Old Babylonian tabular accounts: a structural study

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1 Introduction

§1.1 Overview This article is the final instalment in a sequence of papers on the data structures in cuneiform tabular accounts that I began some years ago (Robson 2003; 2004; cf. Robson 2008: 157–66). It presents and analyses twenty-one Old Babylonian tabular accounts from the collections of the British Museum and Columbia University Library, together with fourteen previously published or newly available tablets that belong to the same archives. In an appendix I update the tables I presented in Robson (2004) by listing all further published Old Babylonian tabular accounts that have come to my attention since then. Here I am concerned solely with the development of tabulation as an information storage device in the cuneiform record; I leave the prosopography and socio-economic analysis to others.

§1.2 Acknowledgements Jane Siegel, curator of the Rare Book and Manuscript Library at Columbia University, drew my attention to the CULC tablets published here while I was working on the papers of their former owner George Plimpton (Robson 2002). Christopher Walker identified and gave me access to the British Museum tablets, many years ago now. I thank them warmly for their generous help, and gratefully acknowledge their institutions' permission to publish. Andrea Seri kindly drew my attention to KVM 32.1184 (Tablet 32 below), which must come from the same archive as the Columbia University Library tablets. Gertrud and Walter Farber helped me with the reading of a key term in Tablets 1–11 and shared with me their edition of Tablet 34 in advance of publication. Zsombor Földi very generously shared his transliteration of Tablet 28 with me and contributed improved readings for many others. He also drew my attention to Tablets 33 and 35, as well as several of those listed in the appendix. To him I am particularly grateful. Finally, I am indebted to Steve Tinney for writing the code that enabled the online presentation of cuneiform tables in Oracc (http://oracc.org/obta/), thereby enabling the publication at last of texts which had proved resistant to traditional print publication.

§1.3 Catalogue For consistency I maintain the tablet numbering first used in Robson (2004), with tablets identified since added at the end, although it should be noted that the Columbia University Library Collection tablets have been renumbered since then. Both sets of numbers are given here. As before, I use the following abbreviations and conventions: Cols: lists the number of tabular columns, including the final row label; + indicates that more

columns may be missing.

Hdgs (headings): I = introductory preamble; M = with final heading MU.BI.IM, O = with some other final heading; Y = yes, final heading missing or illegible; — = existence of headings undetermined.

Or (orientation): L = landscape, with width longer than height; P = portrait, with height longer than width; R = round; S = square; — = orientation undetermined.

Axes (of calculation): V1 = vertical, 1 level; H2 = horizontal, 2 levels, etc.; — = undetermined.

Notes (explanatory interpolations within the body of the table): L = linear, breaking the tabulation; C = within a single cell of the table; — = undetermined.

Year: RS = Rim-Sin; Ha = Hammurabi; Si = Samsu-iluna; in Rim-Sin year 31 the months follow the unusual dating patterns described by Robertson (1983), such as ^{iti}DU$_6$.KU$_3$ KI-3 or ITI-33 KI-5 and are notated as RS 31.07/3.-- and RS 31.33/5.-- respectively.

Date: according to the Middle Chronology.

Table 1: Catalogue of Old Babylonian tabular accounts discussed in this article

No.	*Museum number (and accession number or previous publication)*	*Provenance*	*Cols*	*Hdgs*	*Or*	*Axes*	*Notes*	*Year*	*Date*
1 (§2.1)	CULC 430 (Plimpton 292)	Larsa	8	M	L			RS 31.07/3.21	1792
2 (§2.1)	CULC 424 (Plimpton 286)	Larsa	8	M	L			RS 31.07/3.28	1792
3 (§2.1)	CULC 452 (Plimpton 314)	Larsa	5	M	L			RS 31.07/4.08	1792
4 (§2.1)	CULC 429 (Plimpton 291)	Larsa	5	M	L			RS 31.07/4.15	1792
5 (§2.1)	CULC 462 (Plimpton 324)	Larsa	4	M	L	H1 V1		no date	
6 (§2.2)	CULC 425 (Plimpton 287)	Larsa	7	M	L	H1 V1	L	RS 31.07/3.07	1792
7 (§2.2)	CULC 426 (Plimpton 288)	Larsa	8	M	L		L	RS 31.07/3.26	1792
8 (§2.2)	CULC 427 (Plimpton 289)	Larsa	5	M	L		L	RS 31.07/3.28	1792
9 (§2.2)	CULC 431 (Plimpton 293)	Larsa	5	M	L		L	RS 31.07/4.02	1792
10 (§2.2)	CULC 428 (Plimpton 290)	Larsa	8	M	L		L	RS 31.07/4.16	1792
11 (§2.2)	CULC 432	Larsa	5	M	L		L	RS 31.07/1.23	1792

	(Plimpton 294)								
12 (§3.3)	CULC 461 (Plimpton 323)	Larsa	4	M	L	H1 V1		no date	
13 (§3.1)	BM 85260	Larsa	4	M	P	H1 V2	L	RS 31.33/5.22	1792
14 (§3.1)	BM 85269	Larsa	4	M	P	H1 V2	L	RS 31.33/5.07	1792
15 (§3.2)	BM 16391	Larsa	7	M	L	H2 V1		RS 32.07.20	1791
16 (§3.2)	BM 85232	Larsa	7	M	L	H2 V1		RS 32.07.[--]	1791
17 (§4.1)	Ash 1922.277 (*OECT* 15, 6)	Larsa	4	I M	P	V3	L	Ha 35.03.20	1758
18 (§4.1)	Ash 1922.283 (*OECT* 15, 12)	Larsa	5	I M	—	H1+	L	Ha 35.03.06	1758
19 (§4.1)	Ash 1923.340 (*OECT* 15, 121)	Larsa	9	I M	L	H2 V1		Ha 35.03.22	1758
20 (§4.1)	AO 8417 (*TCL* 11, 151; Arnaud 1976)	Larsa	4	I O	P	H1 V1	L	Ha 35.02.20	1758
21 (§4.2)	AO 8425 (*TCL* 11, 171)	Larsa	5	M	P	H2 V1	L	Ha 39.01.20	1753
22 (§4.3)	Ash 1922.286 (*OECT* 15, 15)	Larsa	4	—	P	H1 V	L	missing	
23 (§4.3)	Ash 1922.287 (*OECT* 15, 16)	Larsa	5	—	P	H1 V	L	missing	
24 (§4.3)	Ash 1923.341 (*OECT* 15, 122)	Larsa	5	—	P	H V	L	missing	
25 (§4.3)	Ash 1923.375 (*OECT* 15, 134)	Larsa	5	—	P	H V	L	missing	
26 (§5.1)	BM 85205	Larsa	6	I M	L	H1 V1	L	Ha 35.06/2.05	1758
27 (§5.2)	BM 22738	Larsa	10	O	L	H2		Ha 35.06.03	1758
28 (§5.3)	BM 85211	unknown	7	O	P	H2 V2	L	Si 07.08.27	1743
29 (§5.2)	BM 85238	unknown	6	O	P	H2 V2	L	Si 07.08.17	1743
30 (§5.4)	BM 13934	unknown	4	M	L	H1 V2		Si 11.01.25	1739
31 (§3.2)	Erm — (*SVJAD* 117)	Larsa	7	M	L	H2 V1		RS 31.28/4.05	1792
32 (§3.2)	KVM 32.1184 (*CDLJ* 2007/1, 43)	Larsa	5	M	L	H1 [V?]		RS 31.28/4.[--]	1792
33 (§2.1)	KM 89540	Larsa	8	M	L			RS 31.07/3.24	1792
34 (§2.2)	A 161000 (Farber and Farber forthcoming)	Larsa	6	M	L			RS 31.07/3.27	1792
35 (§2.2)	MSR 21	Larsa	5	M	L			RS 31.07/4.13	1792

