5 The state of decipherment of proto-Elamite

ROBERT K. ENGLUND

With the ongoing publication of the proto-cuneiform texts by the collaborators of the project Cuneiform Digital Library Initiative (CDLI), we are achieving a more substantial basis for the continuing discussion of the early development of writing in Mesopotamia.[1] Cuneiform is a system of writing with a history of over 3,000 years of use, and can boast of a text corpus unparalleled in number and breadth before the invention of the printing press. Cuneiform offers, moreover, a unique view of the earliest stages of development of an advanced writing system. In a career spanning over thirty years, Denise Schmandt-Besserat has published and discussed the significance of a means of accountancy employed in the ancient Near East that represents a clear precursor of the first proto-cuneiform tablets. Small clay objects unearthed in prehistoric strata were termed "tokens" by Schmandt-Besserat, who wished to underscore their use as markers in an ancient system of bookkeeping. These clay objects consist on the one hand of simple geometrical forms, for instance cones, spheres, etc., and on the other, of complex shapes or of simpler, but incised, forms. Simple, geometrically formed tokens were found encased within clay balls (usually called "bullae") dating to the period immediately preceding that characterized by the development of the earliest proto-cuneiform texts; these tokens most certainly assumed numerical functions in emerging urban centers of the late fourth millennium BC. Indeed, impressed signs of an array of numerical systems found in proto-cuneiform accounts represented, in both form and function, many of the archaic tokens, so that the forerunner role of the simple tokens in the development of writing in Mesopotamia belongs, as the editor of this volume would understand the term, to the "core knowledge" of modern cuneiformists.

The spate of new proto-cuneiform tablets on the London markets deriving from post-Kuwait-War Iraq, including over 400 new texts of both Uruk III and Uruk IV period date, reputedly from the ancient city of Umma, have increased the size of the proto-cuneiform corpus to over 6,000 tablets and fragments containing more than 38,000 lines of text.[2] Two elements provide us with a relatively firm understanding of the contents of many of the earliest cuneiform documents. First, there is an evident continuous paleographic and semiotic progression of the cuneiform sign repertory into periods, beginning with the Early Dynastic IIIa period *c.* 2600–2500 BC, whose administrative and literary documents are increasingly comprehensible. Second and more importantly, a scholastic tradition of many centuries of compiling and copying lexical lists, ancient "vocabularies," helps bridge the gap between proto-historical and historical context. It should also not be forgotten that the seventy years in which a limited but quite involved circle of Sumerologists has worked on proto-cuneiform have resulted in a number of tools helpful in continuing research – including the first Uruk sign list of Falkenstein (1936) and its revision by M. Green and Nissen (1987) – but also in a growing number of primary and secondary publications by, among others, Friberg (1978–1979, 1982, 1997–1998), M. Green (1980, 1981), M. Green and Nissen (1987), Charvát (1993, 1998), and the members of the CDLI. Despite such research tools enjoyed by those involved in the decipherment of proto-cuneiform, no definitive evidence has been produced that would identify the language of proto-cuneiform scribes. The onus to make the case one way or the other would appear to rest with specialists in the field of Sumerology, since, given its later linguistic presence and the strong cultural continuity in southern Babylonia, Sumerian must be the favorite candidate for an eventual decipherment. Yet neither the evidence for possible multivalent use of signs in the archaic period, nor, for instance, the more sophisticated argument of a unique connection between Sumerian number words and the sexagesimal numerical system – a notational system which appears to be attested already in the token assemblages of the prehistoric clay bullae – have sufficient weight to convince skeptics.[3] On the contrary, it seems that a strong argument from silence can be made that Sumerian is not present in the earliest literate communities, particularly given the large numbers of sign sequences which, with high likelihood, represent personal names and thus should be amenable to grammatical and lexical analyses comparable to those made of later Sumerian onomastics.[4]

Despite these uncertainties in the proto-cuneiform record, many factors make the interpretation of the earliest phase of writing in Mesopotamia a very rewarding study. In Mesopotamia we are favored with a substantially unbroken tradition of writing in both form and function through a period of three millennia, including most importantly an exceedingly conservative tradition of so-called "Listenliteratur," that is, of compilation and transmission of thematically organized word lists beginning with those of the earliest, Uruk IV-period phase of writing; we count large numbers of inscribed tablets and fragments from archaic Babylonia, now approximately 6,000, which for purposes of graphotactical analysis and context-related

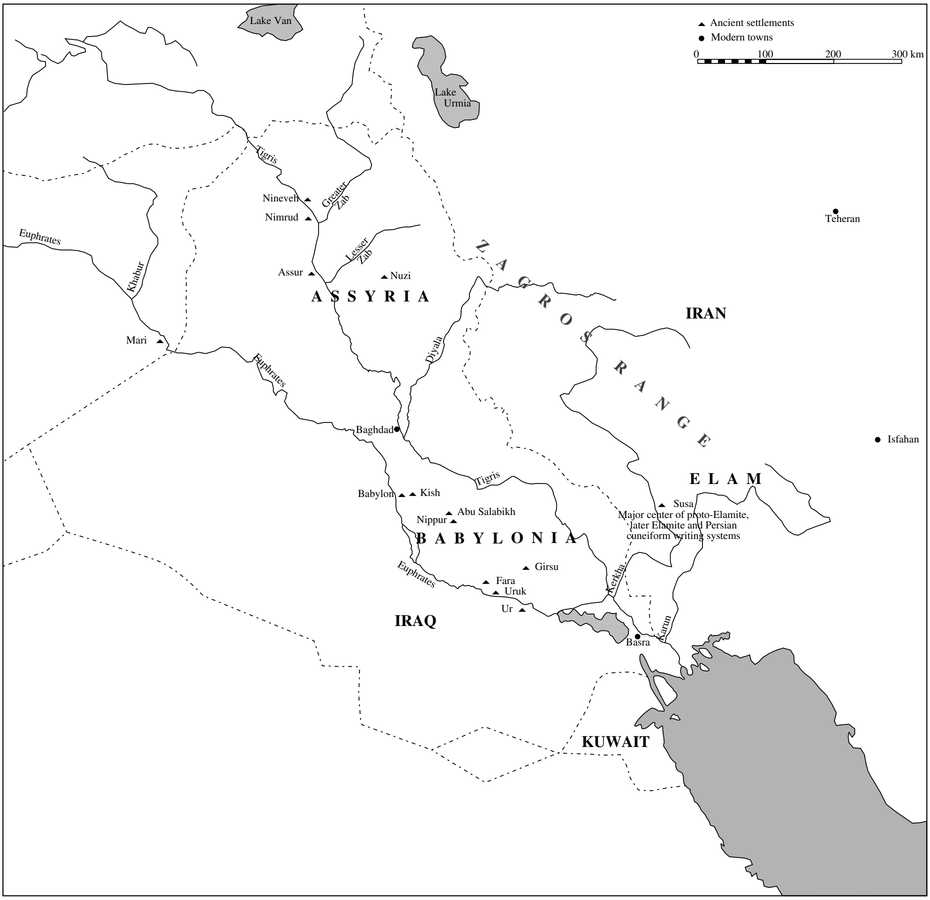


Fig. 5.1 Map of western Asia.

semantic categorization of signs and sign combinations represents a text mass of high promise; and assuming populations in Babylonia were relatively stable through time, we can utilize language decipherments from texts of later periods in working hypotheses dealing with the linguistic affiliation of archaic scribes.

Against this backdrop, the task of deciphering early texts from Persia seems all the more daunting. Although these texts have played an historically minor role relative to early cuneiform, the late nineteenth- to early twentieth-century French excavations of Susa (Fig. 5.2) made that script the first archaic Near Eastern writing system known to us. A quarter of a century before British–American excavators of Jemdet Nasr and German excavators of Uruk unearthed their proto-cuneiform tablet collections, de Morgan's archaeological earth-moving machine sent to the Louvre examples of an

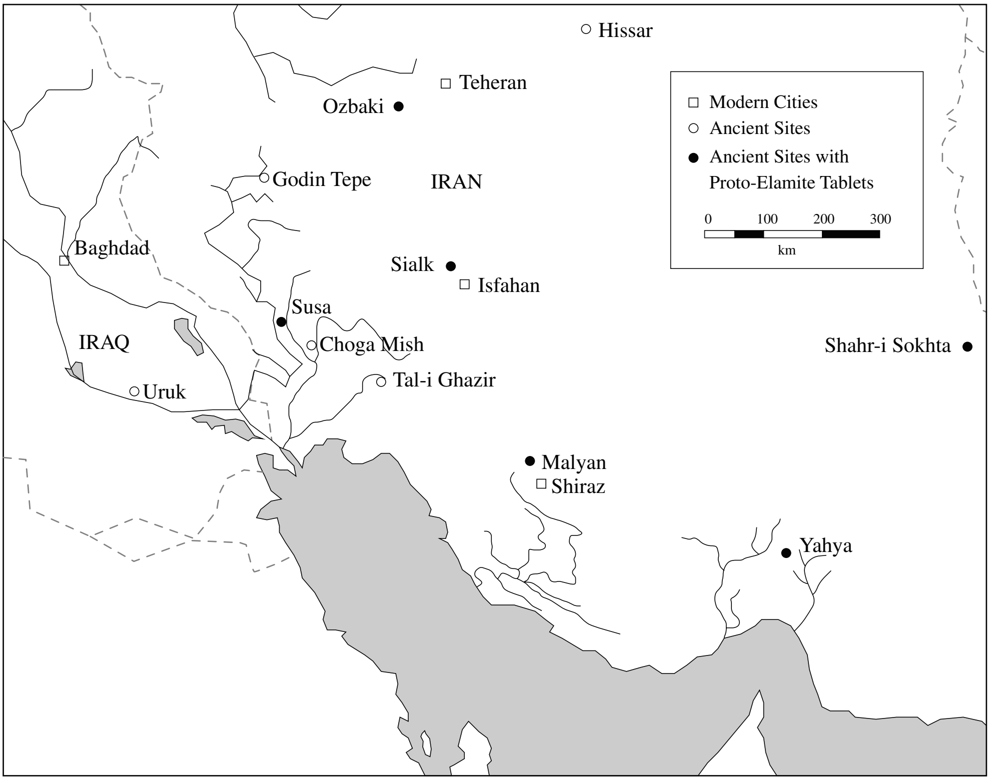


Fig. 5.2 Major sites of Late Uruk and proto-Elamite inscriptions in Persia.

evidently very early writing system which, based on a presumed genetic relationship to texts of the later-attested Elamite-speaking peoples of the Susiana plain, has been only conventionally named proto-Elamite.[5] The proto-Elamite corpus numbers just over 1,600 pieces, with around 10,000 lines of text, that is, about a quarter as many as from Babylonia (still, it represents a large amount of material compared to the relatively humble inscriptions of Linear A or of early Harappan).[6] The publication of tablets appears to have proceeded with little understanding of the text corpus and the accounting system it represented, and with little attention paid to an accurate representation in hand copies of the texts themselves.[7]

Accompanying sign lists were published with scant thought given to the high number of signs and the likelihood that the upwards of 5,500 signs in the final list attached to a primary publication by Mecquenem (1949) contained large numbers of sign variants. The list published by Meriggi (1971–1974) attempted to solve this problem by including under discrete headings presumed variant graphs and so arrived at a total of less than 400 sign entries. Unfortunately, that list was itself laced with incorrect identifications and graphic forms of many signs, in part reflecting the wayward decision of the author to opt to follow the original orientation of the proto-Elamite tablets, rather than the established conventional one. This, added to the fact that seemingly all of the signs were published as mirror images, and that the important numerical sign systems were defectively organized, makes the Meriggi list a research tool of limited value.[8] However, proto-Elamite inscriptions have been, and will remain, highly problematic in a discussion of writing because they represent a very unclear period of literacy, possibly beginning around 3300 and ending around 3000 BC, after which, unlike Mesopotamia, no writing tradition existed that might have served to reflect light back upon this earliest phase. The few so-called "Linear Elamite" inscriptions from the late Old Akkadian period, that is, from a period some eight centuries after the proto-Elamite age, exhibit little graphic and no obvious semantic connection to the earlier writing system.[9]

Still, the proto-Elamite writing system exhibits high potential and, but for its uniqueness as a largely undeciphered script of an entirely unknown dead language, has some features which might have made it an even better candidate for decipherment than proto-cuneiform. Among these are a substantially more developed syntax evident in a linear "line of sight" in the writing practice (see below), and in an apparently more static graphotactical sign sequence.

