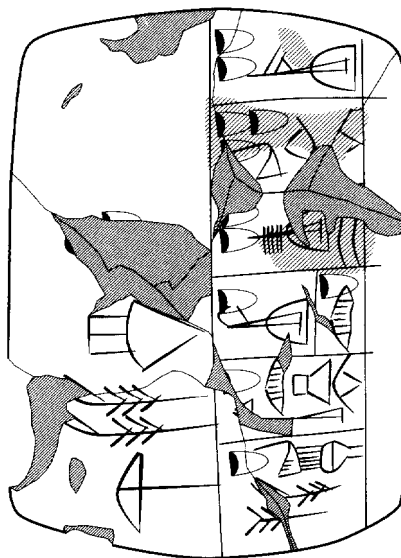


Figure 6: Accounts concerning dairy fat stored in the jar DUG_c.

gical system which exhibits the structure $1 \times N_1 \text{ vessel} = 2 \times N_1 + KU_{3a} = 10 \times N_2$ (corresponding to the basic unit N_1 crossed by a horizontal stroke: \Rightarrow ; see figure 9). W 20274,6 in figure 6 offers a simple summation of three entries with numbers of a container of fats represented by the sign DUG_c :³⁷ $7N_1 DUG_c 1N_1 KU_{3a} + 4N_1 (DUG_c) 1 KU_{3a} + 5N_1 (DUG_c) = 1N_{14} 7N_1 DUG_c$, that is, $7 \frac{1}{2} + 4 \frac{1}{2} + 5 = 17$. The only known duplicate administrative texts from the archaic text corpus, W 20274,33 and W 20274,89 (see figure 6 and the transliterations below), contain a somewhat more involved account, yet the reckoning steps exhibited by both are easily recognizable as simple additions of whole numbers and fractions from the same metrological system.³⁸

	W 20274,33	W 20274,89
Obv. i 1a	'5N ₁ ' ; 'DUG _c ' DUB _a	5N ₁ ; DUG _c DUB _a
1b1a1	1N ₁ ; BA AN ZABALAM _a	1N ₁ ; BA AN ZABALAM _a
1b1a2	1N ₁ ; SAL BA PIRIG _{b1}	1N ₁ ; SAL BA PIRIG _{b1}
1b1b	ZATU751 _a DUR ₂ 3N ₅₇ 'BU _a +DU ₆ '	ZATU751 _a DUR ₂ 3N ₅₇ BU _a +DU ₆
1b2	3N ₁ ; BA 'KI _a '	3N ₁ ; BA KI _a
2	1N ₁ / 1N ₁ KU _{3a} ; ZATU649	1N ₁ / 1N ₁ KU _{3a} ; ZATU649
3	1N ₁ 'KU _{3a} ' ; 'ZABALAM _a ' AB ₂	1N ₁ KU _{3a} ; ZABALAM _a AB ₂
4	1N ₁ ; SI _{4a} NE _a ŠE _a GI	1N ₁ ; SI _{4a} NE _a ŠE _a 'GI'
5	GA _a MUD NUN _a	'GA _a ' [MUD NUN _a]
ii 1	2N ₁ ; ZATU648	2N ₁ ; ZATU648
2	AB _b PIRIG _{b1} +3N ₅₇ SU _a	PIRIG _{b1} +3N ₅₇ AB _b SU _a
3	3N ₁ ; SI U ₄ 'SIG'	3N ₁ ; SI U ₄ SIG
4	2N ₁ ; TUR _{3a} A	2N ₁ ; TUR _{3a} A
5	GA _a BU _a 'HI'	GA _a BU _a HI
6	BA GI+GI ZATU648	[BA GI+GI ZATU648]
Rev. i 1	2N ₁ ; ZATU648	[2N ₁ ; ZATU648]
2	'3N ₁ ' ; 'SI U ₄ SIG'	'3N ₁ ' ; 'SI U ₄ SIG'
3	'2N ₁ ' ; 'TUR _{3a} A'	2N ₁ ; TUR _{3a} A
4	1N ₁ / 1N ₁ KU _{3a} ; ZATU649	1N ₁ / 1N ₁ KU _{3a} ; ZATU649
5	1N ₁ KU _{3a} ; ZABALAM _a AB ₂	1N ₁ KU _{3a} ; ZABALAM _a 'AB ₂ '
6	1N ₁ ; SI _{4a} NE _a 'GI' ŠE _a	1N ₁ ; NE _a SI _{4a} GI ŠE _a
ii 1	'1N ₁₄ 3N ₁ ' ; DUG _c GI+GI BA	1N ₁₄ 3N ₁ ; 'ZATU648' DUG _c GI+GI BA