2 An archive of cattle accounts from Rim-Sin 31 (Tablets 1–11 and 33–35)

§2.0.1 Provenance This group comprises fourteen tablets in landscape format, of which thirteen date to Rim-Sin 31 and one is undated. George A. Plimpton purchased Tablets 1–11, along with Tablet 12 (§3.1 below), from Edgar J. Banks in 1923 for $100; in the surviving documentation Banks gives their findspot as Larsa (Robson 2002: 270–271, 277, 279). Plimpton bequeathed his entire collection of cuneiform tablets to Columbia Rare Book and Manuscript Library, New York, where they were catalogued by Mendelsohn (1943: 63–65, 69, 71). The copies presented here were made during April 2002.

Tablets 33–34 also appear to have been sold to their original owners by Banks (Brisch n.d.; G. Farber, pers. comm. 20.i.2011). The provenance of Tablet 35 is not known to me, but given that it is now in a small American collection it is likely have been purchased from Banks as well.

§2.0.2 Contents These tablets comprise two groups of daily accounts, tabulating cattle and supplies for them (fodder, bran, straw) assigned to four cowherds working for the moon-god Nanna of Ur (**§2.1**: six tablets) and to three cowherds and a ferryman working for the three gods Enlil, Utu, and Nanna of Ur (**§2.2**: eight tablets).

§2.0.3 Language It is a moot point whether these tablets are to be read in Sumerian or heavily logographic Akkadian. I have chosen the latter, on the basis of a few key syllabically-written Akkadian words, but in reality I remain agnostic (and most certainly non-expert) on the question of language use in the administrative praxis of the Old Babylonian kingdom of Larsa.

2.1 Accounts for Nanna of Ur (Tablets 1–5 and 33)

§2.1.1 Overview Each account is for four cowherds, always attested in the same order: Ubar-Šamaš, Suen-iddinam, Suen-reʾum, and plus the accountant himself: the final entries are always recorded as *yāʾu* "mine", except in the undated Tablet 5, where the name Ea-iddinam is given. The men collectively manage oxen which are the property of the god Nanna of Ur. Three are dated to month DU$_6$.KÙ KI-3 and two to DU$_6$.KÙ KI-4 of Rim-Sin year 31 (see Kraus 1959; Robertson 1983).

§2.1.2 Quantifications Each man takes—or has on hand—fodder (^{še}MUR.GU$_4$), bran (DUḪ(-ḪI.A)), and straw (IN.NU.DA) for his bovine charges, at greatly fluctuating rates. At the start month DU$_6$.KÙ KI-3 the men are feeding just over 150 animals (Tablet 1) and double that a few weeks later (Tablet 33), while in month DU$_6$.KÙ KI-4 the cattle are back down to 264 (Tablets 3–4). An undated tabular account (Tablet 5) gives the total number of oxen (GU$_4$.BI), cows, and calves (ÁB AMAR.BI) in the charge of each man in the Šulgi Field of the god Nanna (A.ŠÀ ^{d}ŠUL.GI ^{d}NANNA). In this tablet the three first men have the same number of oxen as in Tablet 1, written in month KI-3, while the total number of cattle assigned to the second and third cowherds

matches the oxen accounted for in month KI-4 (Tablets 3–4).

§2.1.3 Dating The tablets are dated at roughly 7-day intervals: KI-3 U_4 7-KAM (Tablet 6), KI-3 U_4 21-KAM (Tablet 1), KI-3 U_4 24-KAM (Tablet 33), KI-3 U_4 28-KAM (Tablet 2), KI-4 U_4 8-KAM (Tablet 3), KI-4 U_4 15-KAM (Tablet 4).

§2.1.4 Formatting and structure The formal features of these tables can be described as follows. Each column is headed, with final column heading MU.BI.IM "Its name". Under each table is a subscript and the date, but no names of officials. The accounts are in general tabular lists: that is, they include no calculations, except in Tablet 4 (the latest in date) where a total is given for straw and probably fodder, implying a vertical axis of calculation. Tablet 3, however, shows sexagesimal numerals written informally on the bottom of the reverse, which suggests that at least some calculation was performed in the process of drawing up the document. Tablet 5, the account of cattle in Šulgi Field, has two axes of calculation: totals are given at the end of each row and the bottom of each column, and a grand total in the bottom right hand corner. There is only one level of calculation on each axis.

§2.1.5 Special features Arrears (LÁ.ì) are noted in Tablet 1; in Tablets 2 and 33, written towards the end of the same month, the columns have been prepared but no entries made, so in month KI-4 (Tablets 3–4) the arrears columns are removed from the format of the table.