Description

Proto-Elamite clay tablets – to date, no known examples of the script have been found on other materials – exhibit a relatively straightforward and standardized format throughout their history. Entries on the obverse face of a tablet usually began in the upper left corner with a general heading, followed by one or more individual entries. These were inscribed in lines from top to bottom kept in columns defined, if at all, by the shank of the stylus pressed along the length of the tablet. No apparent organizing importance was attached to the end of these columns; the notation of a particular entry often began in a column at the bottom of a tablet, and continued at the top of the adjoining column. This phenomenon is particularly obvious in the many examples of numerical notations spread across two such "columns."[10]

Their clearly recognizable, standardized structure divides proto-Elamite administrative texts into three major sections (Fig. 5.3a). Many texts begin with a *heading*, a sign or a sign combination which qualifies all transactions recorded in the text and which never contains a numerical notation. The

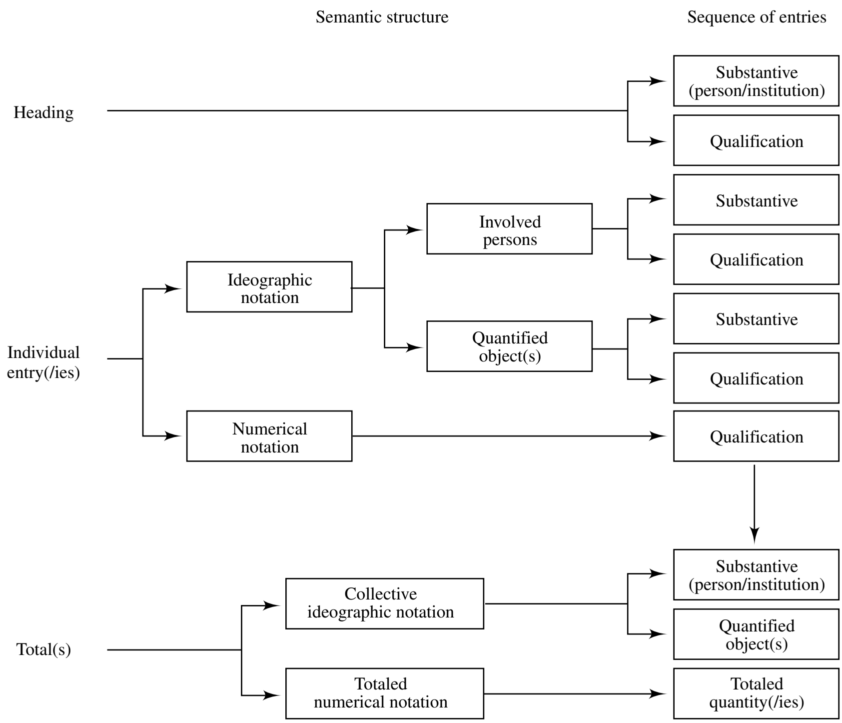


Fig. 5.3a Semantic structure of the proto-Elamite accounts.

clear formal structure of the following individual text entries allows their isolation from the headings and appended summations. These individual entries consisted of, first, a series of ideographic signs representing persons or institutions involved in the account, followed by signs representing objects qualified by further ideograms and by numerical notations. The sign combinations seem to indicate a possibly spoken sequence of substantive followed by qualification, as is also the case with the object designations and the numerical notations themselves.

Multiple-entry documents in the proto-Elamite corpus range in complexity from a simple linear sequence of entries of exactly the same type to involved accounts recording the consolidation of numerous primary accounts. A simple example may on the one hand be found in an account from the records of animal husbandry offices consisting of one or more entries representing numbers of animals moving from the care of one person or office to the next. On the other hand, texts may be highly structured, with up to three identifiable levels of hierarchy, reflecting, for instance, the organizational structure of a labor unit.[11]

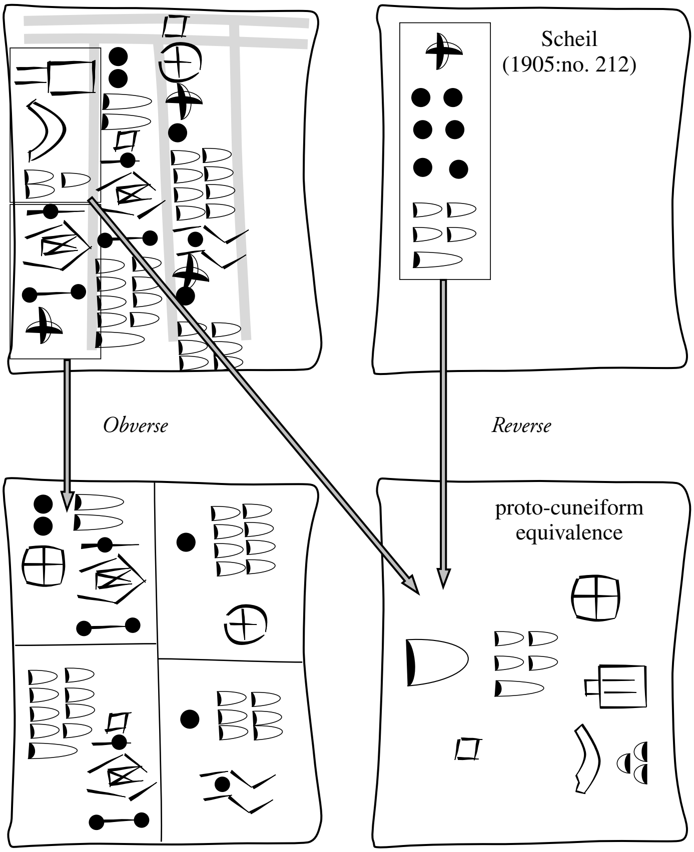


Fig. 5.3b Correspondence of proto-Elamite and proto-cuneiform accounts.

Particular entries, of a higher order which we call totals, contain summations of numerical notations from all or some entries together with collective ideographic notations. Since all entries seem to contain numerical notations, the syntax of these texts would seem more to represent the structure of a system of bookkeeping than the division of a spoken language into distinct semantic units, although within strings of ideographic signs we must anticipate such as-yet-undeciphered semantics.[12]

The first attempts to establish a clear relationship between the proto-Elamite and proto-cuneiform scripts were concentrated on the conformity between the number signs and numerical systems used in the respective scripts. This conformity is already suggested by the fact that, contrary to the ideograms, the proto-Elamite and the proto-cuneiform numerical signs exhibit the same sign forms (Fig. 5.4). More importantly, the

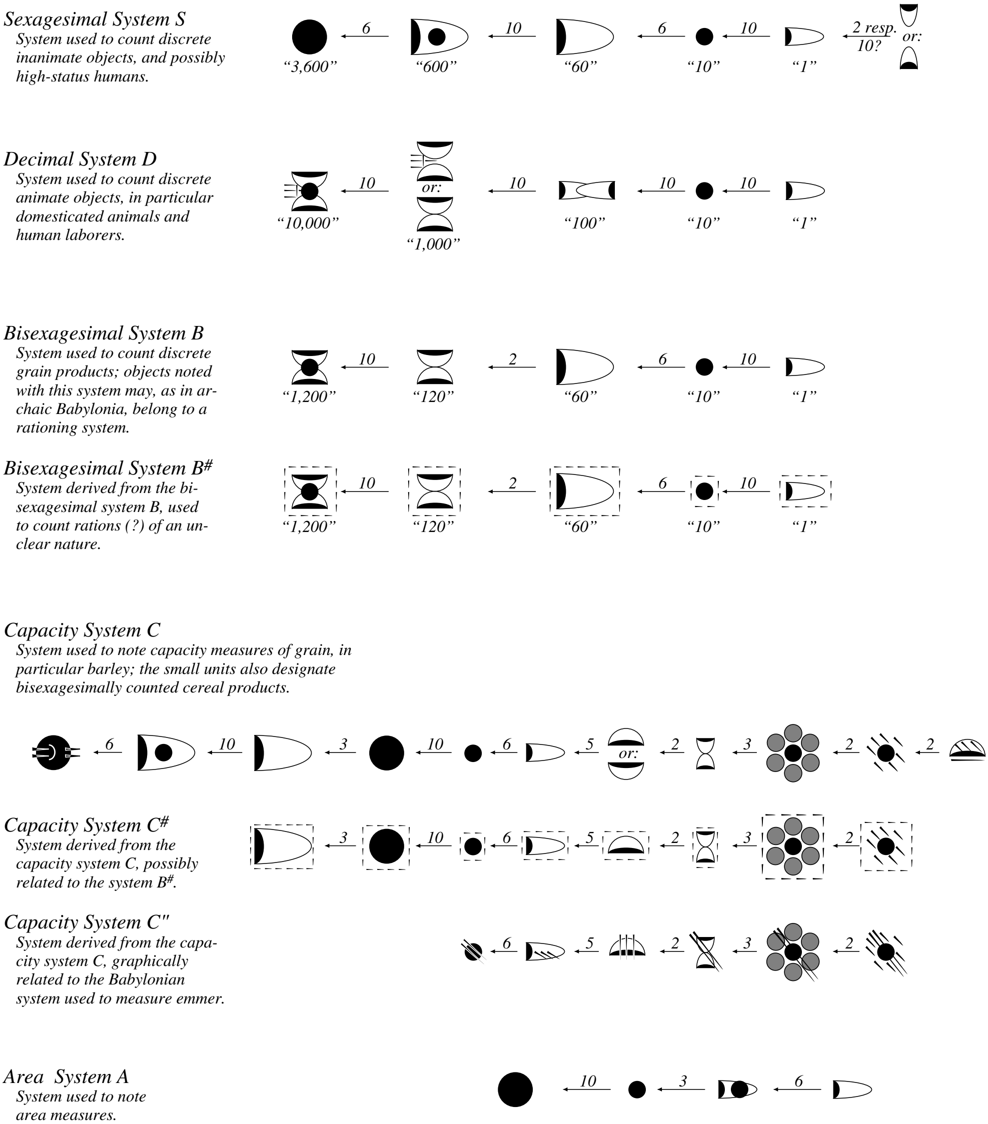


Fig. 5.4 Numerical systems attested in proto-Elamite accounts.

sequence of the basic signs (i.e., the combinations of vertical and oblique impressions of a round stylus) in the proto-Elamite numerical notations corresponds to that of the proto-cuneiform notations, thus indicating that the scribes of the proto-Elamite texts used numerical systems with at the very least the same quantitative order as the proto-cuneiform texts. Further, proto-Elamite numerical signs exhibit the same arithmetical ambiguity as the proto-cuneiform numerical signs, in that the numerical value of a particular sign differs according to its specific context of application. The exact quantitative relationships between the various members of an assumed system exhibited by the proto-Elamite text corpus could be inferred in many cases only by this analogy. When examined according to summations in the texts, however, these relationships stood in exact conformity with the relationships of the proto-cuneiform numerical systems.

One difference between proto-cuneiform and proto-Elamite numerical systems has already been noted in earlier treatments. In addition to the sexagesimal and the bisexagesimal systems well known from the proto-cuneiform administrative texts as numerical systems used to count discrete objects, a strictly decimal system was used in certain areas of application. Aside from six possible but unlikely exceptions, this numerical system finds no parallel in the proto-cuneiform corpus.[13]

An important result of our analysis of the proto-cuneiform numerical systems was the determination of ideograms which indicate in the texts the objects of the bookkeeping activities; this resulted in the confirmation that the numerical systems had distinctive areas of application. A comparably systematic analysis of the areas of application of proto-Elamite numerical systems has not yet been undertaken because of, in large part, the difficulty of identifying the semantic function of the signs.[14] A previous publication explored the numerical notations of proto-cuneiform accounts according to probability analysis in an attempt to isolate all systems employed in archaic Babylonian bookkeeping.[15] The same statistical method applied to the corpus of proto-Elamite texts allows us to reject confidently the presumption that the accounts record a hitherto unknown numerical system. The only exception would appear to be the surface area system identified in only one example (see Fig. 5.9). This tablet might represent a physical import from Babylonia.

The *sexagesimal system* (see Fig. 5.5) used in Mesopotamia for most discrete objects, including domestic and wild animals and humans, tools, products of wood and stone and containers of in some cases standard measures, is also well attested in the Susa administrative texts, although with an obviously restricted field of application.[16] The few discrete objects counted with the proto-Elamite sexagesimal system that can with some plausibility be identified include vessels and other products of craftsmen, and, it seems, humans of high status, but exclude animals and dependent laborers. Few tablets contain sufficiently preserved accounts to allow of a clear calculation of individual entries combined in a summation. For instance, Scheil

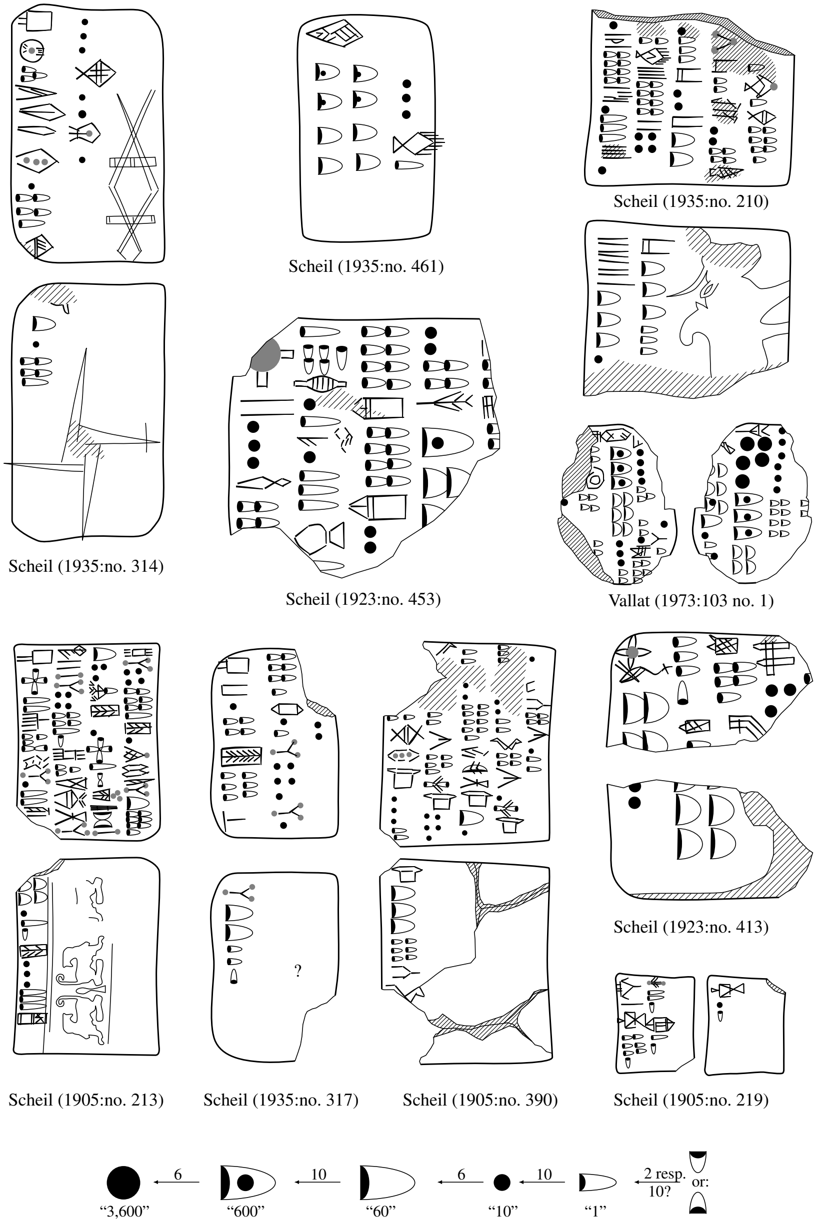


Fig. 5.5 Attestations of the sexagesimal system.