An example of an account containing the full structure of the second conventional system used to record fractions of containers of fat is found in figure 7. This and a small number of other accounts clearly demonstrate the relationships $N_1 KU_{3a} = \frac{1}{2}$, and $N_2 (\Rightarrow) = \frac{1}{10} N_1 DUG_c$ in this system³⁹ and thus make plausible the assumption that it may represent a development from the Uruk IV system with, dependent on context, N_8 equal both to $N_1 KU_{3a}$ and to N_2 . The meaning of KU_{3a} in this connection is, aside from the fact that it indicated a half measure, not obvious.⁴⁰

The third means of designating fractions of oil jars is found in just one text, presented in figure 8, but here fully documented. W 21682 contains on its obverse face two columns with 5 entries, each of which consists of the numerical sign N_1 together with the sign combinations $SILA_{3a}+GARA_{2a}$ or $SILA_{3a}+GA_a$ —the former explicitly written in the first four cases of the first column, the latter probably only in the lost first case of the second column—representing

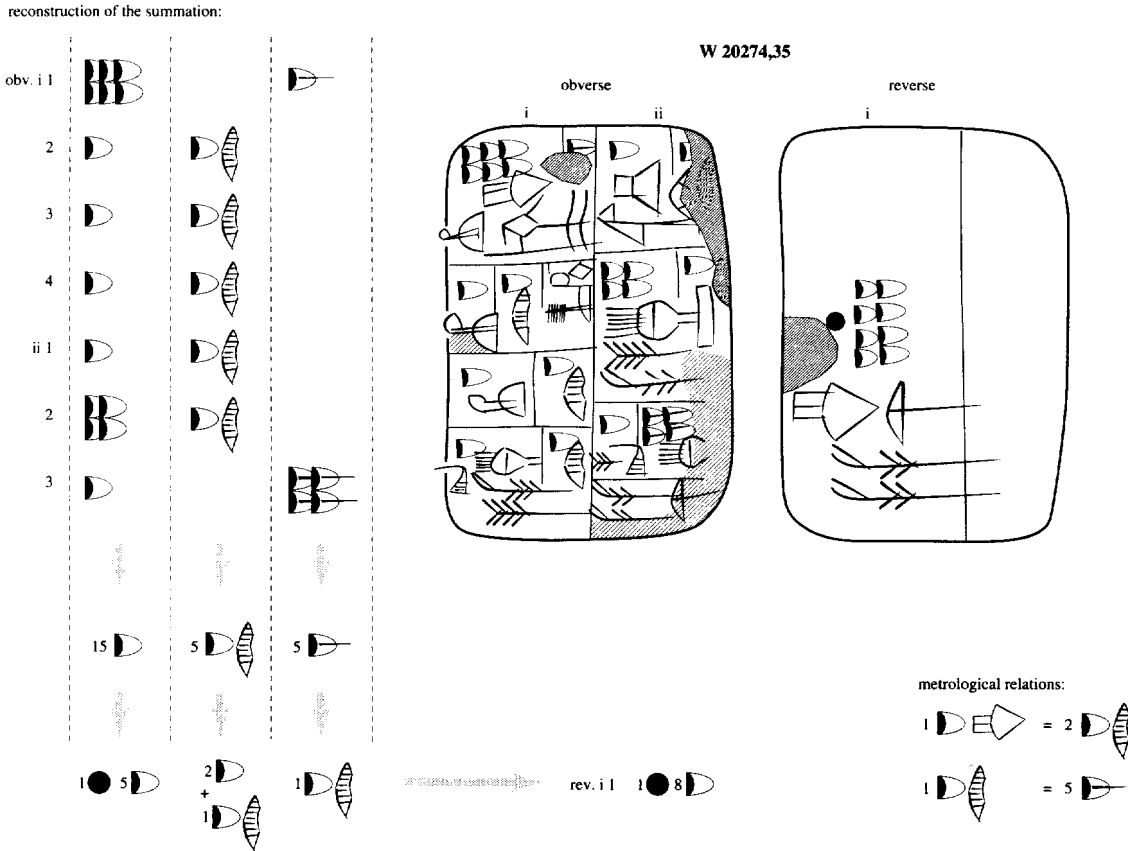


Figure 7: Reconstructed account of dairy fat stored in jars demonstrating the metrological relations in the system DUG_c .