2.2 Accounts for Enlil, Utu and Nanna-Suen (Tablets 6–11 and 34–35)

§2.2.1 Overview Cattle are assigned to three chief herdsmen (Ú.TÚL): Ea-malik's, working for the god Enlil; Iddin-Šamaš's, working for the god Šamaš; and "mine", working for Nanna-Suen of Ur. About a sixth of Iddin-Šamaš's animals are assigned to his ferryman (*a'ûm*) in Tablet 11. We have already seen "me" (= Ea-iddinam?) attested in **§2.1**. The accounts cover the same time-span, namely months DU_6.KÙ KI-3 and KI-4 of Rim-Sin 31, and are undoubtedly from the same archive: again we see fodder, bran, and straw assigned to each cowherd, while the layout, vocabulary, and material features of the two groups are very similar.

§2.2.2 Quantifications The six accounts concern a consistent number of cattle: 164 assigned to Ea-malik for the god Enlil, 230 to Iddin-Šamaš for the god Šamaš, and just 16 of "mine" for the god Nanna-Suen of Ur. Tablet 11 shows the herds to be divided between roughly equal numbers of cows and calves (ÁB AMAR) and oxen (GU_4.ḪI.A); the other accounts use the phrase GU_4.ḪI.A to refer to the cattle as a whole.

§2.2.3 Dating The extant dates suggests that we are dealing with the remains of a daily sequence, over roughly the same period as Tablets 1–5 and 33, as Tablets 7–8 and 34 were written on consecutive days at the end of DU_6.KU_3 KI-3, while Tablets 9–10 and 35 are from the first half of KI-4. Tablet 11, whose badly written month name apparently does not include a KI-*n* formula, was written on an odd day.

§2.2.4 Formatting and structure Again, the tables are headed, with final column MU.BI.IM; there is a consistent subscript (NÍG.Ú.RUM DINGIR.RE.E.NE (LARSA^{ki}) "property of the gods (of

Larsa)", except Tablet 11, which is "the responsibility of the palace" (ŠU É.GAL), and date. There are summary subscripts within the tables, below each section relating to the property (NÍG.Ú.RUM) of each god. There are no calculations — these are again tabular lists — except in Tablet 6, where there is one horizontal axis of calculation. Here the total number of cattle is given in the subscript and also written roughly at bottom right of table.

§2.2.5 Special features Arrears columns are included for all three categories when at least one is necessary (Tablet 7) but are not always headed (Tablets 8, 10 and 35). If not needed they are usually omitted (Tablets 6, 9, and 11) but have been retain in Tablet 34.

3 Agricultural labour accounts from Rim-Sin 31–32 (Tablets 12–16 and 31–32)

§3.0.1 Provenance Six of these seven tabular accounts, two in portrait and four in landscape orientation, date to Rim-Sin 31–32. They exhibit similar month names to the accounts discussed in **§2.1** and **§2.2**, suggesting a provenance near Nippur in the kingdom of Larsa. Tablet 12 was purchased from Edgar J. Banks, in the same lot as Tablets 1–11 (§2.0.1 above), who gave Larsa as their place of origin. The British Museum tablets were acquired from two Paris-based dealers in the late nineteenth century: Tablet 15 from Kirkor Minassian in 1896 (Sigrist *et al.* 1996) and Tablets 13–14 and 16 from Isaac Élias Géjou in 1899 (Sigrist *et al.* 2006). No provenance information is known for Tablet 31 or Tablet 32 (Seri 2007: §§1.2–1.4).

§3.0.2. Contents The six dated accounts all concern 'allocations of work' (*šerʾānum*) for labourers carrying out earthworks for the same group of overseers. They can be split into two subgroups. In the two portrait-orientated tablets (Tablets 13–14, **§3.1**) the overseers are grouped into four different categories and their workers subtotalled. In the dated landscape-orientated tablets (Tablets 15–16 and 31–32, **§3.2**), there are no subtotals, but the labourers' work-rates are explicitly stated. This is the only certain instance, to my knowledge, of the OB use of theoretical work-rates known from Ur III accounts and OB school mathematics (see Robson 1999: esp. ch. 9); for further possible candidates, see Tablets 28–29 (**§5.3**). Lastly, in the undated account (**§3.3**), workers are assigned to two different areas of land, without work-rates, and their totals added both horizontally and vertically. This tablet has a long subscript explaining the circumstances of its production.

§3.0.3. Language The accounts are written in heavily logographic Akkadian.

3.1 Subtotalled accounts (Tablets 13–14)

§3.1.1 Overview These two tablets are virtually identical. Labourers are assigned to about a dozen different overseers, the first nine of whom are found in the same order on both tablets, who appear to be designated as working the "property" (NÍG.ŠU) of three different individuals or on "the king's share" (ḪA.LA LUGAL). The number of men allocated to the first two properties are identical on both tablets, while the numbers for the last two are lower on the later account.

§3.1.2 Quantifications No overseer has more than about ten men in his gang. The workers are accounted for in fractions (1/3) as well as whole days, suggesting that they are in fact work-days rather than individuals (see §3.2 below). They are first listed as SAG NÍG.GA "assets" (work-days expected or paid for), then as GÚRUM AK "inspection made" (workers present), and the deficit (LÁL) calculated.

§3.1.3 Dating The tablets were written 15 days apart in month 33/5 (ITI 33 KI-5) of Rim-Sin 31.

§3.1.4 Formatting and structure The tables are consistently headed, again with final heading MU.BI.IM. The worker deficits are calculated horizontally by subtraction, and all three worker columns subtotalled vertically, annotated by means of interlinear comments. The grand total of expected , present and missing workers is given at the end of table, followed by a final subscript and the date, with the full year name given.

§3.1.5 Special features The technical term *šer'ānum* "allocation of work" is spelled in a different way on each tablet. Does this suggest two different scribes, or a single one with inconsistent spelling habits?

3.2 Accounts with work-rates (Tablets 15–16 and 31–32)

§3.2.1 Overview These four tablets, in landscape format, are closely related to Tablets 13–14, discussed in §3.2 above. They concern similar sized work-gangs under the responsibility of many of the same men in the same order (but here there as many as 17 teams), and date to the same period. However, in these tablets the workers are not assigned to particular "properties" as they are in Tablets 13–14.