(1935: no. 314) consists of four entries on its obverse surface representing 15, 30, 20 and 10 units; thus the total on the text's reverse surface is to be considered a sexagesimal notation of N_{34} N_{14} $5N_1 = 75$ (counting presumed beer vessels).[17] Scheil (1905:no. 219) contains the individual entries $6\frac{1}{2} + 2\frac{1}{2} + 1\frac{1}{2}$ totaling, on its reverse surface, N_{14} $N_8 = 10\frac{1}{2}$. Other texts, though not completely preserved, retain individual entries which are compatible only with a sexagesimal interpretation of the texts' numerical system. For instance, the obverse of Scheil (1905:no. 213) consists of three entries of counted $M149_a$ – [13] + 10 + 10 = 33 ($3N_{14}$ $3N_1$, rev. line 2) units – and five of counted M376 – $12 + 45\frac{1}{2} + 90 + 47 + 67 =$ or $251\frac{1}{2}$ ($4N_{34}$ N_{14} N_1 N_8) units (reducing one of the obverse entries by 10); likewise, Scheil (1935:no. 317) may be reconstructed obv. N_{14} $4N_1$ / $6N_1$ / $7N_1$ / N_{14} $1N_1$ / $5N_{14}$ / N_{14} [$4N_1$ N_8] / $2N_{14} = 2N_{34}$ $2N_1$ N_8 (counting several presumable categories of humans). Both accounts appear to deal with humans of high status.[18] In other cases, numerical signs in large notations exhibit sequences which in all likelihood are sexagesimal, for example Scheil (1935:no. 461) with $4N_{48}$ $4N_{34}$ $3N_{14}$, and Vallat (1973:103 no. 1) with rev. i 2 $5N_{45}$ $3N_{48}$ $4N_{34}$ $5^{!?}N_{14}$ $8N_1$, are both evidence of large sexagesimal notations, the former text counting vessels, the latter among other commodities a sign very close to proto-cuneiform TI and thus possibly designating a large number of "bows and arrows."[19]

The *decimal system* (Figs. 5.6a–b) was used to count discrete objects in proto-Elamite texts; it has no proto-cuneiform counterpart. A handful of texts offer fully reconstructable calculations of counted objects with summations on reverse tablet surfaces and thus a clear interpretation of the absolute values represented by the individual signs of the system. For example, Scheil (1923:no. 45), contains individual entries on the obverse surface representing 94 + 69 + 147 + 44 + 50 + 112 + 75 subsumed in a notation on the reverse surface equaling 591 ($5N_{23}$ $9N_{14}$ N_1) of counted M388 ().[20] For individual groups of small cattle (M346, ), Scheil (1905:no. 212; also Nissen *et al.* 1993:93–95) in like manner records notations representing 22 + 9 + 18 + 16 head, subsumed in a notation on the reverse surface equaling 65 ($6N_{14}$ $5N_1$).[21] Accounts such as Scheil (1935:no. 205; Fig. 5.6a) with the sequence

$$N_{51} \leftarrow N_{23} \leftarrow N_{14} \leftarrow N_1,$$

for instance in line 1, N_{51} $7N_{23}$ $7N_{14}$ $4N_1$ (and see the accounts Scheil [1923:nos. 19, 86, 105, and 275–277]), confirm the structure of the numerical system as reconstructed in Fig. 5.6a, while the use of the sign N_{54} as the bundling unit above 1,000 is evident in only two texts, Mecquenem (1949: no. 31) and an unpublished Susa account in the Louvre. Each exhibits the use

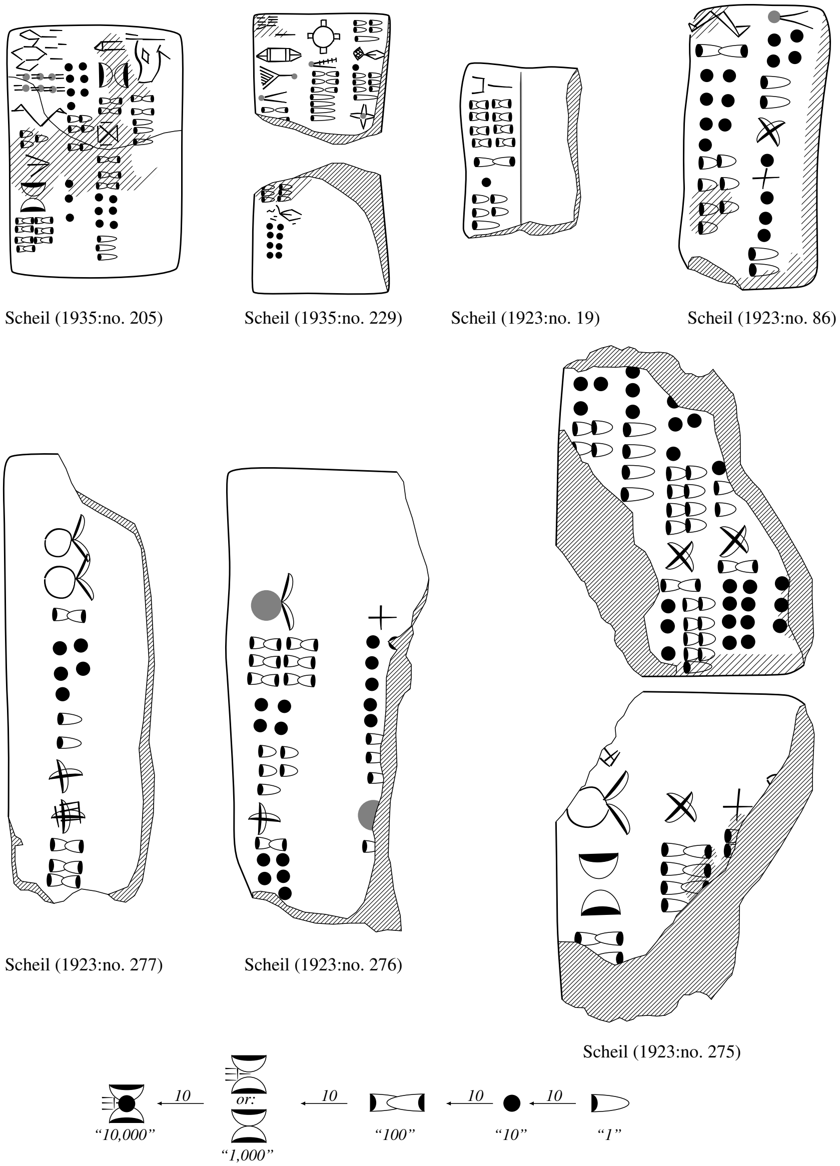
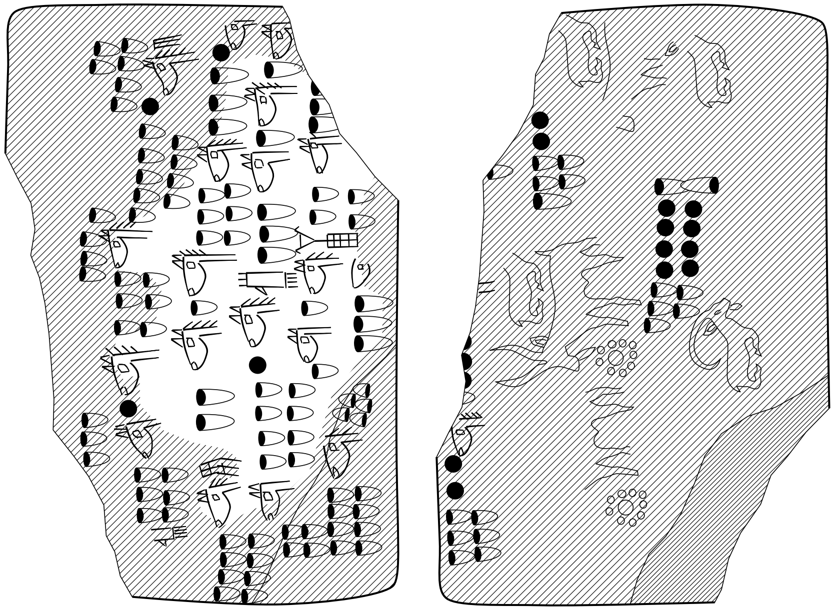


Fig. 5.6a Attestations of the decimal system.

of this number sign qualified with a graph resembling the proto-cuneiform sign GAL, "large." Although it would be tempting to imagine a relationship with Semitic /*riba*/ attested in the Ebla corpus, it would seem more likely that the graph is a form of gunification[22] used to differentiate this system clearly from the bisexagesimal system and its higher value signs N_{51} and N_{54} representing 120 and 1,200, respectively.



Scheil (1923:no. 105)

Fig. 5.6b Attestations of the decimal system.

The proto-cuneiform sexagesimal system was used to register *all* discrete objects with the exception of rations. Its field of application is shared in archaic Persia by the proto-Elamite sexagesimal system presumably loaned directly from Mesopotamia, and by a native proto-Elamite decimal system restricted to living beings, including animals *and* humans of low status. This categorization may be taxonomically relevant in our understanding of the world view of ancient Persians. Mesopotamian tradition established a dual gender system of animate and non-animate, whereby non-animate objects included animals and, charged with some ambivalence, occasionally household chattel and state slave laborers.[23] The proto-Elamite sexagesimal system may have been used to count objects of high, the decimal system to count objects of low, prestige. As an import from what was seen as a culturally advanced population, the sexagesimal system and the objects it was used to qualify might have enjoyed the status of prestige and power; the native decimal system may have been relegated to a qualifier of low-prestige humans and animals, in substantially the same fashion as Late Uruk Babylonian scribes treated dependent laborers KUR_a and SAL in their accounts. These were recorded with a tablet format wholly parallel to that employed in the bookkeeping of domesticated animals; the only difference between the two types of accounts was the inclusion of personal names in those concerning laborers (Englund 1998: 176–180).

It should be noted that both the sign representing 1,000 (N_{51}) and that representing 100 (N_{23}) in the proto-Elamite corpus, as well as apparently a spate of other numerical signs including N_{28} (¼ N_{39} in the grain capacity system) and N_{34} ("60" in the sexagesimal and bisexagesimal systems), were used ideographically, or perhaps more likely phonetically in contexts strongly suggesting they formed parts of personal designations.[24] This frequent usage of numerical signs in non-numerical and non-metrological context should form a particular target of future attempts to reach a language decipherment of the proto-Elamite writing system.

The *bisexagesimal system* (Fig. 5.7) shows only minor differences in its structure and field of application relative to the same system in proto-cuneiform accounts. It was used to record barley rations and other cereal products in the form of discrete objects.[25] These barley products were themselves represented by numerical signs from the lower size registers of the grain capacity system, for instance in the text Scheil (1923:no. 421) with N_{30c} qualified by a bisexagesimal notation including $4N_{51}$ and $2[+n]N_{14}$, or in the text Scheil (1935:no. 50), with N_{30d} followed by a notation representing 120 + 60 units.[26] Other grain products are represented by a combination of low-register capacity signs and an ideogram, for instance the sign contained in the texts Scheil (1905:no. 388, and 1935:nos. 27, 125, 386) in Fig. 5.7.[27] Further, as in proto-cuneiform texts, proto-Elamite records of grain products can evidently insert grain equivalents of processed items. For example, the text Scheil (1905:no. 388) records various vessels that are followed by notations in the sexagesimal system and accompanied by dry grain products qualified in the bisexagesimal system. All entries were transferred into a grain capacity notation on the reverse surface of the tablet. A sufficient number of these accounts will permit us to determine the capacity typologies of the vessels used in proto-Elamite administration.[28]

There is no evidence of a proto-Elamite system comparable to the derived proto-cuneiform bisexagesimal system B* characterized by the addition of horizontal and vertical strokes to individual members of the related signs. Instead, proto-Elamite shows a derivation from the basic system in that an entire bisexagesimal notation can be framed with discontinuous strokes (therefore conventionally and mnemonically referred to as $B^{\#}$). The basic and this derived system can be added together, for instance in the account Scheil (1935:no. 27), combining $4N_{51}$ $4N_{14}$ + [$N_{34\#}$ $2N_{14\#}$] + $6N_{51}$ + $N_{34\#}$ (520 + 80 + 720 + 60) in a common total N_{54} N_{51} N_{34} (1380), in contrast to the bisexagesimal systems in proto-cuneiform documents. The use of the proto-Elamite $B^{\#}$ system exclusively with grain products, and its graphic similarity to the derived proto-Elamite grain capacity system $Š^{\#}$ (see below)