units of a dairy product, the sign SI (meaning unknown) and further ideograms probably representing receiving individuals.

The meaning of both signs $GARA_{2a}$ and GA_a is not certain. Clearly, they represent vessels and are both invariably in context with dairy products. The former sign, a gunified variant of the sign DUG_c , is attested in the archaic Ur (ED I-II) version of the lexical list $Lú A$, l. 20, as a

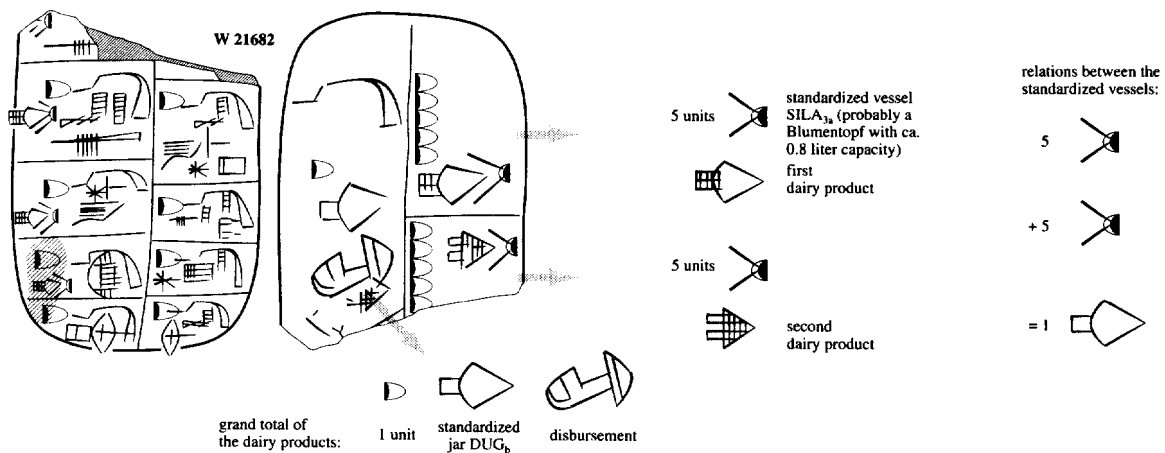


Figure 8: Metrological relationship between $SILA_{3a}$ and DUG_b .

variant of GA_a in the combination $GAL_a GARA_{2a}$, “head of $GARA_{2a}$ ”, and representing a product among notations for domestic animals and other agricultural products in the list ‘Tribute’.⁴¹ The Uruk IV period form of the latter sign (see figure 10 below) is apparently the representation of a flat basket, the inner surface of which was probably coated with bitumen so that the basket could be used in the milking of dairy animals.

The reverse face of the tablet contains in the first column (to the right) subtotals of each of the obverse columns, numerical notations representing five units qualified by the sign combinations $SILA_{3a}+GARA_{2a}$ and $SILA_{3a}+GA_a$, in the second column the final total $N_1 DUG_b$ qualified with SI and the sign GU_7 ($SAG+GAR =$ ‘human’ + ‘rationing bowl’; the specific administrative meanings in the use in archaic texts of the two signs BA and GU_7 , both apparently qualifying distributions, are poorly understood⁴²) representing “disbursement”. This equation proves that the sign $SILA_{3a}$, to be identified as a pictographic representation of the mass-produced Blumentopf which followed and for some time in Late Uruk levels coexisted with use of the beveled-rim bowl GAR , assumed the same metrological function in the three systems discussed as Uruk IV period N_8 and Uruk III N_2 , all representing a measure equal to $1/10$ of the amount of liquids or semi-liquids contained in some larger vessel.⁴³ According to data derived from excavations, above all measurements conducted of the masses of beveled-rim bowls found in Late Uruk settlements, and in accordance with textual analysis, the most plausible current working hypothesis of the absolute capacities of these various units is the following:⁴⁴