§3.2.2 Quantifications The teams of workers are consistently the same size across tablets in this group, and tend to be the same as, or a little larger than, those in Tablets 13–14. However, the work-rates vary from tablet to tablet, ranging from 1/3 shekel to 1 1/2 and 2 1/2 shekels (Tablets 31, 15, and 16 respectively). Tablet 32 does not specify a daily rate and the heading specifying the work involved is illegible to me. As the volumes concerned are tiny ($0.1 m^3$ – $0.75 m^3$), the work may well have comprised, or included, transporting excavated earth a relatively long way. Relevant constants and calculations in Old Babylonian mathematical texts suggest that the distances concerned range from 40 NINDAN (c. 240 m) for 2 1/2 shekels a day to 300 NINDAN (c. 1.8 km) for 1/3 shekel a day (Robson 1999: 77–81). I know of no comparable work rates in either Ur III or Old Babylonian accounts (Robson 1999: 156).

§3.2.3 Dating Tablets 31–32 are both dated to ITI 28 KI-4 of Rim-Sin 31 (not RS 30, *pace* Seri 2007), while Tablets 15 and 16 are both dated to DU_6.KÙ of the following year. Without a better understanding of these date formulae, it is impossible to determine how long the works took place for. Shorter versions of the year names are used here, compared with those on Tablets 13–14 (§3.1).

§3.2.4 Formatting and structure The accounts are all headed, with the final column

marked MU.BI.IM. As in Tablets 13–14 (§3.1) the deficit of expected versus checked workers is calculated on the horizontal axis by subtraction, while in Tablets 15–16 and 31 the expected volume of earth to be moved by the workers present is also calculated horizontally by multiplication. The two calculated values are, of course, independent of each other. As none of these accounts groups the teams by "properties" as Tablets 13–14 do, there is just one vertical axis of calculation, namely the totals in each column. Tablets 31–32 (dated to the same month) give the same subscript, ÉREN *šerḫānum* ("labourers, allocation of work") as Tablets 13–14, while Tablets 15–16 have none.

§3.2.5 The labourers available for work in Tablets 15–16 and 31 are all described as "having been sent from Suen's dyke" (*i-na* ÉG ^{d}SUEN *uš-ta-bi-lu*).

3.3 Account of workers, fields and canals (Tablet 12)

§3.3.1 Overview Tablet 12 is an undated account of labourers assigned to canal works on two different areas of land over two months, which are assigned to a single overseer (UGULA), one Ninurta-abi. There is no apparent connection with the accounts discussed in §2.1 and §2.2, although the tablet is remarkably similar to them in shape, size, fabric, and layout. It was also acquired by Plimpton as part of the same lot as Tablets 1–11, strongly suggesting that the twelve are somehow related. The surface flaking makes it very hard to read in places, but the long subscript seems to suggest that it records an amendment to a larger account made at the palace's behest.

§3.3.2 Quantifications Small numbers of workers (ÉREN.ḪI.A) are assigned to different areas of land, some 17–36 *iku* (c. 6–13 ha) in size.

§3.3.3 Dating The tablet is not dated, but according to Zsombor Földi (pers. comm. 11.ix.2011), the mention of the Lagaš canal in obv. 8 suggests a date before Samsu-iluna 12, most likely in the period Hammurabi 30–43.

§3.3.4 Formatting and structure The table is headed, with final column heading MU.BI.IM. It has two axes of calculation, with the workers subtotalled horizontally town by town and totalled vertically in the subscript. The areas listed in the column headings are totalled in the subscript too.

§3.3.5 Special features The long subscript is difficult to decipher, but seems to suggest that (some of) these workers have been re-allocated from the Lagaš canal to the Tigris on palace instructions, while another area is assigned to the first canal by one Ipqu-erṣetim.

4 Land accounts from late in Hammurabi's reign, in the Ashmolean and Louvre museums (Tablets 17–25)

§4.0.1 Provenance Four of these nine accounts (**§4.1** below, Tablets 17–20) were written in Hammurabi 35, one four years later (**§4.2**, Tablet 21). The dates of the remaining four are now missing but are very similar structurally to the first five (**§4.3**, Tablets 22–25). Internal and

museological pointers suggest that they were all written in or near the city of Larsa (*TCL* 11: p. 1; *OECT* 15: pp. 3–5, 11–12, 17–18). Tablets 20–21, now in the Louvre, were copied by Jean (*TCL* 11: nos. 151, 171), with corrections to the former by Arnaud (1976: 89). The remaining seven are now housed in the Ashmolean Museum, Oxford, where they were accessioned in the early 1920s and copied by me in the early 1990s for *OECT* 15 (nos. 6, 12, 15, 16, 121, 122, 134). Many are now in poor condition, making them difficult to read. They would benefit greatly from collation by an expert in Old Babylonian socio-economic history.

§4.0.2 Contents These accounts all record areas of land, their expected grain yields, and any areas left uncultivated. Each is assigned to an individual owner or farmer, and many entries are grouped by type or location. Tablets 18 and 19 state that they were written for Šamaš-hazir, the well-known field registrar at Larsa under Hammurabi, and his colleague Marduk-naṣir. It is likely that the rest of the tablets in this group belong to the same archive.

§4.0.3. Language These accounts are in syllabic Akkadian, with a high number of logographically written technical terms.

4.1 Accounts of estimated yield from Hammurabi 35 (Tablets 17–20)

§4.1.1 Overview According to their preambles, the aim of these four tablets seems to be to record the extent of cultivation around various small settlements in the Larsa region. The land accounted for in Tablets 17 and 19 is owned by the crown (NÍG É.GAL) and the god Nanna's temple (NÍG É ^{d}NANNA). At least some of it has fallen into neglect because the soldiers to which it was assigned have died (ÉREN UG$_7$, Tablets 17–18), absconded (ÉREN ZÁH, Tablet 17) or been neglectful (A.ŠÀ ... UKU.UŠ.MEŠ *ša* AB.SÍN *iš-ta-ad-du*, Tablet 19). The preamble to Tablet 20 is too fragmentary to read, but the dating, terminology and structure are sufficiently similar to justify its inclusion in this section.

The management of dead soldiers' land in the Old Babylonian period was studied by Ellis (1977). She describes how the land was leased back to the state or to entrepreneurial *iššiakkum* middle-men. A half-share of the harvest, *miksum* or *biltum*, was paid back to the land-owner's family and the rest kept by the state or the *iššiakkum*. The same situation pertains here, it seems.