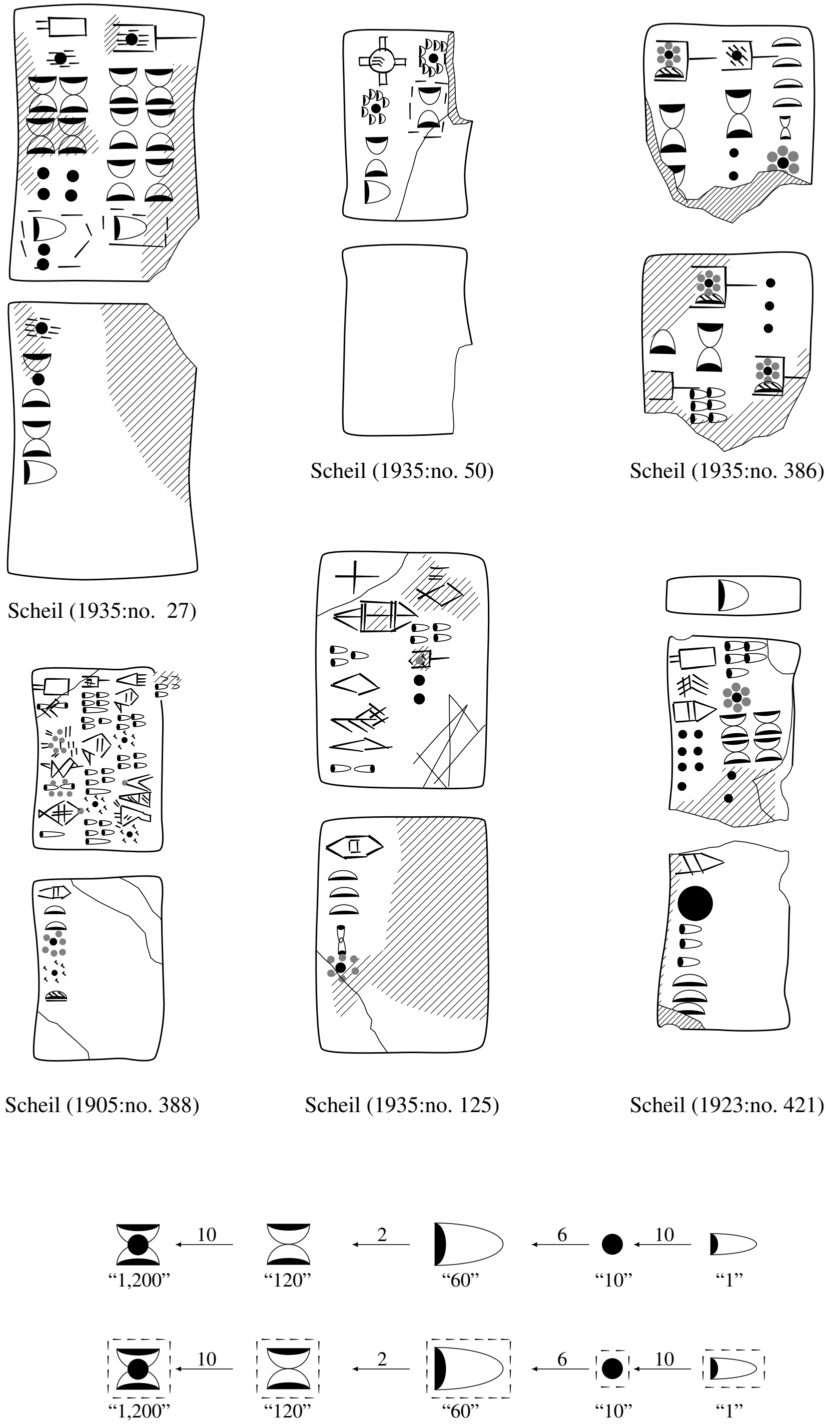


Fig. 5.7 Attestations of the bisexagesimal system.

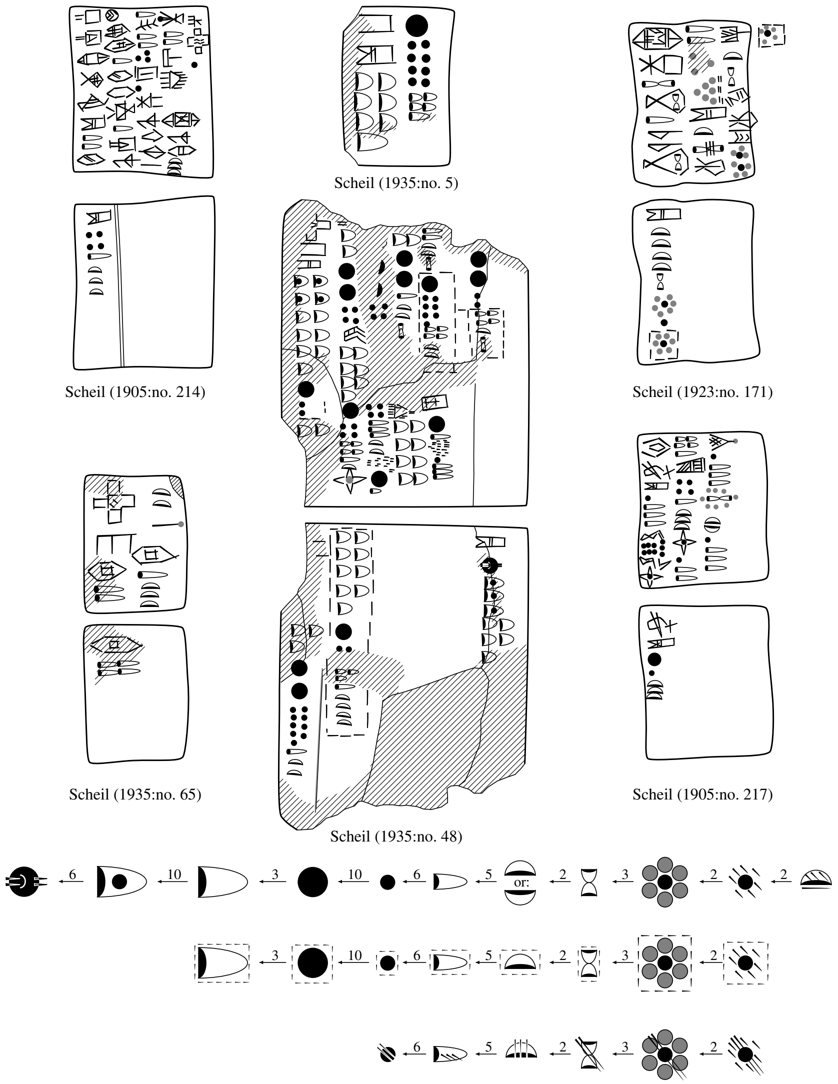


Fig. 5.8a Attestations of the grain capacity system.

suggests that $B^{\#}$ was used to register grain products containing amounts of grain recorded in the derived $Š^{\#}$ system. This would therefore imply that the basic system B recorded unprocessed grains, the derived system $B^{\#}$ products of those grains, including flour or simply cracked barley, along with breads and possibly malts.

One primary and two derived *grain capacity systems* (Fig. 5.8a) employ signs of the sexagesimal system, yet with entirely different arithmetical

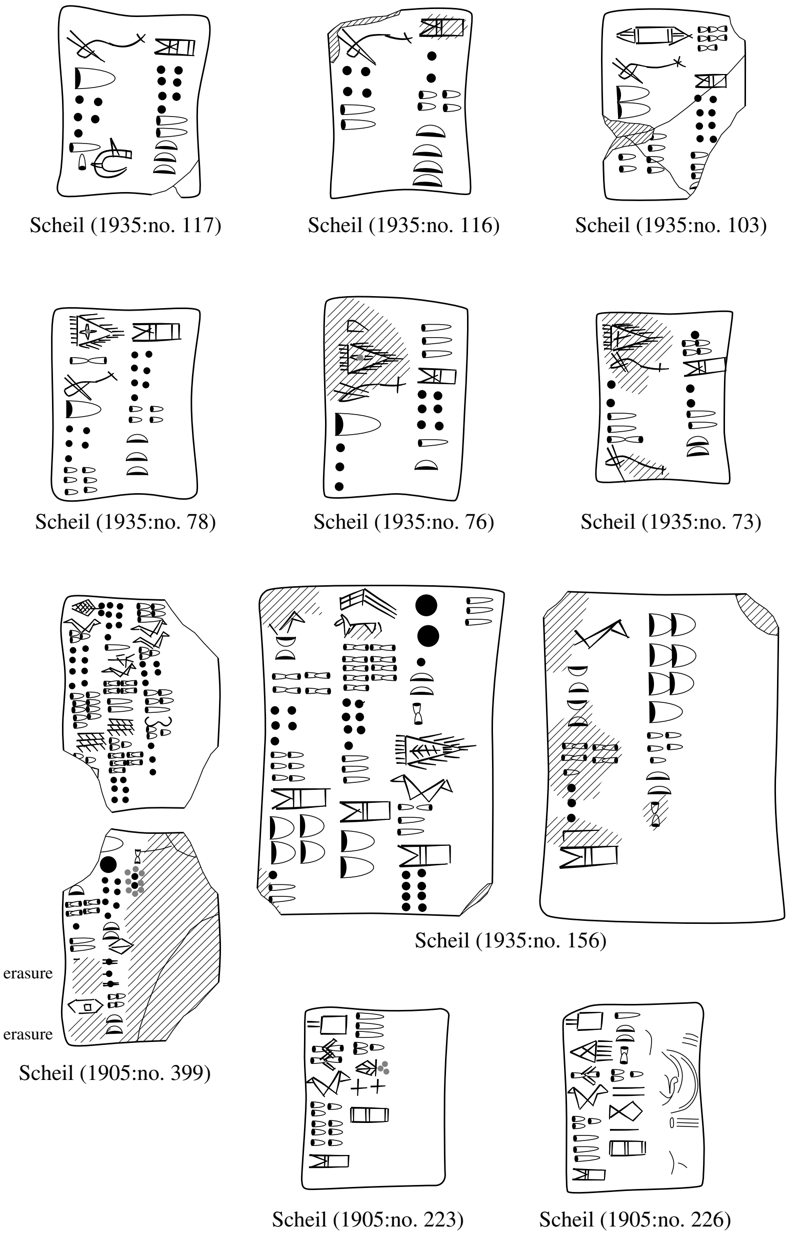


Fig. 5.8b PLOW = $2N_{39b}$, YOKE = $2\frac{1}{2}\ N_{39b}$ ($\frac{1}{2}\ N_1$).

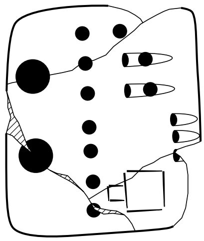
values.[29] This system is as well attested in the proto-Elamite as in the proto-cuneiform sources, and seems to have the same field of application. In particular, the small units of the system are, in the same manner as in Mesopotamia, used as qualifying ideograms for grain products, thus denoting the quantity of grain in one unit of the product (Fig. 5.7). Contrary to the complex proto-cuneiform system of fractions represented by signs of the system below N_{39}, units in the proto-Elamite system are multiples of each other, including linearization down to $\frac{1}{12}$ and $\frac{1}{24}$ of N_{39b}.[30] Accounts such as Scheil (1935:no. 48) with the sequence

$$N_{48} \leftarrow N_{34} \leftarrow N_{45} \leftarrow N_{14} \leftarrow N_{1} \leftarrow N_{39b} \leftarrow N_{24},$$

and Scheil (1923:no. 171) (both Fig. 5.8a) with the sequence

$$N_{39} \leftarrow N_{24} \leftarrow N_{39c},$$

clearly demonstrate the correspondence between the Babylonian and Persian basic systems. Numerical capacity systems derived from the primary system are as common in proto-Elamite texts as are such systems in proto-cuneiform. Best attested is the system $Š^{\#}$, which seems related to the framed bisexagesimal system and probably is the functional equivalent of the proto-cuneiform system $Š^{*}$ used to qualify measures of processed grain. A further derived system with individual signs in a notation qualified with two or more additional impressed bars is graphically similar to the proto-cuneiform system ŠE", which, based above all on its resemblance to the later Sumerian sign *zíz*, has been interpreted to represent measures of emmer wheat.[31] Evidence concerning the absolute size of measures represented by the signs of the proto-Elamite grain capacity systems is, as with proto-cuneiform, very meager. Although the occurrence of both beveled-rim bowls and very nearly the same numerical systems for grain measures in archaic Persia as in Mesopotamia might indicate that the absolute volumes these numerical signs represented were the same in both administrative centers, we must remember that the proto-Elamite grain capacity system includes a sign in the lower range less than $\frac{1}{2}$ as large as the smallest arithmetically determined member of the proto-cuneiform system. A mean value of 0.6 liters for the beveled-rim bowls in Susa would have the smallest measure corresponding to just 0.15 liter, a measure which seems too small in an administration concerned with, at the least, measures of daily rations.[32] Numerous proto-Elamite texts indicate, moreover, that the signs representing worker categories were equated to $\frac{1}{2}$ of a basic unit of grain. If these texts followed Babylonian tradition, they most likely recorded the regular monthly rations of dependent workers, so that $\frac{1}{2}$  should



Scheil (1935:no. 5224)

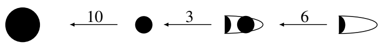


Fig. 5.9 Attestations of the area system.

approximately correspond to a one-month ration for a worker in contemporaneous Mesopotamia. Proto-Elamite grain numerical signs might therefore have represented measures roughly twice as large as those in Mesopotamia.[33]

A substantial number of proto-Elamite accounts attest to a standardized relationship of a given amount of grain recorded in the grain capacity system to a discrete number of objects qualified as YOKE (M54) or PLOW (M56; Fig. 5.8b). For instance, Scheil (1935:no. 117) contains two numerical notations qualifying M56 and the "gur" sign M288 ( ). The first records $111\frac{1}{2}$ M56, the second $7N_{14}$ $2N_{1}$ $3N_{39b}$, that is, $223N_{39b}$ of grain, corresponding to exactly $2N_{39b}$ grain per M56. On the other hand, the large account Scheil (1935:no. 156) contains in its summation the notations M54 $2N_{51}$ $5N_{23}$ $3N_{14}$ N_{1}, or 2,531 M54, followed by M288 $7N_{34}$ $5N_{1}$ $2N_{39b}$ N_{24}, or $6{,}327\frac{1}{2}N_{39b}$, resulting in the exact relationship of $2\frac{1}{2}N_{39b}$ (= $\frac{1}{2}N_{1}$) per M54. Peter Damerow and I have interpreted these texts as representing grain distributions for the sowing of fields, whereby M54/YOKE is a sign for seeding workmen or workmen and their plow animals, M56/PLOW a sign for a measure of plowed and sowed field (Damerow and Englund 1989:57–58, no. 159).