$$\begin{aligned} GAR &= 1N_8 \text{ (?; Uruk IV)} = SILA_{3a} = 1N_2 && = \text{ca. } 4/5 \text{ liter} \\ 1N_8 &= 1N_1 KU_{3a} && = \text{ca. 4 liters} \\ 1N_1 DUG_{b/c} \text{ etc.} &&& = \text{ca. 8 liters} \end{aligned}$$

These measures would, moreover, suggest a yearly delivery in the Uruk III period of from two to four liters of dairy fat per milk cow (see figure 3 above) and be in general accordance with figures known from the Ur III period. With an expected yearly delivery of between $1/4$ and $1/2$

DUG_b per cow-year, the notation of ‘26 DUG_b ’ in W 20274,97 obv. i 1 (figure 5), understood as part of an annual account, would correspond to ca. 50-100 milk cows, or total herds of perhaps 100-200 head.

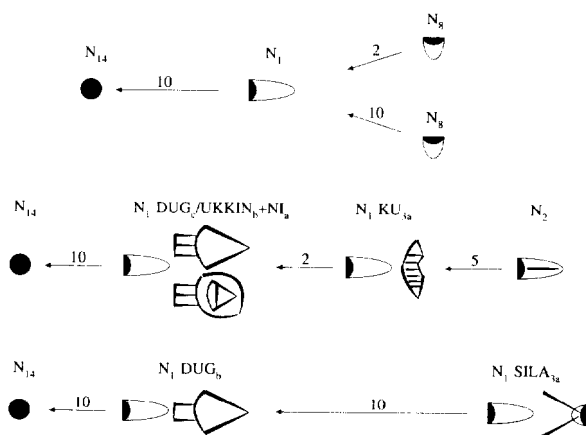


Figure 9: Metrological systems employed in dairy notations (cp. Englund, Iraq 53 [1991] 101-4). The application of the upper system with dairy products is not proven, the lower two systems are only known from the Uruk III period.

The sign DUG_b , representing a ceramic jar without a spout, was consistently distinguished from the sign DUG_a including the representation of a spout. This fact and the contextual usage of both signs suggest that the former jar will most likely have contained semi-liquids, the latter liquids, above all beers. A large number of signs were impressed in DUG_b in archaic lexical texts, to a lesser extent attested in ad-

Uruk IV	Uruk III	sign name	meaning	Uruk IV	Uruk III	sign name	meaning	Uruk IV	Uruk III	sign name	meaning
		DUG _a	beer			DUG _b	dairy fat			NI _a	dairy fat ?
		KAS _a	beer			DUG _c	dairy fat			GA _a	milk ?
		KISIM _a	butter fat from sheep's milk			ŠAKIR _c	dairy fat			KAS _b	dairy fat mixed with crushed barley?
		KISIM _b	butter fat from goat's milk			KAS _c	dairy fat mixed with crushed barley?			GARA _{2a}	cream ?

Figure 10: Probable archaic designations of liquid /semi-liquid products.

ministrative texts, to specify the product contained in the jar represented by the sign, including among others ŠE ('barley'), NAGA ('an alkaline plant' ?), TI (?), MAŠ (male goat), KUR (a plant related to the grapevine ?), GIŠ ('wood'), KU₆ ('fish') and ŠAH₂ ('pig').⁴⁵ The sign KAŠ_b is also one of these composita, consisting of dots impressed within the sign DUG_b in its Uruk IV form, abstracted to vertical lines in the Uruk III writing phase. These impressed dots are in my opinion the same as those added to numerical signs from the grain capacity system (forming the system Š*)⁴⁶ to indicate amounts of barley groats used in the production of dry and liquid grain products.⁴⁷ This KAŠ_b is also consistently distinguished from the related sign KAŠ_a; whereas the latter sign is generally attested together with notations representing both rough-ground barley and malt, thus representing beer, the former is invariably found in a dairy context.⁴⁸ The same applies for the sign KAŠ_c (see figure 10).⁴⁹