§4.1.2 Quantifications The areas of land given in Tablets 18–20 are typically 3–30 *iku* (c. 1–10 ha) in size, with a few much smaller fields. Each field in these three accounts is assigned an 'estimated yield' constant (*šukunnûm* or NÍG.GAR), of 10, 15, 20, 30 or even 40 *gur* per *bur* (c.460–1850 litres/ha). However, with one exception in Tablet 19 (see §4.1.5 below), the expected yield is always calculated as exactly half of the area (in *bur*) multiplied by the *šukunnûm* constant, which suggests that the cultivator got to keep the other half (or more or less, depending on the field's actual productivity). *Šukunnûm* constants are not, to my knowledge, widely attested for grain (see *CAD* Š/III 232 for examples, mostly letters from

Larsa) and do not feature in Old Babylonian mathematical exercises, but are well known from Old Babylonian date-cultivation contracts (e.g., Cocquerillat 1967: 175–178).

By contrast, the field areas in Tablet 17 are mostly in the range 75–750 *iku* (c. 27–270 ha) and are not associated with *šukunnûm* constants. This strongly suggests that this is a summary account, drawn up from multiple primary documents whose constituent entries were associated with a range of estimated yield constants.

§4.1.3 Dating The accounts were written within the space of about a month, in the late spring of Hammurabi's 35th regnal year. The earliest is Tablet 20 (month ii/20), then Tablet 18 (month iii/6) followed by Tablets 17 and 19 (iii/20 and iii/22 respectively).

§4.1.4 Formatting and structure All four accounts begin with a prose preamble of 2–5 lines, describing the purpose for which they were written. All columns are headed. The first records the area of cultivated land, A.ŠÀ AB.SÍN (Tablets 17–18), AB.SÍN (Tablet 19) or just A.ŠÀ (Tablet 20). The second column in all but Tablet 17 records the estimated yield constant, NÍG.GAR, followed by the calculated expected yield, ŠE.BI (Tablets 17–20) and the area of land left uncultivated: AB.SÍN ŠE NU (Tablet 17), AB.SÍN NU (Tablet 18) or ŠE NU (Tablet 19). Tablet 20 omits this penultimate column and it is left empty or marked as TIL 'completed'(?) in Tablets 18–19. In Tablet 19, the four-column structure is duplicated, so that the figures for palace and temple are shown side by side. The final, descriptive column is headed with the usual MU.BI.IM in all but Tablet 20, which appears to read [ŠU.RI].A.BI 'its half'.

Tablets 18–20 have short prose subscripts which assign responsibility to Šamaš-hazir, Marduk-naṣir and others (Tablets 18–19) and/or reiterate the geographical location of the surveys (Tablets 19–20). As tabulation and structuration otherwise varies from account to account, further descriptions are given in §4.1.5 below.

§4.1.5 Special features Tablet 17 is, as suggested in §4.1.2 above, likely to be a summary account; maybe that is how we should understand IGI.DU$_8$.A *šu-ku-un-na* in the first line of the preamble. It first treats 'palace property' (NÍG É.GAL), further divided into land in Nirda and land in Kurkanum town; it then considers 'property of Nanna's temple' (NÍG É ^{d}NANNA) in the same two locations. The subscripts marking these designations are inconsistently placed, in columns 1, 2 and 4 of the table. Descriptions in the final column mostly relate to various types of soldiers, as well as land belonging to (or worked by) named individuals and different sorts of taxes. Most of the expected grain, as listed in column 2, has a fraction removed from it as the agricultural middle-man's due (APIN ÉNSI), set out in semi-tabulated interlinear comments. There are no discernible horizontal axes of calculation: I can detect no consistent numerical relationship between area cultivated, expected grain, and uncultivated land. However, there are running totals—a unique feature of this table, so far as I know—for columns 1–3 running vertically down the section of the table that pertains to pertaining to 'palace property' in Nirda; the other totals are all simple ones. The values of these totals suggest that Nirda is about ten times the size of Kurkanum, and that palace and temple own

roughly the same amount of land as each other in both settlements. The tablet has no subscript, only a date on the left edge. It is striking that no responsible official is named anywhere in the document.

Relatively little remains of Tablet 18. The fragmentary prose preamble informs that we are again dealing with dead soldiers, palace land, and various taxes and dues in (at least) three settlements—Yazilum, Marat-Šarrim and Yaʾenkum—near a river or canal that borders on enemy territory. Zsombor Földi (pers. comm., 11.ix.2011) notes that these settlements are all listed on BRM 4, 53, 'a text dealing with taxes(?) from various towns and cities in the Lagaš canal district, collected by Sin-muštal, Overseer of Merchants of Ur' (cf. Stol 2001: 463). One Šamaš-mušallim is named three times in preamble and in connection with a partially preserved total on the reverse. Too little of the table itself survives to determine the details of its vertical structuration, although one interlinear comment on the obverse suggests that fields were grouped by town as well as by owner or cultivator. However, it is clear that expected grain (column 3) is calculated horizontally by multiplying areas in *bur* (column 1) with estimated yield constants (column 2). Column 4, for uncultivated land, is consistently marked as TIL, presumably 'completed'. On the the reverse, responsibility for the account is assigned not only to crown officials Šamaš-hazir and Marduk-naṣir but also to six named local men, described as AD.DA MAR.TU.MEŠ *ù* ŠÀ.TAM.MEŠ, 'the Amorite sheikhs(?) and auditors'.

The short preamble to Tablet 19 tells us that it too concerns Nanna's temple property and soldiers' abandoned land, in two named meadow-lands in a town (one Šunnamundim) on a watercourse bordering enemy territory. Where Tablet 17 organises crown land and temple property vertically on the tablet, here they are laid out next to each other. Each cultivator apparently works identical areas of palace and temple land, with identical yields; or (in four cases) only works for one or the other. This strongly suggests that, in all but those four cases, each man works land that is jointly owned by palace and temple and whose yields are split between them. In no instance is any land left uncultivated. For both temple and palace there is one horizontal axis of calculation, in which the expected yield of each field is calculated as the product of its area and estimated yield constant. There are simple totals of land and expected grain for palace property (with a small numerical error in the latter). For Nanna's property, the first entry—which belongs to Nanna alone, is much larger than the rest and whose yield is calculated at 100%, not 50%—is excluded from the subtotal and listed separately, but then seems to have been added back in in the final line. However, if that were the intention, then the grand totals of both area and grain have been miscalculated: the correct values would be 67 *iku* 15 *sar* and 65 *gur* 50 *sila* respectively instead of the 53 *iku* 65 *sar* and 62 *gur* 100 *sila* given. The account ends with a subscript repeating the geographical information from the preamble, and an assignation of responsibility to Šamaš-hazir and Marduk-naṣir, as in Tablet 19, plus an unknown number of unnamed ŠÀ.TAM.MEŠ, 'auditors'.