Among the proto-Elamite texts, only Scheil (1935:no. 5224) contains a notation which may have been written in a numerical system used to register *surface measures* (Fig. 5.9). The diagrammed system assumes that the sign representing "10 BÙR" ("BUR′U") in the proto-Elamite corpus replaced the normal sign N_{50} of proto-cuneiform documents, although it must be remembered that its unique occurrence might act as evidence *against* the

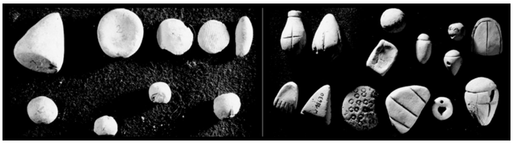


Fig. 5.10 Examples of simple (left) and complex (right) "tokens" from Uruk (digital images courtesy of CDLI).

use of this Babylonian system in Persia, given also the fact that we have reason to believe that the sign M56 discussed above may have served as a measure of arable land, registered in the sexagesimal system.[34] Format and text layout of Scheil (1935:no. 5224), moreover, give the impression of a true proto-cuneiform tablet, so that one might suspect that despite its possibly irregular use of the sign N_{45} this text was imported from Babylonia.

Precursors

Western Persia has been of particular interest to historians of early Mesopotamian history, since as Babylonian hinterland it always enjoyed a very close – oftentimes a desperately close – relationship with the early civilizations of the river plains. Indeed, as a more immediate source of items of trade and plunder, Persia was a natural partner of southern Mesopotamia, more so than ancient Syria to the northwest. For this reason, the Uruk Expansion of the fourth millennium BC is best attested in the Persian settlements of Susa, Choga Mish, and Godin Tepe. Above all, Susa demonstrates in its archaeological record a development parallel to that of Uruk, so parallel in fact that one might wonder who was influencing whom. In this Late Uruk period of shared culture, the most striking diagnostic features were the common use of seals and the development of writing as an administrative tool.

H. Nissen (1983:83–98, 1999:41–50) has emphasized the prehistoric means of administrative communication which in part led to the development of proto-cuneiform, including the use of stamp and then cylinder seals. He makes these claims in part on the basis of material presented in an array of articles and now a monograph by D. Schmandt-Besserat (1992), according to which archaic cuneiform derived from a prehistoric Near Eastern system of administration characterized by the use of small clay markers she terms "tokens" (see Fig. 5.10). The Susiana finds of both simple and complex tokens from the latter half of the fourth millennium BC represent possible evidence of a borrowing from southern Mesopotamia during the Late Uruk period, a prehistoric phase at the close of which the

Fig. 5.11 Examples of sealed (top), sealed and impressed (middle) bullae, and a "numerical" tablet (all from Susa – top: Sb 1932; middle: Sb 1940; bottom: Sb 2313; digital images courtesy of CDLI).

proto-cuneiform writing system was developed in Uruk. Schmandt-Besserat goes on to cite evidence of the close relationship between Uruk and Susa in the period immediately before the first Uruk IVa tablets, characterized above all at both of these centers by the insertion of tokens into clay balls, the outer surface of which was decorated with the impression of a cylinder seal. The next step in this scheme is the impression of those same tokens on the outer surface of the balls. Finally, immediately before the emergence of pictography, a flat, token-less clay tablet replaced the function of the earlier balls (Fig. 5.11).

Stratigraphically insensitive work at Susa by the mining engineers de Morgan and de Mecquenem – both laboring in a less sophisticated era of

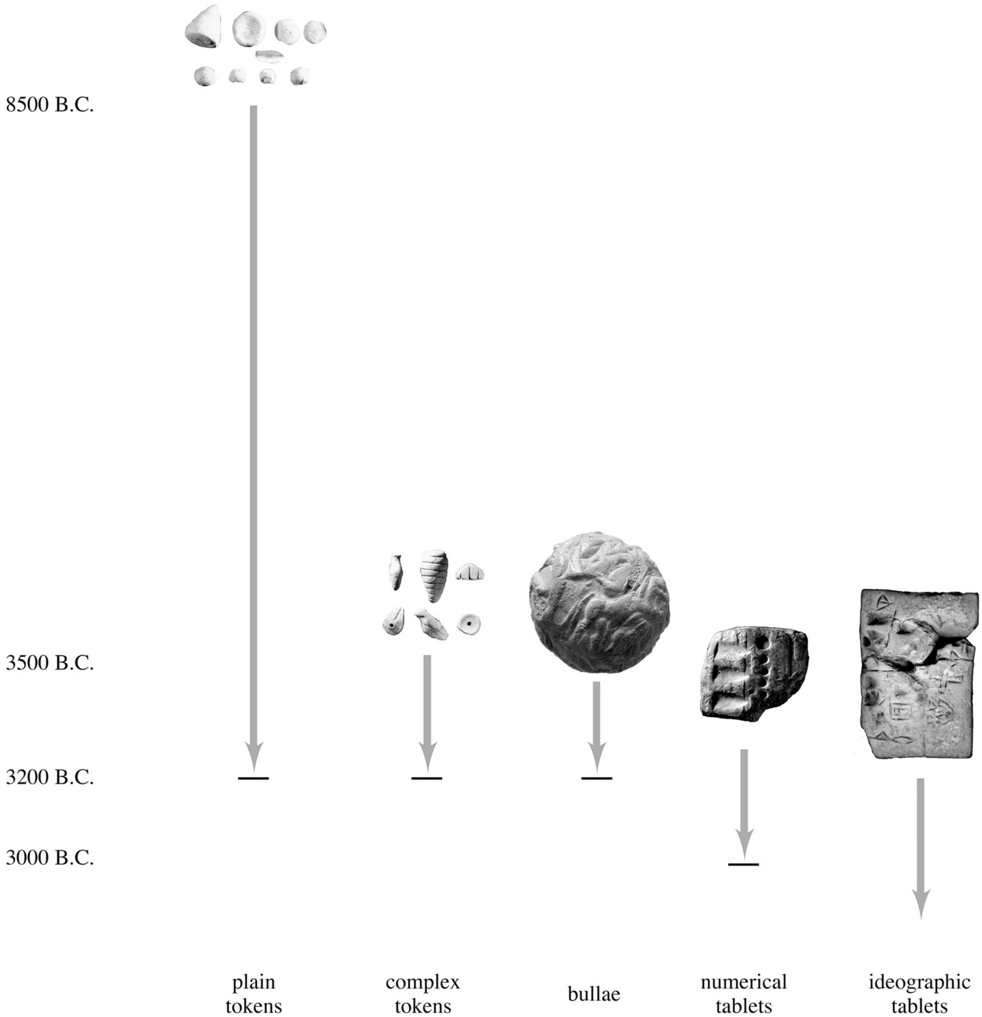


Fig. 5.12 Development of cuneiform, after Schmandt-Besserat (1992).

archaeological method – heavily disturbed the evidence we might expect from the single largest Persian settlement of the fourth millennium BC. The scheme devised by Schmandt-Besserat (Fig. 5.12) nevertheless fits well with the stratigraphic sequences outlined by Le Breton (1957:79–124) and improved upon by subsequent excavations at Susa and other Late Uruk and proto-Elamite sites in Persia.[35] Thus, the bullae with enclosed tokens derive primarily from level Susa 18, numerical tablets from level 17, and proto-Elamite tablets from 16–14. Architectural seriation by German archaeologists at Uruk has presented us with a confusing chronology from the

Babylonian locus of these developments. Neither the context of the bullae W 20987 from Uruk (Damerow and Meinzer 1995:7–33 + pls. 1–4) nor that of the numerical tablets from the area of the so-called "Red Temple" was undisturbed in antiquity, so that at the most we can state that the evidence from Uruk does not contradict that from Susa.[36]

Accordingly, Uruk and Late Uruk precursors of writing in Mesopotamia and Persia can be tentatively divided into a *period of early tokens* prior to *c.* 3500 BC, in which simply formed geometric clay counters were used in an ad hoc fashion to record simple deliveries of goods, primarily grain and animal products of local economies. This was followed by a *period of clay envelopes*, *c.* 3500–3400 BC, in which these same geometric clay counters with some further ideographic differentiations were enclosed in clay envelopes, and these envelopes were covered with impressions from cylinder seals. The outer surfaces of some envelopes were impressed with counters in a one-to-one correspondence to the enclosed pieces. The subsequent *period of early numerical tablets*, *c.* 3400–3350 BC, is characterized by flat and rounded clay tablets, sealed and unsealed, that were impressed with counters or with styli cut and shaped to imitate counters, thus representing numerical notations. In the *period of late numerical tablets*, *c.* 3350–3300 BC, flat and rectangular-shaped sealed clay tablets were impressed with styli to record numerical notations. Finally, during the last Late Uruk *period of numero-ideographic tablets*, *c.* 3300 BC, flat and rectangular-shaped sealed clay tablets were impressed with styli to record numerical notations and one, or at most two, ideograms. All ideograms represented the objects of the transaction, including sheep and goats and products derived from them, above all textiles and dairy oils (Englund 1998:214–215).

The Late Uruk loan

Interestingly, numerical tablets found in Susa coincide, according to more recent French examination of Susa stratigraphy, with the retreat of the cultural influence exerted by southern Babylonia over Persia and Syria *c.* 3300 BC, that is, at precisely the moment when Uruk succumbed to administrative pressures and began keeping complex written records. Sufficient evidence may be found in the proto-Elamite texts to support this moment in time, corresponding to the architectural level IVa at Uruk, as the period of final direct contact between Uruk and Susa. In the first place, there is general evidence that the proto-Elamite accounting system was strongly influenced by proto-cuneiform, including, in a sequence of increasing importance, the use of

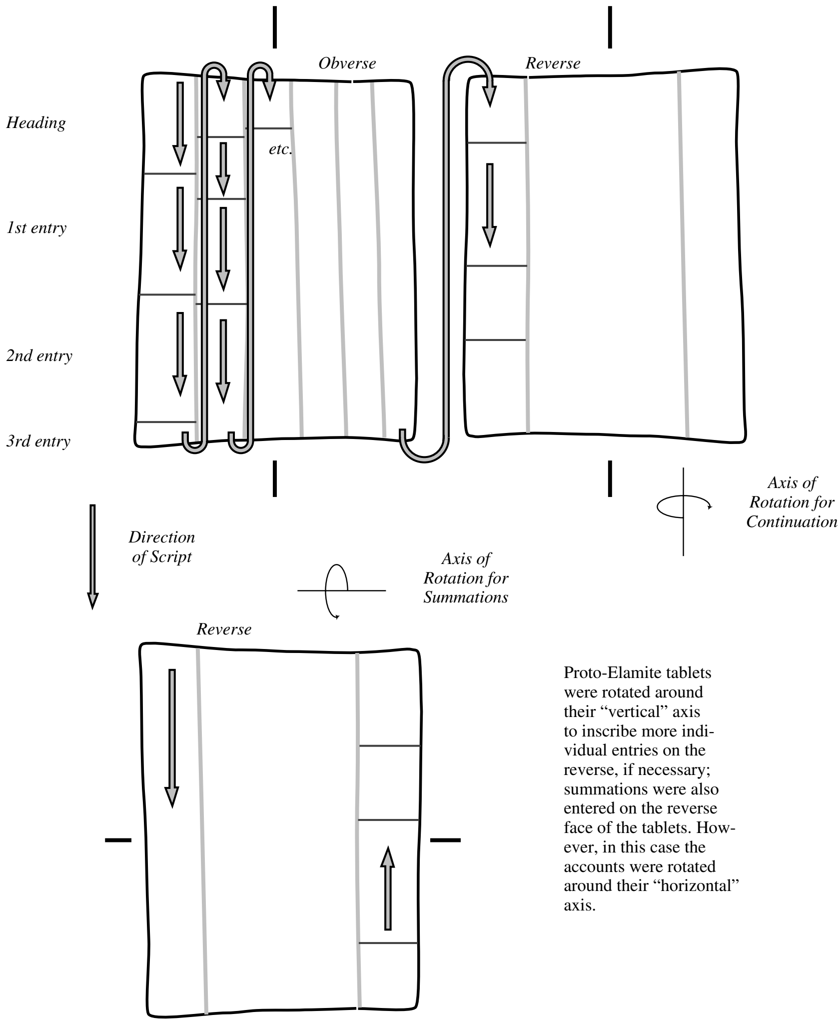
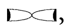
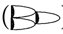


Fig. 5.13 Complex tablet rotation among proto-Elamite tablets (Scheil 1905:no. 4997).

- the same material for writing (clay and evidently a reed or wood stylus);[37]
- the same tablet format (usually *c.* 3:2) relative to the direction of writing;
- seals on the surfaces of bullae and the earliest texts (numerical tablets), whereas seals were not used later, when presumably ideograms replaced them in function;
- comparable accounting formats, according to which summations of numerical data on accounts were, as a rule, recorded on the reverse face of the tablets;

- the same rotation of tablets (simple and complex, Fig. 5.13). When more space for separate entries was required than available on the obverse of a tablet, the scribe continued these entries on the reverse, flipping the tablet over on its vertical axis. Totals were then inscribed by returning to the obverse face of the tablet and flipping it on its horizontal axis, as was normal practice in texts which had only such totals on their reverse faces;[38]
- the same numerical signs and sign systems, but including the derivative use of bisexagesimal signs for the 1,000 and 10,000 steps of the decimal system found only in Elam (the sign for "100," , itself follows the productive method of placing two signs in opposition to form the next bundling step in the system); and of
- the same sign repertoires for humans and animals, including collective designations (Fig. 5.14). For instance, the proto-Elamite tablet Scheil (1923:no. 45), contains an account of various groups of persons qualified with the sign M388 (), totaling 591, as noted on the reverse of the text (Fig. 5.15). We have found very similar representations of persons designated KUR$_a$ () in the often discussed "slave labor" accounts of Uruk and Jemdet Nasr. Moreover, further qualifications of related signs (Fig. 5.14), for instance the fact that the proto-Elamite sign closely resembling the proto-cuneiform sign TUR is itself qualified with signs which seem clearly to represent male and female slaves, would seem to indicate a borrowing of these signs and sign combinations from Mesopotamia.