NOTES TO TEXT

- 1 See, for example, the two texts R. Englund, *Archaic Administrative Texts from Uruk: The Early Campaigns* (= *ATU* 5; Berlin 1994) pl. 86, W 9656,f, and pl. 100, W 9656,dr, with counted APIN GU₄ apparently assigned to temple households. The inscription of the latter text is duplicated in the second column of the obverse of the former.
- 2 The very meager bone remains from Uruk of *Bos taurus* identified by J. Boessneck, A. von den Driesch and U. Steger, *BagM* 15 (1984) 170-172, were almost entirely of adult animals. Although the authors believed the crushed remains indicated the exploitation of cattle for meat, the numbers of bones—only 30 of the 73 specimens were from Late Uruk levels—permit no more than speculation as to whether the animals were selected for meat or were simply butchered in old age or after having died from some other cause.
- 3 A general idea of the sizes of state-controlled herds in the pre-Sargonic Lagash period is offered by the text *DP* 93, which registers a total of 119 adult and juvenile animals in the care of dairy herders (cf. K. Maekawa, *Zinbun* 15 [1979] 122-123) in the year Enentarzi 5. The numbers in *DP* 93 are confirmed by further documents recording the delivery quotas imposed on the herders of the dairy fat *ì áb sè.ga/dé.a* and the cheese *LAK* 490 (*DP* 273-276; *Nik.* 1, 257, 259; *RTC* 64; *TSA* 37; *VS* 14, 89) on the one hand, the amount of feed distributed to the herders (*Nik.* 1, 68, *HSS* 3, 37, etc.) on the other. This suggests total holdings, including draft oxen, of ca. 250 head in the economic unit represented by the archive from Girsu. State-owned herds in the Ur III period were substantially larger; the account *MVN* 15, 108, books for a single dairy herd supervisor from Umma over 300 milk cows, from which may be extrapolated a total of close to 1000 cattle. The supervisor *Atu* was, moreover, one of possibly several such managers active in Umma (see also the numbers in the text *SET* 130). The archaic texts from Uruk discussed in the