Finally, Tablet 20 is structurally the simplest of the accounts in this group, with just one

horizontal and one vertical axis of calculation. The preamble is barely extant but subscripts within the table tell us that it concerns meadow-lands in the towns of Elalia and Ukua on the banks of the Gabu canal. It tabulates areas of land, constants of estimated yield per *bur*, and calculates expected yields for each field, assigned to both a cultivator and an owner (noted in interlinear comments). There is a single total at the end of the account, plus a terse subscript note of the adjacent watercourse. As in Tablet 17, no officials are assigned responsibility for the document.

4.2 Account of estimated yield from Hammurabi 39 (Tablet 21)

§4.2.1 Overview This tablet is very similar in content and function to Tablets 17–20 (§4.1), in that it calculates 50% expected harvest yields from numerous pieces of land, but it exhibits several significant structural differences to those accounts. Cocquerillat (1967: 205–206) considered it to be an account of dates, but it lacks clear date-cultivation terminology, its quantifications are much more like those in Tablets 17–20 than those of the certain date account Tablet 27 (§5.2), and, as Zsombor Földi (pers. comm., 11.ix.2011) notes, date harvest accounts are normally dated to months v–vii of the year, not month i as here. The balance of likelihood, then, is that Tablet 21 concerns grain, not dates.

§4.2.2 Quantifications The fields in Tablet 21 range in size from about 1 to just over 20 *iku* (c. 0.36–7.5 ha) with estimated yield constants (NÍG.GAR) of 10–30 *gur* per *bur* of land.

§4.2.3 Dating The tablet is dated towards the end of Month I in Hammurabi year 39, slightly earlier in the spring than Tablets 17–20 of four years earlier.

§4.2.4 Formatting and structure Unlike its four predecessors, Tablet 21 has no preamble. The headings of columns 1–3 and 5 are identical to those of Tablet 19, while column 4 is headed ŠU.RI.A.BI 'its half'. In other words, where Tablets 17–20 calculated expected yield with an implicit division by two, Tablet 21 presents the 100% yield in column 3 (ŠE.BI) and then explicitly halves it in column 4. It thus has two horizontal axes of calculation. Field areas and calculated expected yields are subtotalled by location, noted interlinearly, before the grand total, giving the table two vertical axes of calculation too. A short subscript identifies the settlement as Adur-Šulgi but no officials are named, just as in Tablets 17 and 20.

§4.2.5 Special features No information is provided about the individuals in the final column, such as their patronyms, professions or relationship to the the land. However, as Zsombor Földi (pers. comm., 11.ix.2011) notes, many of these men are well attested in Šamaš-hazir's archive: Diqqum (OECT 15, 44; TCL 11, 182, 240), Mannašu (TCL 11, 168), Muhaddum (TCL 11, 170, 184), and Sinni (TCL 11, 150, 170, 186). He suggests that they may well have been entrepreneurial *iššiakkum* middle-men who rented fields for a fixed share of the crop.

4.3 Accounts of estimated yield with missing dates (Tablets 22–25)

§4.3.1 Overview As these four tablets are missing the top of the obverse and bottom of the reverse, their exact functions and dates cannot be determined with confidence. Nevertheless they appear to share several structural features with Tablets 17–21, which suggest that they too are estimated yield accounts drawn up in the Larsa region during the final third of Hammurabi's reign. Tablets 23–24 most closely fit this model; the purposes of Tablets 22 and 25 are harder to identify.

§4.3.2 Quantifications All four accounts enumerate small fields, mostly in the range 1–24 *iku* (c. 0.36–8.6 ha) in Tablets 22–24 but as small as 20 *sar* and as great as 55 *iku* (c. 720 m^2 – c. 20 ha) in the much larger Tablet 25. The *šukunnûm* estimated yield constants (if such they are) in the second column of Tablets 22–24 are all in multiples of 10 *gur* per *bur*, up to 40, but Tablet 25 also has values 5, 6, 12 and 15 in this column. In Tablets 23–24, the third column contains quantities of grain that are commensurate with the 50% expected yield calculation described in §4.1.2 above, namely the half of the product of columns 1 and 2. In Tablet 25, however, the grain values in column 3 are typically 1/10 of those expected (i.e., 5% expected yield) and sometimes much smaller. Tablet 22, by contrast, lists areas of land in its third column, which may be smaller, larger or the same as those in its first. The areas in column 4 of Tablets 23 and 25 are likewise difficult to explain.

§4.3.3 Dating No dates survive on these tablets.

§4.3.4 Formatting and structure In the absence of preambles, headings and subscripts the only formatting features to note are the interlinear comments, present on all four tablets, which group the fields geographically. Tablet 24 also has at least two subtotal lines, and various other interlinear comments which break up the tabular formatting quite significantly.

§4.3.5 Special features Unusually, Tablet 22 lists the (non-agricultural) professions of almost all the individuals it names. Tablet 23 mentions Uraš-muballiṭ, a name which also features prominently in Tablet 17, as well as ERÉN NU ZÁḪ 'troops who have not absconded', providing a further link with Tablets 17–20.

5 Tabular accounts from the reigns of Hammurabi and Samsu-iluna, in the British Museum (Tablets 26–30)

§5.0.1 Introduction These last unpublished tabular accounts, all now in the British Museum, do not form clear groupings, except for one pair of duplicates (Tablets 28–29). I therefore treat them individually below. They are all in syllabic Akkadian with an admixture of logograms.

§5.0.2 Provenance Tablet 27 was part of a small collection sold to the British Museum by one J. Svoboda in 1897 (Sigrist *et al.* 1996). Tablets 26 and 28–29 were purchased from the Paris-based dealer Isaac Élias Géjou in 1899, in the same large lot as Tablets 13–14 and 16. The provenance of Tablet 30 is undocumented (Figulla 1961). On internal evidence Tablets

26–27 are probably from Larsa but I have not been able to determine the likely origins of Tablets 28–30.