Susa stratigraphy and a relative chronology between Babylonia and the Susiana have helped generally to date the inception of the proto-Elamite system of writing to the Jemdet Nasr / Uruk III phase of Mesopotamia. It was noted above that the linearity and the apparently developed separation of semantics and syntax of proto-Elamite writing are evidence of a more advanced system than that of proto-cuneiform, in which much of the syntactical burden of the texts was carried by a complex format consisting of cases and subcases. This historical argument further supports a relative sequence of Uruk IV texts from Babylonia followed by Uruk III texts in the same region and, contemporaneously, proto-Elamite texts from Persia. However, if we attempt to define more precisely the period of borrowing, then several features of proto-Elamite script are suggestive of contact between Susa and Uruk during the early Uruk IVa period. These include:

- use of N$_{39b}$ () in grain capacity notations, as was the rule in proto-cuneiform texts from the earliest writing phase, following which

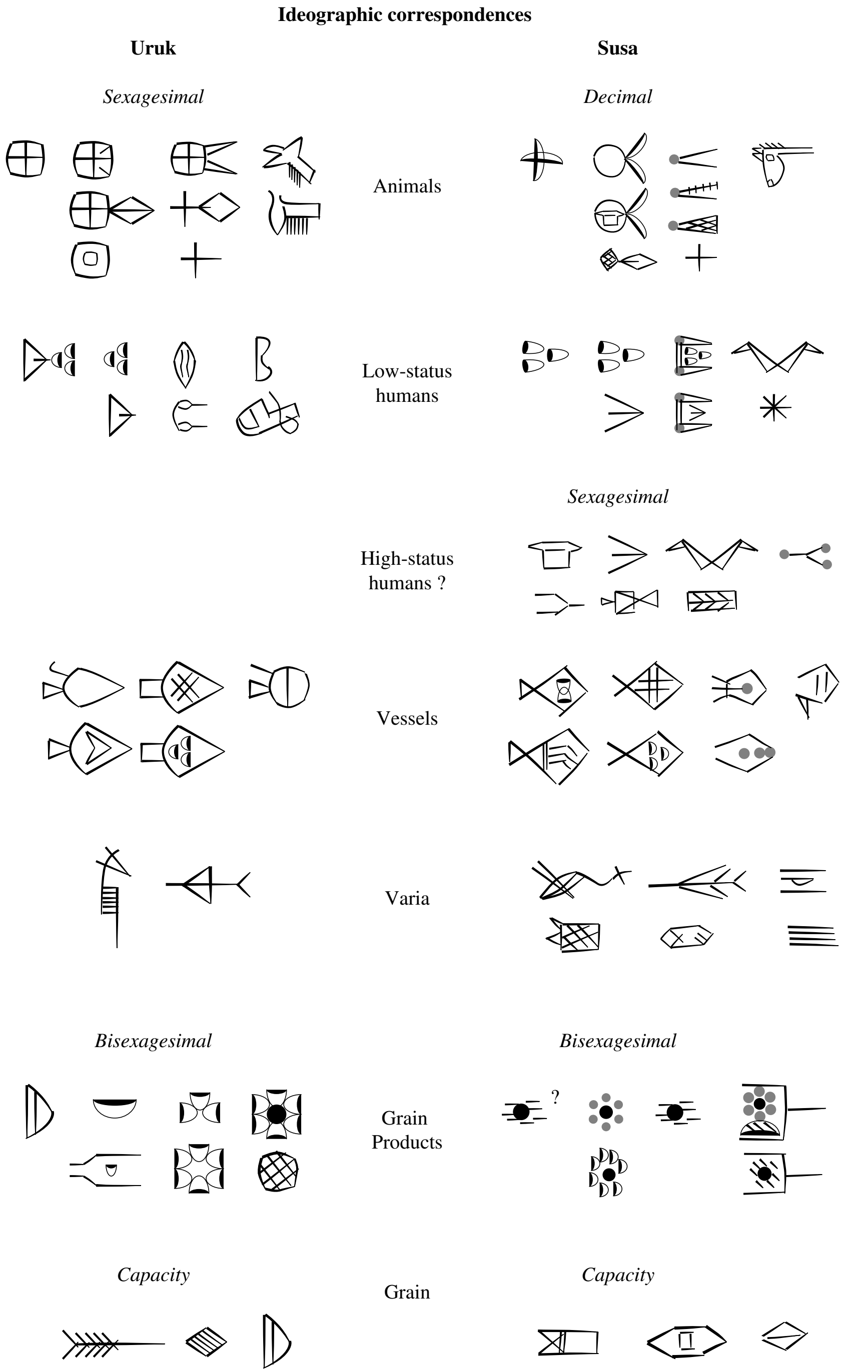


Fig. 5.14 Semantic and graphic correspondences between proto-cuneiform and proto-Elamite ideograms.

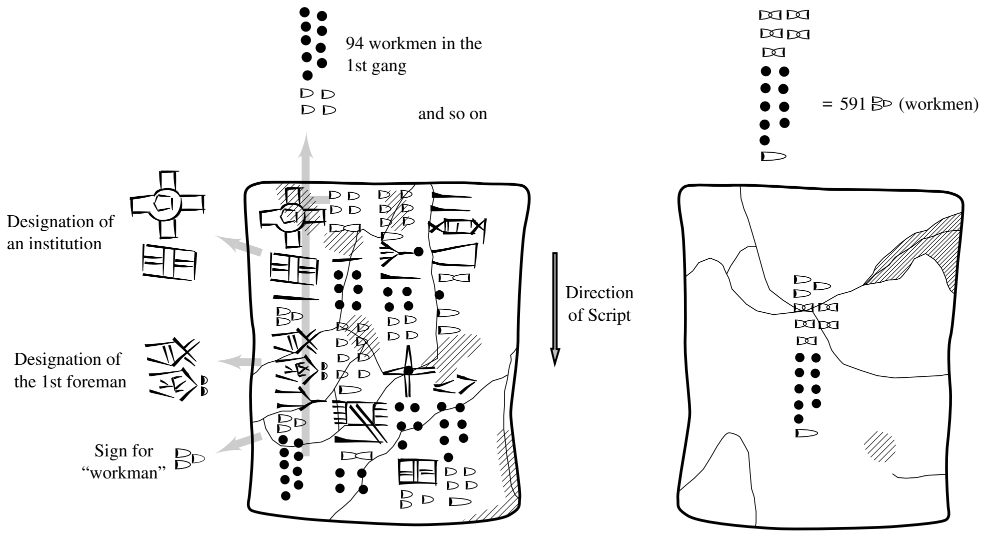


Fig. 5.15 Scheil (1923:no. 45), an account of 7 labor gangs, totaling 591 workmen.

(in the Jemdet Nasr/Uruk III period) Babylonian scribes used exclusively the inverted sign form N_{39a};[39]

- use of the same dividing lines formed with the shank of a stylus. This is a feature known only, but generally, in the numerical tablets from both Uruk (IVa) and Susa (17, Fig. 5.16);
- the same high occurrence of apparent sign variants as an indication of inchoate standardization (this may in fact be a means for the internal dating of the proto-Elamite tablets in a relative sequence, since we should expect to find more and more agreement on particular graphs, as is the case in Uruk).
- the same earliest ideograms. The most telling evidence of continuing contact between Uruk and Susa into the earliest phase of writing is found in a comparison of a number of tablets from both cities which combine the elements of numerical tablets (numerical notations, seal impressions, stylus shank dividers) with one, and at most two, apparent ideograms. I count about a dozen of these texts from unclear Uruk find spots – the stratigraphy of tablets from that settlement is impossible to reconstruct – including both purely numerical and ideographic tablets of phase IVa (Fig. 5.17), and several from Susa, Godin, and possibly Sialk in Persia (Fig. 5.18). A simple comparison (Fig. 5.20) of the signs found in this context would seem to show that at least in the case of this first block at the top the same sign is found in both centers.[40] Note that although the topmost signs would correspond nicely with a type of "complex" token found in nearly all token

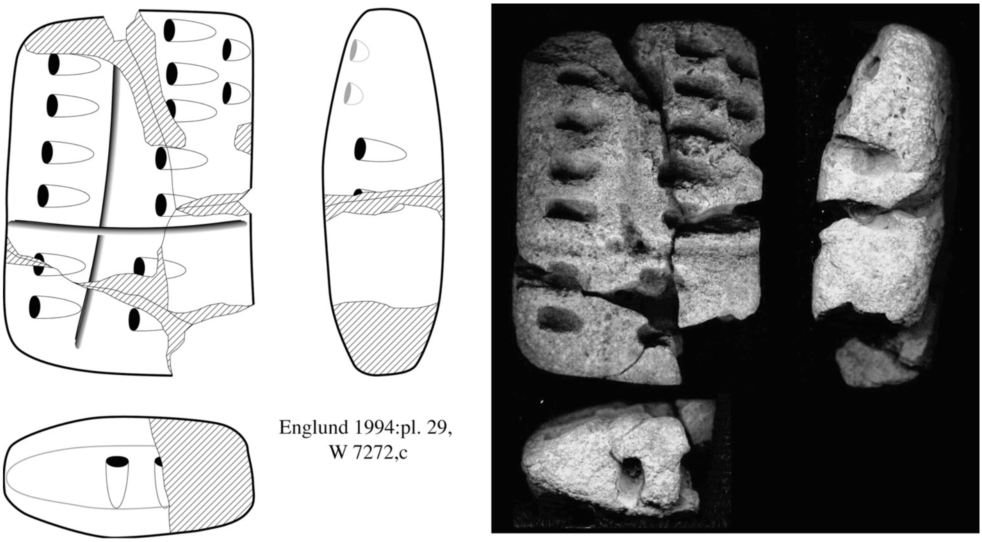


Fig. 5.16 Stylus shank case dividers on a numerical tablet from Uruk (digital image of original courtesy of CDLI).

deposits and equated by Schmandt-Besserat and others to the later sign KU_3 ("precious metal"), such tokens are more likely to represent the fraction "$\frac{1}{2}$" of a metrological unit from the archaic liquid capacity system based on a ceramic vessel containing butter oil (Englund 1998:168, fig. 61).

Conclusion

The prospects of discovering script characteristics that could lead to a decipherment of proto-Elamite are not great, but there are some areas of promise. In the first place, the proto-Elamite texts do contain sign sequences which are distinctly longer than the average of those from Mesopotamia. The texts are therefore more likely to contain language-based syntactical information than the very cursory notations in proto-cuneiform documents. There is, however, a more important, second point. Statistical analysis of text transliterations should point toward meaningful sign combinations of a fixed sign sequence which could reflect speech (Fig. 5.20). Further, the "proto-Elamites" are not entirely foreign to us. We can assume that they were a people who used a decimal system to count discrete objects, and some of their number words, in particular the words for "hundred" and "thousand," may have been used syllabically. In proto-Elamite accounts, the numerical notations *follow* counted objects and their qualifications. This deviation stands in contrast to Mesopotamian tradition (we have of late seen only one

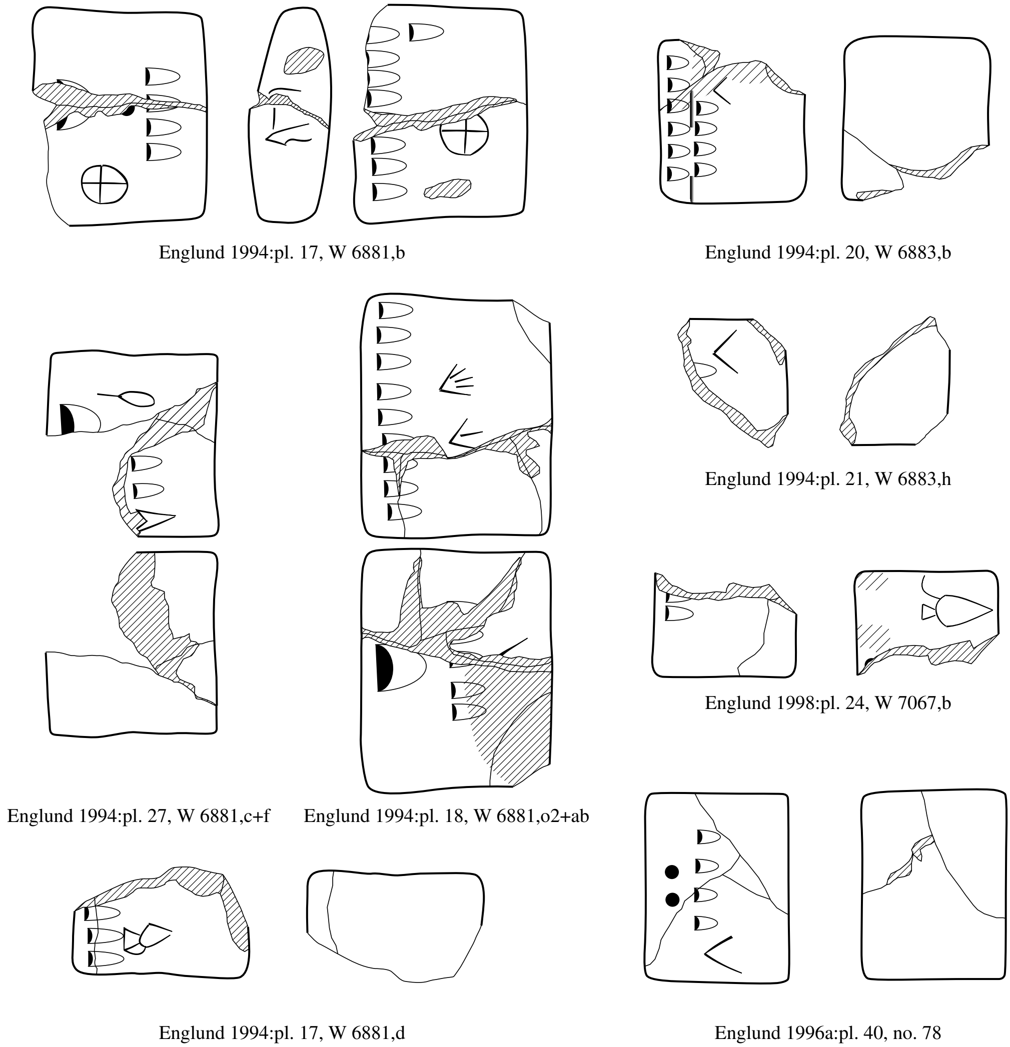
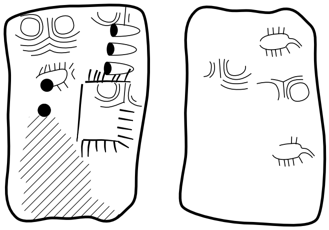


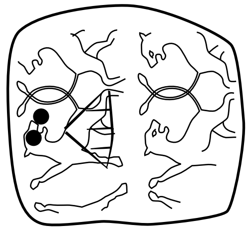
Fig. 5.17 Uruk "numero-ideographic" texts.

other example of such a convention, namely in the 24th-century BC accounts from Syrian Tell Beydar), and more importantly in contrast to the first ideographic tradition in Persia itself, that is, in the numero-ideographic tablets from Susa and Godin Tepe presumably imposed on the local population by Babylonian accountants.[41] We might therefore speculate that our so-called "proto-Elamite" derived from a language whose numerical qualifications were post-positional.