- present study document cattle herd sizes of between 50 in the Uruk IV period and possibly 100-200 in the Uruk III period.
- 4 While it is true that with a current count of 5000 texts and fragments the corpus from Uruk can be expected to contain the majority of all early accounting genres, the ca. 450 archaic texts now registered from excavations of other sites, above all Jemdet Nasr (together with some few texts from Kish numbering 244 tablets and fragments), and from the antiquities market, do exhibit a broad spectrum of features known from archaic bookkeeping, in some cases containing the best documentation of particular economic activities. Still, the certainly uneven coverage of household activities in the proto-cuneiform documents, resulting from the vagaries of excavations, is the more to be underscored given the relatively modest number of texts and fragments from the Late Uruk period.
 - 5 V. Scheil, "Quelques signes originaux de l'écriture cunéiforme," *RA* 14 (1917) 93-94; A. Deimel, *LAK* (1922) p. 73, no. 2; F. Thureau-Dangin, "Tablettes à signes picturaux," *RA* 24 (1927) 26-29. The inscriptions on the archaic stone tablets republished by I. J. Gelb, P. Steinkeller and R. Whiting, *OIP* 104 (1989) as nos. 1-11 and 13, of which the Blau pieces (10-11) were first published in 1885, and that on the tablet published by S. Langdon in *Excavations at Kish I* (Paris 1924) 99-101 and pl. XXXI, are in my opinion to be dated to Early Dynastic I-II.
 - 6 *The Herbert Weld Collection in the Ashmolean Museum: Pictographic Inscriptions from Jemdet Nasr Excavated by the Oxford and Field Museum Expedition* (= *Oxford Editions of Cuneiform Texts* 7; London etc. 1928). See now the edition by R. Englund and J.-P. Grégoire, *The Proto-Cuneiform Texts from Jemdet Nasr* (= *Materialien zu den frühen Schriftzeugnissen des Vorderen Orients* [MSVO] 1; Berlin 1991).
 - 7 See the introduction to *ATU* 5, pp. 11-23.
 - 8 *ATU* 1, p. 52⁺⁵-53⁺¹. Falkenstein drew particular attention to the different graphic forms of the two signs AB₂ and SIG (first noted by S. Langdon in *OECT* 7 s.v.), the latter a *tenû*-form of the sign U₄ which seems to designate "evening."
 - 9 R. Englund, review of D. Schmandt-Besserat, *Before Writing*, in: *Science*, from 11 June 1993, p. 1671; P. Damerow and H.-P. Meinzer, "Computertomografische Untersuchung ungeöffneter archaischer Tonkugeln aus Uruk: W 20987,9, W 20987,11 und W 20987,12," *BagM* 26 (1995) 9.
 - 10 I am not aware of a graphic differentiation in archaic documents between breeding bulls and castrated oxen, both apparently = GU₄ (the few bulls kept for breeding in pre-Sargonic Girsu were called simply gu₄ áb, "bull of the cow").
 - 11 See figure 4 for a table of the graphic forms which represented large cattle in the Late Uruk texts.
 - 12 R. Englund and H. Nissen, *Die lexikalischen Listen der archaischen Texte aus Uruk* (= *ATU* 3; Berlin 1993), esp. pp. 22 and 89-93.
 - 13 *SF* 81; *OIP* 99, nos. 25-27; *MEE* 3, nos. 12-17, pp. 47-50 ("Lista di animali A"); s. Th. Krispijn, *JEOL* 27 (1981-82) 47-53, and J. Krecher, *OrAnt.* 22 (1983) 179-189, to the syllabic version *MEE* 3, no. 62.
 - 14 See *ATU* 3, 22⁴¹.
 - 15 See *ATU* 3, 25-29. The numerical relationship probably mirrors the number of males kept in herds for purposes of breeding.
 - 16 Incidentally, these accounts were without exception uncovered during the first Uruk campaigns, published as photos in A. Falkenstein's *ATU* 1 and subsequently as copies and indexed in my *ATU* 5.
 - 17 For an overview of the text formats employed in such accounts see M. Green, "The Construction and Implementation of the Cuneiform Writing System," *Visible Language* 15 (1981) 345-372, esp. 349-356.
 - 18 All tablet copies found in this and the following figures are represented at 75% of original size.
 - 19 See the texts included in figure 1, W 9579,cz (upper row) and W 9579,dd (second row). ERIM_a may mean in this context "for the yoke," and since both W 9579,dd and W 9656,ak depicted in the second row of this figure contain the sign combination NESAG₂ GAR₃, it may be reasonable to assume that the sign AL in the former text represented a function of the ox (GU₄) recorded there (see also *ATU* 3, 91, to line 51: U₄ AL X GU₄, with no apparent correspondence in the ED texts, assuming *MEE* 3, p. 53, ll. 51-52 = *ATU* 3, 91, ll. 50 and 52).
 - 20 While this is not the place to discuss the methods available for the isolation and identification of object designations, in the cases involved here of cattle, as against the other ideographic representations found in