5.1 A summary land account from Hammurabi year 35 (Tablet 26)

§5.1.1 Overview This account tabulates large areas of land under the responsibility of four different individuals in the region of Larsa. The tablet is in poor condition and its non-numerical components are difficult to read but it appears to concern fields and water-meadown assigned to bird-catchers, fishermen and other marsh-dwellers (MUŠEN.DÙ, ŠU.HA and LÚ A.AB.BA). As Zsombor Földi and Gábor Kalla (pers. comm., 11.ix.2011) point out, the same four men featured in the heading of this account also appear together in *OECT* 15: 126, dated to the following year.

§5.1.2 Quantifications The field areas are relatively large, in the region of 2 1/2 – 48 *bur* (c. 16–320 ha). The summations are all correct except for the total in rev 5. col. 4, which is 3 *bur* 1 *iku* too small.

§5.1.3 Dating The tablet was written in intercalary month vi/2 of Hammurabi's 35th regnal year, just a few months later than Tablets 17–20 and 27.

§5.1.4 Formatting and structure The one-line preamble mostly illegible. Unusually, the entries in the table are grouped horizontally by individual, as well as vertically by location. Short interlinear comments give further geographical information. Both horizontal and vertical totals are given, with a grand total in the antepenultimate line. The function of the two lines after the total remains unclear. If there was a final summary, it is now missing due to surface damage.

5.2 A sealed account of date cultivation from Hammurabi year 35 (Tablet 27)

§5.2.1 Overview This account calculates the harvests of dates that were due and paid over a two-year period. The tablet is signed and sealed by ten witnesses from Iliš-tikal town, apparently in response to royal orders.

§5.2.2 Quantifications The areas of land under cultivation, in the range 5 *sar* to 2 1/2 *iku* (c. 180–6,500 m^2), are significantly smaller than the fields of Tablets 17–25. Conversely, the estimated yield constant of 12 *gur* per *iku*, given explicitly at the start of the table, is an order of magnitude higher (at 216 *gur* per *bur*) than those in the agricultural accounts. These values, together with the frequent occurrence of the words ^{giš}KIRI$_6$ 'orchard' and NU.GIŠ.KIRI$_6$ 'gardener' in the final column of the table, together suggest that dates are the commodity of account here.

§5.2.3 Dating The account concerns Hammurabi's 33rd and 34th regnal years, according to the headings of columns 5 and 10, but was drawn up towards the end of year 35.

§5.2.4 Formatting and structure Tablet 27 has no preamble. Like Tablet 19, it features two sub-tables side by side, one for each year of the account (named in the headings of columns 5

and 10). Some headings are missing or damaged, but the surviving ones tell us that they record capacities that 'he measured' (*im-du-ud*, cols. 3 and 8) and arrears, LÁL.ì (cols. 4 and 9). The locations and cultivators of the orchards are listed under the year names in the final columns; blank lines in column 5 appear to suggest that some orchards did not change hands from one year to the next. Expected yields are calculated by multiplying the areas in *iku* by 12 *gur*, as set out explicitly in the sub-heading at the top of the table. The 'measured' yields are then subtracted from these theoretical figures to give the capacities of crop that are owed on each piece of land. However, these figures are not totalled. In other words, each sub-table has two horizontal axes of calculation but no vertical ones. The subscript, as noted above, lists the ten local officials who are responsible to the palace for this document.

§5.2.5 Special features This is the only tabular account I know of which is sealed by the officials who produced it.

5.3 Duplicate accounts of canal work from Samsu-iluna year 7 (Tablets 28–29)

§5.3.1 Overview These two tablets present duplicate accounts, formatted slightly differently and written ten days apart from each other. They calculate volumes to be excavated—presumably for a canal, as a dyke is mentioned—but do not assign responsibility for the work or note its state of completion.

§5.3.2 Quantifications The excavations are 5–275 rods (c. 30 m – 1.65 km) in length and of rectangular or tapering cross-section, 0;10–0;20 rods (c. 1–2 m) wide and 1–2 cubits (c. 0.5–1 m) deep. The measurements are given in these particular units—note especially the sexagesimal fractions of rods for the lengths and widths, which the surveyor could have expressed more conveniently in cubits—so that the volume in *sar* can be calculated without converting any metrological units. (The *sar* is defined as 1 rod length × 1 rod width × 1 cubit height.)

Exactly the same methods are used to find the excavated volumes of canals with vertical or sloping sides in Old Babylonian mathematics (e.g., Robson 1999: 97–101). In this light, it may thus be possible to propose a meaning for the conspicuously round values marked SAḪAR 'earth' or 'volume' in column 2, which are not apparently used in the volume calculations. If we read them as sexagesimal fractions rather than integers, they look very like the single worker's daily excavation work-rates (e.g., 0;07 30 sar, c. 2.25 m^3) used in both Old Babylonian mathematics and Ur III administrative accounts (Robson 1999: 159–160). However, this data does not seem to be used anywhere in these accounts.

§5.3.3 Dating Tablet 29 is dated 10 days earlier than Tablet 28. Given their poor state of preservation, I have not been able to determine precisely why Tablet 29 needed to be re-written, though it may be due to the fact that in the preliminary version the scribe failed to provide a separate final column for qualitative information about the excavations.

§5.3.4 Formatting and structure Neither tablet has a preamble and, as noted above, Tablet

29 uses its final column for both quantitative data (calculated volume) and qualitative information (the location of the excavation). The heading of Tablet 28's final column is, unusually, LÚ 'man' instead of MU.BI.IM. Each table has one horizontal axis of calculation and two levels of vertical summation (of lengths and volumes). Subtotals and totals are shown as interlinear comments which are placed inconsistently within the structure of the table. There are no final comments which contextualise, justify or authorise the accounts.

5.4 A harvest account from Samsu-iluna year 11 (Tablet 30)

§5.4.1 Overview This is a simple tabular account of losses of grain products between what was sent and what arrived in the storeroom, from two estates, recorded over about 14 days of a single month. It appears to have been compiled from several primary documents which inventorised the goods at the relevant locations.