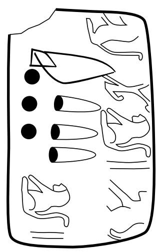
A first step in the reevaluation of the proto-Elamite text corpus is necessarily the electronic transliteration of all texts. CDLI staff have completed



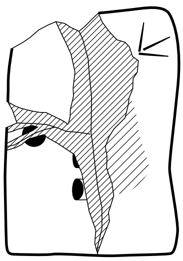
Scheil (1923:no. 106)



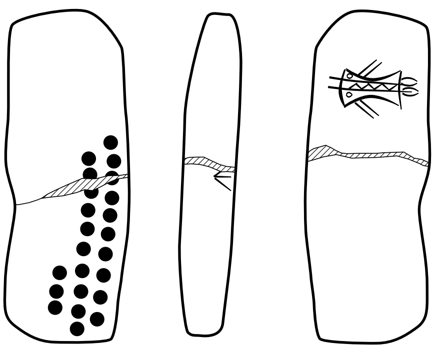
Amiet (1972:no. 474)



Weiss and Young (1975:9 no. 2)



Amiet (1972:no. 604)



Ghirshman (1938:no. 1631)(?)

Fig. 5.18 Persian "numero-ideographic" texts.

this task, and are now beginning a new graphotactical examination of the texts. The following list demonstrates the use to which these data might be put. The proto-Elamite sign M371 (two round impressions connected by a single stroke) appears in the accounts in initial, intermediate, and final position, in altogether over 300 attestations.[42] As seems evident from attestations of the sign in initial and final position, it represents a discrete object counted in the sexagesimal or decimal system. A quick check of the sources confirms that the system is in fact sexagesimal. Scheil (1905:no. 391), for instance, contains clear sexagesimal notations ($1N_{34}$, $2N_{34}$) of

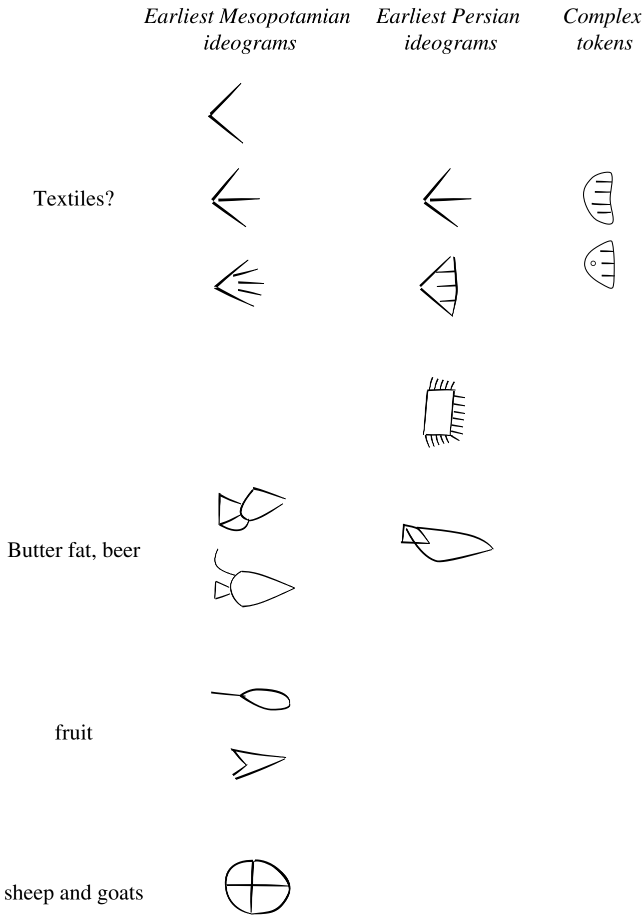


Fig. 5.19 A comparison of "numero-ideograms" in Mesopotamia and Persia.

objects including M371. Scheil (1923:no. 94) and other accounts imply that M371 is related to the proto-Elamite sign for male laborers (M388), possibly – since M371 is not reckoned in the decimal system – in a supervisory capacity.

1) *M371 in initial and final position*

Scheil (1935:no. 107)	O0101	INIT&FINAL**M371**
Scheil (1923:no. 139)	O0102	INIT&FINAL**M371** [ ]
Scheil (1923:no. 162)	O0102	INIT&FINAL**M371** $1N_1$
Mecquenem (1949:no. 029)	O0103	INIT&FINAL**M371** $2N_1$
Scheil (1923:no. 299)	O0104	INIT&FINAL**M371** $1N_1$
Scheil (1935:no. 5207)	O0104	INIT&FINAL**M371** $1N_{39b}$
Scheil (1935:no. 5196)	O0104	INIT&FINAL**M371** $3N_1$

Scheil (1935:no. 020)	O0105	INIT& FINAL**M371** $1N_{14}$
Scheil (1935:no. 264)	O0106	INIT&FINAL**M371** $1N_{14}$ $2N_1$
Scheil (1923:no. 248)	O0108	INIT&FINAL**M371** $2N_1$
Scheil (1935:no. 052)	O0109	INIT&FINAL**M371** $1N_1$
Scheil (1923:no. 437)	O0110	INIT&FINAL**M371** [ ]
Scheil (1935:no. 329)	O0110	INIT&FINAL**M371** $1N_1$
Scheil (1905:no. 215)	O0111	INIT&FINAL**M371** $1N_1$
Scheil (1935:no. 002)	O0114	INIT&FINAL**M371** $1N_{14}$
Scheil (1935:no. 0335)	O0118	INIT&FINAL**M371** $2N_1$ $2N_{39b}$
Scheil (1935:no. 342)	O0123	INIT&FINAL**M371** $6N_1$
Scheil (1923:no. 292)	O0217	INIT&FINAL**M371** [ ]
Scheil (1905:no. 391)	R0102	INIT&FINAL**M371** $1N_{34}$
Scheil (1935:no. 342)	R0104	INIT&FINAL**M371** $1N_{14}$ $8N_1$

2) *M371 in initial position, sorted according to following signs*

Scheil (1935:no. 218)	O0109	INIT**M371** $M3_b$ $2N_1$
Scheil (1905:no. 343)	O0112	INIT**M371** M9 INTER**M371** $M3_c$ $2N_1$
Scheil (1923:no. 121)	R0101	INIT**M371** M9 FINAL**M371** $2N_{39b}$
Scheil (1935:no. 5019)	O0103	INIT**M371** M9 FINAL**M371** $1N_1$
Scheil (1905:no. 344)	O0105	INIT**M371** M32 M96 $M329^?$ [ ]
Scheil (1935:no. 5206)	O0105	INIT**M371** $M36_o$ $1N_{14\#}$
Scheil (1935:no. 256)	O0102	INIT**M371** M54 $1N_{14}$ $7N_1$
Scheil (1923:no. 474)	O0103	INIT**M371** M139 $M296_c$ [ ]
Scheil (1905:no. 213)	O0109	INIT**M371** $M207_a{}^?$ M376 $4N_{14}$ $7N_1$
Scheil (1935:no. 311)	O0109	INIT**M371** M218 $1N_1$
Scheil (1923:no. 450)	O0105	INIT**M371** M218 M220 $M132_b$ M263 $2N_1$
Scheil (1905:no. 380)	O0105	INIT**M371** M263 [ ]
Scheil (1935:no. 468)	O0103	INIT**M371** M263 $2N_1$
Scheil (1905:no. 293)	O0111	INIT**M371** M263 M96 X M243 X [ ]
Scheil (1905:no. 292)	O0109	INIT**M371** $M295_k$ $M66^?$ M376 $1N_{8a}$
Scheil (1905:no. 389)	O0103	INIT**M371** $M298^?$ $4N_{14}$ $4N_{39b}$
Mecquenem (1949:no. 014)	O0102	INIT**M371** M325 M376 $4N_{14}$
Scheil (1905:no. 243)	O0106	INIT**M371** $M332_d{}^?$ M218 $1N_1$
Scheil (1905:no. 204)	O0106	INIT**M371** M346 $2N_1$
Scheil (1923:no. 292)	O0242	INIT**M371** $M370_c$ $1N_1$
Scheil (1923:no. 292)	O0241	INIT**M371** INTER**M371** $M124_c{}^?$ $1N_1$
Scheil (1923:no. 345)	O0102	INIT**M371** M376 $5N_1$
Scheil (1935:no. 284)	O0109	INIT**M371** M387 [ ]
Scheil (1935:no. 5037)	O0102	INIT**M371** M387 M9 $M264_b$ $3N_1$
Scheil (1935:no. 5207)	R0102	INIT**M371** X M118 M9
Scheil (1935:no. 5055)	O0111	INIT**M371** X M131 M263 X $1N_1$
Scheil (1905:no. 319)	O0110	INIT**M371** X M218 $1N_1$
Scheil (1905:no. 5002)	O0109	INIT**M371** X M218 $1N_{39b}$
Scheil (1905:no. 300)	R0101	INIT**M371** X X M218 X $1N_1$

3) *M371 in intermediate position, sorted according to immediately preceding signs*

Scheil (1923:no. 112)	R0116	M387 M372$_{a}$ M388 M296$_{c}$ M1 INTER**M371** M317 1N$_{1}$
Scheil (1905:no. 290)	O0110	X M1 INTER**M371** M1 1N$_{1}$ [ ]
Scheil (1923:no. 112)	R0114	M51 M388 M302$_{e}$ M3$_{b}$ INTER**M371** M317 1N$_{1}$
Scheil (1923:no. 112)	O0113	M112$_{o}$ M388 M24$_{c}$ M3$_{b}$ INTER**M371** M317 1N$_{1}$
Scheil (1905:no. 316)	R0107	M9 INTER**M371** M54 [ ]
Scheil (1935:no. 330)	O0109	M9 INTER**M371** M218 3N$_{14}$ 4N$_{1}$
Scheil (1905:no. 213)	O0104	M149$_{a}$ M246$_{g}$ M9 INTER**M371** M376 4N$_{14}$ 5N$_{1}$ 1N$_{?}$
Scheil (1905:no. 267)	R0105	M318$^{?}$ M9 INTER**M371** M288 4N$_{1}$ 4N$_{39b}$
Scheil (1935:no. 401)	R0103	M364 M9 INTER**M371** M288 1N$_{1}$
Scheil (1905:no. 240)	O0102	M377 M124$_{a}$ M48$_{d}$ M9 INTER**M371** M301$^{?}$ X INTER**M371** M348 1N$_{39b}$
Scheil (1923:no. 468)	O0106	X M9 INTER**M371** M288 1N$_{14}$
Scheil (1905:no. 311)	O0108	X M24 INTER**M371** M376 M370 X [ ]
Scheil (1935:no. 472)	O0109	M32 INTER**M371** M317 1N$_{1}$
Scheil (1905:no. 4999)	O0103	M263$_{a}$ M33 INTER**M371** M288 6N$_{14}$ 1N$_{1}$
Scheil (1923:no. 023)	O0103	X M33 INTER**M371** M288 3N$_{1}$
Scheil (1905:no. 369)	O0102	M181 M38$_{a}$ INTER**M371** M269$_{d}$ 1N$_{1}$
Scheil (1905:no. 369)	O0106	M38$_{l}$ INTER**M371** M264$_{a}$ 1N$_{1}$
Scheil (1935:no. 400)	O0102	M54 INTER**M371** M243$_{g}$ 1N$_{1}$
DE (1989:no. 11)	O0116	M388 M72 INTER**M371** M346 6N$_{1}$
Scheil (1923:no. 059)	O0102	M237 M263 M73$_{q}$ INTER**M371** M288 2N$_{14}$ 1N$_{1}$
Scheil (1935:no. 218)	O0102	M75$_{h}$ INTER**M371** M3$_{c}$ 1N$_{1}$
Scheil (1905:no. 258)	O0102	[ ] M388 M57$_{c}$ M96 INTER**M371** M288 4N$_{1}$ [ ]
Scheil (1923:no. 414)	O0106	M240$_{i}$ M132$_{a}$ M99 INTER**M371** M288$_{k}$ 1N$_{1}$
Scheil (1905:no. 240)	O0103	M110 INTER**M371** M346 M24 M434 M68$^{?}$ M266 M241 1N$_{39b}$
Scheil (1923:no. 292)	O0170	M388 M218 M110 INTER**M371** M3$_{b}$ 1N$_{1}$
Scheil (1923:no. 292)	O0221	M388 M387 M263$_{a}$ M110 INTER**M371** M352 M3$_{b}$ 1N$_{1}$
Scheil (1905:no. 267)	O0102	M124$_{a}$ INTER**M371** M9 M288 2N$_{1}$ 4N$_{39b}$
Scheil (1923:no. 157)	O0107	M124$_{a}$ INTER**M371** M9 INTER**M371** M288
Scheil (1935:no. 017)	O0102	M128$_{d}$ INTER**M371** X M290$_{c}$ 1N$_{14}$
Scheil (1905:no. 4997)	R0106	X M388 M139 INTER**M371** M291 M388 M373 1N$_{14}$ 1N$_{1}$
Scheil (1923:no. 217)	O0102	M145$_{a}$ INTER**M371** M297 1N$_{39b}$
Scheil (1935:no. 033)	O0102	M196 M147$_{e}$ M145$_{a}$ INTER**M371** M56 M288 3N$_{1}$