- syntax-free archaic accounts, it may be stated that as a general rule signs representing counted objects are situated closest to the numerical notation, inscribed, insofar as this is discernible due to the existence of sign distortions caused by subsequent inscription, immediately after the numerical notation and before the impression of the accompanying ideograms.
- 21 This is true both for receipts, for example, W 9335,c in figure 1, lower right, and in such large accounts as W 7227,a in figure 2.
- 22 The largest attested total of adult animals is '54' contained on the reverse of W 7227,a in figure 2. Although the bundling step '60' was thus not crossed, there can be little doubt that this notation is from the sexagesimal system, since the only other candidate known from the early Near East used to count animals, the decimal system from proto-Elamite Susiana, was not used in Babylonia (see P. Damerow and R. Englund, *The Proto-Elamite Texts from Tepe Yahya* [= *American School of Prehistoric Research Bulletin* 39; Cambridge, MA, 1989] 24 and 53-55 with footnotes) and since other animals and humans were demonstrably counted sexagesimally in the archaic period.
- 23 See A. Vaiman, "Die Bezeichnungen von Sklaven und Sklavinnen in der protosumerischen Schrift," *BagM* 20 (1989) 121-133, and the comments of P. Damerow and R. Englund, *BagM* 20, 137-138.
- 24 See above, notes 12-14. The sign combination AM_a KUR_a of obv. ii 3 may bear some relationship to the presumed AM_b section of the archaic cattle list cited above.
- 25 E. Burrows, *Archaic Texts* (= *UET* 2; London 1935).
- 26 For a description of archaic designations of years and animal ages see *ATU* 2, 146, and R. Englund, "Administrative Timekeeping in Ancient Mesopotamia," *JESHO* 31 (1988) 140-148 and 156-162. The standard age sequence for Ur III bulls/oxen attested, for example, in the theoretical account *TCL* 2, 5499 (I. J. Gelb, *JCS* 21 [1967] 64-69), was gu₄ amar ga, gu₄ mu.1(AŠ, sign ◀), mu.2, mu.3, gu₄ gal, "milk bull-calf, one-year bull, two-year bull, three-year bull, large (full-grown) bull."
- 27 First published by M. Green, "Animal Husbandry at Uruk in the Archaic Period," *JNES* 39 (1980) 32, nos. 35-36; see now H. Nissen, P. Damerow and R. Englund, *Archaic Bookkeeping* (Chicago/London 1993) 89-93 with figure 71.
- 28 The same ratio is attested in the Ur III account cited in note 26 above; this reference should be understood as hard evidence for an administrative rule, since as a theoretical exercise (see *Archaic Bookkeeping*, 97-102) the text mirrored traditional quotas and since those quotas and value equivalencies—yearly deliveries per milk cow of dairy fat and cheese, and silver values of these products, respectively—also underlying numerical entries in the text are found to be exactly the same in contemporaneous administrative documentation. Insofar as an adult cow should bear one calf per year, the ratio of 1:2 may result from a set number of calves either culled from the herd for meat, sacrifice or some other purpose, or a number accorded hired herders as their income. However, it is impossible to derive a similar rule for the archaic period based on just two small accounts, in particular since the production of dairy fat per cow registered in the two texts seems to be inconsistent.
- 29 M. Green, *op.cit.*, pp. 12-13 (the last column of this table records the fraction of the oil contained in the jars KISIM_{a,b} delivered per adult female animals; for example, the first text W 20274,55 books obv. i 1 70 ewes and rev. i 2 a fat delivery of 3N₁ 1N₈ = 3 1/2 KISIM_a for a quota of 1/20, or, with the author, 0.050 KISIM_a fat per ewe).
- 30 See *ATU* 3, p. 29, figure 12, and pp. 30-32.
- 31 Of the proto-cuneiform signs representing ceramic vessels, only NI_a may have been a two-dimensional depiction of clay objects found in the pre-literate accounting devices known as clay bullae; see now the summary of D. Schmandt-Besserat's important work on these symbols in her *Before Writing*, vol. 1 (Austin 1992) 108-128, and my review of her treatise in *Science*, 11 June 1993, p. 1671. The 'oil tokens,' believed themselves to have represented concrete containers, have been found in bullae from Uruk and from Habuba Kabira in Syria.
- 32 *ATU* 3, pp. 29-32.
- 33 See P. Damerow and R. Englund, *ATU* 2, 132-134.
- 34 Alone the use of different numerical systems with the two products in archaic texts would obscure a possible connection between DUG_b and GA²AR. Cheese was in later periods quantified not as discrete units but in capacity measures. The specific contents of dairy milk (87% water, and 13% solids, of which ca.

3,5% was fat, 3,5% casein, and 5% lactose) may have played a role in determining that herders from the pre-Sargonic Lagash period were required to deliver 18 sila, from the neo-Sumerian period 7 1/2 sila of cheese per year; i.e., ca. 1.5 × the norm set for dairy fat. This roughly corresponds to the volume of *kašk* cheese which may be derived from a measure of milk relative to its fat content. I assume that the norm of 7 1/2 sila derived from a nice relationship to the norm of 5 sila of ì nun fat from Ur III times, and that 18 was also a “nice number” in pre-Sargonic Girsu bookkeeping: 3 bán, or 1/2 of the barig consisting of 36 sila.