§5.4.2 Quantifications Large quantities of grain, 3–75 *gur* (c. 900–22,500 litres), are recorded, with losses mostly of 5% or less. The fact that the account gives subtotals for each of the two estates allows individual entries to be attributed to one or the other, despite damage to the right edge of the tablet. It is not clear to me whether the relatively small quantities of ZÍD ^{d}UTU (lit. 'flour of Šamaš', sunflower flour?), chick-peas and lentils(?) listed next to these subtotals are included in the overall totals or additional to them.

§5.4.3 Dating The account was drawn up at start of the year (month i, day 25), immediately after the sequence of days mentioned in the final column.

§5.4.4 Formatting and structure The account has no preamble. All four columns are headed, with the usual label MU.BI.IM for the descriptive information. There is one horizontal axis of calculation, as the grain entering the storeroom (MU.TÚM É.KIŠIB.BA) is subtracted from the goods that 'he sent' (SAG NÍG.GA.RA *ub-lam*) to give the arrears (LÁL.Ì). Each column is totalled at the end of the account, with subtotals per estate also given and totalled to check with the grand total. There are thus two independent axes of vertical calculation. There is final subscript comment that Á.BI GIŠ.MÁ.HI.A *ù* ÉREN.HI.A *la har-ṣú* 'the costs of the boats and the workers have not been deducted'.

6 Conclusions

§6.1 Tabular practices The detailed study of several series of closely related tabular accounts reveals a surprising degree of inconsistency—or perhaps, more positively, flexibility—in layout and formatting. The same account could be rewritten with an extra column (Tablets 28–29); columns for particular data categories could be relabelled, and come and go as needed (Tablets 1–4 and 33; Tablets 6–11 and 34–35); the layout and content of a set of accounts could be rethought (compare Tablets 13–14 to Tablets 15–16 and 31–32); identically structured sub-tables could be laid out one above the other, or side by side for easier comparison (compare Tablets 17 and 19). Not one of the series of accounts presented here

shows strict structural uniformity. It appears, then, that by decomposing an account into its constituent components tabulation encouraged accountants to think particularly clearly about the relationships between different data categories and to experiment with the most effective ways of representing them. Indeed, tabulation seems to have helped accountants to see quantitative relationships in increasingly complex ways, given the tendency to increased length and complexity that is visible over the half-century represented here.

§6.2 Use of constants It is well known that Ur III accountants made widespread use of constants to estimate the labour, time and costs of large-scale agricultural and construction works (e.g., Robson 1999: chapter 9; 2008: 67–75). They are particularly visible in the annual accounts of entrepreneurial overseers contracted to institutions of the Ur III state, as the means by which payment, profit and loss were calculated. The accounting practices of the Old Babylonian period have been little studied by comparison, but until now it seemed that constants were not a prominent feature (Robson 1999: 141). These accounts, however, present unequivocal evidence, not only for for daily work-rates to estimate labour needs (Tablets 15–16 and 31–32; perhaps also Tablets 28–29) but also metrological conversion constants to estimate crop yields of grain and dates per square area of cultivated land (Tablets 17–21 and 27; probably also Tablets 22–25). In doing so, they establish a new and important link between Old Babylonian school mathematics and the praxis of contemporary working scribes.

§6.3 Prospects There is still much to be understood of the quantitative aspects of Old Babylonian labour and land management and its relationship(s) to scribal schooling. This article does not pretend to have exhausted the possibilities for research offered by these Old Babylonian tabular accounts. Rather, I hope to draw attention to a rich set of sources for socio-economic, political and cognitive history, whose potential has been largely overlooked.

7 Appendix: further dated tabular accounts

§7.0 Overview In Robson (2004) I tabulated all published Old Babylonian accounts then known to me. This appendix updates that listing, bringing the total number to 118 tablets. The entire catalogue, which will be further updated as further documents come to my attention, can be found at http://oracc.org/obta/corpus.

§7.1 Dated tabular accounts from the last years of Rim-Sin and the mid-Old Babylonian period (updates to Robson 2004: Tables 5–6). For conventions and abbreviations used, see **§1.3** above.

Publication	*Museum number*	*Provenance*	*Cols*	*Hdgs*	*Or*	*Axes*	*Notes*	*Year*	*Date*
SVJAD 114	—	Larsa	6	M	L	H4 V1		RS 31	1792
SVJAD 116	—	Larsa	6	M	L	H4 V1		RS 31	1792
SVJAD 115	—	Larsa	3	M	L	V1		RS 31	1792
CDLI P234963	KM 89186	Larsa	9	M	L	H2+ V1		RS 57	1766

TEBA 14	MAH 16032	—	5	M	P	H2 V4		Ha 39	1754
DoCu 114	HE 114	—	13	M	L	H1 V1	L	Ha 43	1751
SVJAD 126	—	Larsa	3	M	P	V1		Si 7	1743
SVJAD 127	—	Larsa	3	M	P	V1		Si 7	1743
TEBA 18	MAH 15936	Larsa	3	M	P	V1		Si 7	1743
TEBA 21	MAH 16004	Larsa	3	M	P	V1		Si 7	1743
TEBA 24	MAH …	—	4	O	P			Si 15	1735
TEBA 28	MAH …	—	3	Y	P	V1		Si 27	1723
CDLI P247946	HMA 9-1854	—	7	M	L	H? V1		—	

SVJAD 114 and 116: calculations of monthly wages of three categories of young female workers in palace, at two different rates

SVJAD 115: summations of two different types of workers, in three different categories; very similar to *SVJAD* 114 and 116, but male workers, no wages calculated.

KM 89186: labour account, with subtractions as well as additions, over four years; drawn up on the last day of the year.

TEBA 14: 8-year balanced account of a grain merchant; reverse non-tabular.

DoCu 114: merchants' accounts of silver and wool for the years Ha 39–41.

SVJAD 126–127: summations of grain and bran over 10 days.

TEBA 18 and 21: summations of grain and bran for brewers over 10 days.

TEBA 24: tabular list of goods and their prices(?) assigned to at least 20 people. Like Tablet 28 above, its final column is headed lú, 'man'.

TEBA 28: Long account of onions received and owing from 53 men.

HMA 9-1854: the headings difficult to read, but the four men concerned are Ibbi-Šamaš, Inbuša, Yašu(?) and Aplum. Final totals include the decimal notation 1 ME.

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