- 35 ATU 2, 128 c.
- 36 Cf. the texts W 19466,a (unpubl.) obv. i 1 (‘5N₁ 5N₈’; DUG_c) and W 20652 (unpubl.) obv. i 1 (4N₁ [] ‘6N₈’; DUG_c []). The notation 3N₁ 9N₈ in ATU 5, pl. 111, W 9656,gl (cited ATU 2, 129 d, as ATU 1, no. 490) refers to an object not preserved in the second case of the tablet, and this and the preceding two notations could in principle derive from a number of other numerical systems. Clearly sexagesimal, however, is the notation 1N₄₈ ‘3N₃₄ 2N₁’ [] ‘4N₈’ in ATU 5, pl. 64, W 9579,u rev. 1 (cited ATU 2, 129 d, as ATU 1, no. 352); the apparent object represented by the sign combination SUHUR KAŠ_b, literally ‘jar of dried fish flour oil,’ must at least be admitted as a weak reference for the use of N₈ < 1/2 in a sexagesimal notation of oil jars. Note further the possible value N₈ = 1/10 ‘iku’ in the area system attested in the two Jemdet Nasr texts R. Englund and J.-P. Grégoire, *MSVO* 1, nos. 2 obv. i 2d, and 4 obv. i 5d.
- 37 See R. Englund, “Archaic Dairy Metrology,” *Iraq* 53 (1991) 101-104.
- 38 Including only the 3 units qualified as BA KI₂ in the second subcase of the first case of each text’s obverse face, the addition is: 3 + 1 1/2 + 1/2 + 1 + 2 + 3 + 2 = 13 DUG_c.
- 39 See ATU 2, 131 c. No dairy accounts known to me contain a notation 5-9N₂, in compliance with the expected replacement of 5N₂ with 1N₁ KU_{3a}.
- 40 I might draw attention to the fact that tokens often related to this sign have been found in clear association with sealed bullae in Uruk (see D. Schmandt-Besserat, *Before Writing*, vol. 1, p. 119, to W 20987,27; unmarked crescent) and possibly within still complete bullae from Susa (identified tomographically; this information was given me by J. Friberg).
- 41 See ATU 3, pp. 73 and 114-116, respectively; in ‘Tribute’ followed by a notation of ‘10 cows’.
- 42 See preliminarily my “Grain Accounting Practices in Archaic Mesopotamia,” in J. Høyrup, ed., *Changing Views on Ancient Near Eastern Mathematics* (Berlin forthcoming).
- 43 The text W 20274,72 (unpublished) seems to contain an addition ‘2N₁’ [] + ‘2N₁ SILA_{3a}+GARA_{2a}’ + 1N₈ = 1N₁ DUG_b, implying that, as might be expected, N₈ also served in this system to represent 1/2 of a basic unit and 5 × N₁ SILA_{3a}. The use of N₂ and N₁ SILA_{3a} together in W 20274,92 (unpubl.) with an apparent summation on the reverse is not otherwise attested among dairy accounts and may so represent a scribal error.
- 44 See ATU 2, 153⁶⁰.
- 45 See ll. 21-61 of the archaic lexical list ‘Vessels’, ATU 3, 125-129. Far fewer examples are known of signs impressed in the beer sign DUG_a, including KASKAL, LAM_b, NAGA_a and U_{2a/b} (types of herbs ?), all of which are attested only in administrative texts.
- 46 ATU 2, 140-141.
- 47 This interpretation should be noted to the suggestion of R. Michel, P. McGovern and V. Badler, “Chemical Evidence for Ancient Beer,” *Nature* 360 (5 November 1992) 24, that the grooves found on the inside surface of vessel shards excavated in Late Uruk levels of Godin Tepe were represented by the internal markings in the DUG signs.
- 48 Cf., for example, the unpublished texts W 15774,b obv. i 1 (KAŠ_b together with DUG_c representing a container of dairy fat) and W 20511,2 obv. v 3a, vi 1b3, 2b3 (registering counted KAŠ_b SILA_{3a} BA in a large account of dairy fats).
- 49 Cf., for example, the texts W 19408,5 (KAŠ_c together with DUG_b), 12, 17, W 20044,40 (all unpublished), and M. Green, *Visible Language* 15, 355, fig. 4a, W 21049 (together with DUG_c), *MSVO* 1, 179 obv. i 3 (KAŠ_c following DUG_b) (in no instance together with DUG_a; to be noted to ATU 2, 131).