Scheil (1935:no. 0295)	O0104	M388 M145$_a$ inter**M371** M154
Scheil (1935:no. 4766)	O0106	M106 M323 M388 M145$_a$ inter**M371** M36 4N$_1$
Scheil (1905:no. 351)	O0102	M388 M146 inter**M371** M297 2N$_{14}$
Scheil (1905:no. 319)	R0112	M139 M388 M146$_b$ inter**M371** M263 M218 M346 1N$_{14}$ 4N$_1$
Scheil (1905:no. 241)	O0102	M325$_d$ M388 M146$_b$ inter**M371** M29$^?$ [ ]
DE (1989:no. 11)	O0111	M388 M206$_b$ inter**M371** M346 7N$_1$
Scheil (1935:no. 400)	O0109	M132 M48 M219 M218 inter**M371** M377$_e$ M390 finalM371 1N$_1$
Scheil (1905:no. 292)	O0110	M311$_b$ M388 M218 inter**M371** M218 [ ] [ ]
Scheil (1923:no. 292)	O0204	M388 M219 inter**M371** M3$_b$ 1N$_1$
Scheil (1935:no. 129)	O0102	M305 M388 M222 inter**M371** M387 M20 M263$_a$ 8N$_1$
Scheil (1935:no. 271)	O0102	M305 M388 M226$_c$ inter**M371** M264$_h$ 1N$_1$
Scheil (1923:no. 153)	O0109	M124$_a$ M372 M229$_h$ inter**M371** M132$_a$ X M218 M288$_f$ [ ]
Scheil (1923:no. 112)	O0109	M387$_l$ M372$_a$ M388 X M229$_m$ inter**M371** M317 1N$_1$
Scheil (1923:no. 112)	R0102	M51 M388 M218 M229$_n$ inter**M371** M317 1N$_1$
Scheil (1923:no. 185)	O0112	M233 inter**M371** M288 1N$_1$
Scheil (1905:no. 391)	O0102	M157 M374 M9 M388 X M233$_b$ inter**M371** M149$_a$ 8N$_1$
Scheil (1905:no. 212)	O0103	M342$^?$ M388 M4 M235$_a$ inter**M371** M346 2N$_{14}$ 2N$_1$
Scheil (1935:no. 218)	O0113	M4 M240 inter**M371** M54 8N$_1$
Scheil (1923:no. 292)	O0167	X M240$^?$ inter**M371** M3$_b$ M388 [ ]
Scheil (1935:no. 340)	O0106	M377 M254$_c$ inter**M371** M297 1N$_{30c}$
Scheil (1905:no. 309)	O0103	[ ] M351 M255 inter**M371** M288 [ ]
Scheil (1905:no. 205)	O0104	M218$_a$ M259$_c$ inter**M371** M223 X 1N$_1$
Scheil (1905:no. 353)	O0102	M305 M388 M218 M259$_m$ inter**M371** M33 M66$^?$ M346 3N$_1$
Mecquenem (1949:no. 024)	O0103	M291 inter**M371** M320 1N$_1$
Scheil (1935:no. 4758)	O0102	M175 M181 M124$_c$ X M297 inter**M371** M297 M377 X X M124 M226$_f$ M101 X X 1N$_1$
Mecquenem (1949:no. 030)	O0102	X M376 M388 M364 M317$_c$ inter**M371** M288 2N$_1$
Scheil (1905:no. 222)	O0102a	M365 M388 M57 M318$_a$ inter**M371** M388 4N$_1$ [ ]
Scheil (1905:no. 205)	O0103	M102$_d$ M318$_a$ inter**M371** M297 M150$_d$ 1N$_1$
Scheil (1923:no. 345)	O0101	M9 M318$_b$ inter**M371** M321$_a$ [ ]
Scheil (1923:no. 317)	O0102	M388 M9 M318$_b$ inter**M371** M36$_b$ [ ]

Scheil (1923:no. 148)	O0102	M388 M218 M364$^{?}$ M320$_{h}$ INTER**M371** M288$_{i}$ 4N$_{14}$ 2N$_{1}$
Scheil (1923:no. 043)	O0108	M240 M347 INTER**M371** M217$_{c}$ 1N$_{1}$
Scheil (1923:no. 490)	R0106	M387$_{a}$ M377$_{e}$ M347 INTER**M371** M288 1N$_{1}$
Scheil (1905:no. 4994)	O0107	M111 M388 M387N M318$_{a}$ X M377$_{e}$ M347 INTER**M371** M36$_{e}$ 5N$_{1}$
Scheil (1935:no. 353)	O0108	M218 M266 M373 INTER**M371** M101 M266 M283$_{e}$ X M266 3N$_{1}$
Scheil (1905:no. 258)	O0105	M380 INTER**M371** M38$_{i}^{?}$ M295$_{s}^{?}$ M218$_{a}$ 4N$_{1}$
Scheil (1905:no. 4997)	O0107	M388 INTER**M371** M117 M68$_{d}^{?}$ 1N$_{14}$ 1N$_{1}$
Mecquenem (1949:no. 031)	O0102	M388 INTER**M371** M263 M314$_{f}$ X X M301 M372 X [ ]
Scheil (1923:no. 159)	O0103	M195 M388 INTER**M371** M387 X [ ]
Mecquenem (1949:no. 004)	R0107	X M388 M263 M390 INTER**M371** M288 2N$_{1}$
Mecquenem (1949:no. 037)	O0109	M377$_{e}$ M390 INTER**M371** M388 M377$_{e}$ X X [ ]
Scheil (1935:no. 5218)	O0102	M388 M146$_{b}$ M377$_{e}$ M390 INTER**M371** M54 1N$_{1}$
Scheil (1905:no. 4996)	O0103	M263 X X M390 INTER**M371** M288 1N$_{14}$

4) *M371 in intermediate position, sorted according to following signs*

Scheil (1905:no. 290)	O0110	X M1 INTER**M371** M1 1N$_{1}$ [ ]
Scheil (1923:no. 292)	O0170	M388 M218 M110 INTER**M371** M3$_{b}$ 1N$_{1}$
Scheil (1923:no. 292)	O0204	M388 M219 INTER**M371** M3$_{b}$ 1N$_{1}$
Scheil (1935:no. 0298)	O0102	X M377 M263 X INTER**M371** M3$_{b}$ [ ]
Scheil (1923:no. 292)	O0167	X M240$^{?}$ INTER**M371** M3$_{b}$ M388 [ ]
Scheil (1935:no. 218)	O0102	M75$_{h}$ INTER**M371** M3$_{c}$ 1N$_{1}$
Scheil (1923:no. 098)	O0111	M96 X INTER**M371** M9 1N$_{30c}$
Scheil (1923:no. 157)	O0107	M124$_{a}$ INTER**M371** M9 INTER**M371** M288
Scheil (1905:no. 267)	O0102	M124$_{a}$ INTER**M371** M9 M288 2N$_{1}$ 4N$_{39b}$
Scheil (1905:no. 353)	O0102	M305 M388 M218 M259$_{m}$ INTER**M371** M33 M66$^{?}$ M346 3N$_{1}$
Scheil (1935:no. 4766)	O0106	M106 M323 M388 M145$_{a}$ INTER**M371** M36 4N$_{1}$
Scheil (1923:no. 317)	O0102	M388 M9 M318$_{b}$ INTER**M371** M36 [ ]
Scheil (1905:no. 4994)	O0107	M111 M388 M387N M318$_{a}$ X M377$_{e}$ M347 INTER**M371** M36$_{e}$ 5N$_{1}$
Scheil (1935:no. 5218)	O0102	M388 M146$_{b}$ M377$_{e}$ M390 INTER**M371** M54 1N$_{1}$
Scheil (1905:no. 246)	O0119	[ ] X INTER**M371** M54 1N$_{1}$
Scheil (1905:no. 316)	R0107	M9 INTER**M371** M54 [ ]
Scheil (1935:no. 218)	O0113	M4 M240 INTER**M371** M54 8N$_{1}$

Scheil (1935:no. 033)	O0102	M196 M147$_e$ M145$_a$ INTER**M371** M56 M288 3N$_1$
Scheil (1935:no. 353)	O0108	M218 M266 M373 INTER**M371** M101 M266 M283$_e$ X M266 3N$_1$
Scheil (1923:no. 357)	O0105	X INTER**M371** M112$_f$ M36$_o$ 4N$_1$
Scheil (1905:no. 4997)	O0107	M388 INTER**M371** M117 M68$_d$$^?$ 1N$_{14}$ 1N$_1$
Scheil (1923:no. 153)	O0109	M124$_a$ M372 M229$_h$ INTER**M371** M132$_a$ X M218 M288$_f$ [ ]
Scheil (1905:no. 306)	O0103	[ ] INTER**M371** M141M54 X 1N$_{39b}$
Scheil (1905:no. 391)	O0102	M157 M374 M9 M388 X M233$_b$ INTER**M371** M149$_a$ 8N$_1$
Scheil (1935:no. 0295)	O0104	M388 M145$_a$ INTER**M371** M154
Scheil (1935:no. 5043)	O0103	M388 X INTER**M371** M154$_r$ [ ]
Scheil (1923:no. 043)	O0108	M240 M347 INTER**M371** M217$_c$ 1N$_1$
Scheil (1905:no. 293)	O0112	X INTER**M371** M218 1N$_{14}$
Scheil (1935:no. 330)	O0109	M9 INTER**M371** M218 3N$_{14}$ 4N$_1$
Scheil (1905:no. 292)	O0110	M311$_b$ M388 M218 INTER**M371** M218 [ ] [ ]
Scheil (1923:no. 292)	O0109	X INTER**M371** M218 M376$_a$$^?$ 1N$_1$
Scheil (1905:no. 205)	O0104	M218$_a$ M259$_c$ INTER**M371** M223 X 1N$_1$
Scheil (1923:no. 073)	O0120	M218 M259$^?$ INTER**M371** M223$_c$ M218 2N$_1$
Scheil (1935:no. 400)	O0102	M54 INTER**M371** M243$_g$ 1N$_1$
Scheil (1905:no. 319)	R0112	M139 M388 M146$_b$ INTER**M371** M263 M218 M346 1N$_{14}$ 4N$_1$
Mecquenem (1949:no. 031)	O0102	M388 INTER**M371** M263 M314$_f$ X X M301 M372 X [ ]
Scheil (1905:no. 369)	O0106	M38$_l$ INTER**M371** M264$_a$ 1N$_1$
Scheil (1935:no. 271)	O0102	M305 M388 M226$_c$ INTER**M371** M264$_h$ 1N$_1$
Scheil (1905:no. 369)	O0102	M181 M38$_a$ INTER**M371** M269$_d$ 1N$_1$
Scheil (1905:no. 258)	O0102	[ ] M388 M57$_c$ M96 INTER**M371** M288 4N$_1$ [ ]
Scheil (1905:no. 267)	R0105	M318$^?$ M9 INTER**M371** M288 4N$_1$ 4N$_{39b}$
Scheil (1905:no. 309)	O0103	[ ] M351 M255 INTER**M371** M288 [ ]
Scheil (1905:no. 4996)	O0103	M263 X X M390 INTER**M371** M288 1N$_{14}$
Scheil (1905:no. 4999)	O0103	M263$_a$ M33 INTER**M371** M288 6N$_{14}$ 1N$_1$
Scheil (1923:no. 023)	O0103	X M33 INTER**M371** M288 3N$_1$
Scheil (1923:no. 059)	O0102	M237 M263 M73$_q$ INTER**M371** M288 2N$_{14}$ 1N$_1$
Scheil (1923:no. 185)	O0112	M233 INTER**M371** M288 1N$_1$
Scheil (1923:no. 468)	O0106	X M9 INTER**M371** M288 1N$_{14}$
Scheil (1923:no. 490)	R0106	M387$_a$ M377$_e$ M347 INTER**M371** M288 1N$_1$
Scheil (1935:no. 401)	R0103	M364 M9 INTER**M371** M288 1N$_1$
Mecquenem (1949:no. 004)	R0107	X M388 M263 M390 INTER**M371** M288 2N$_1$
Mecquenem (1949:no. 030)	O0102	X M376 M388 M364 M317$_c$ INTER**M371** M288 2N$_1$

Scheil (1923:no. 148)	O0102	M388 M218 M364$^{?}$ M320$_{h}$ INTER**M371** M288$_{i}$ 4N$_{14}$ 2N$_{1}$
Scheil (1923:no. 414)	O0106	M240$_{i}$ M132$_{a}$ M99 INTER**M371** M288$_{k}$ 1N$_{1}$
Scheil (1905:no. 4997)	R0106	X M388 M139 INTER**M371** M291 M388 M373 1N$_{14}$ 1N$_{1}$
Scheil (1905:no. 351)	O0102	M388 M146 INTER**M371** M297 2N$_{14}$
Scheil (1923:no. 217)	O0102	M145$_{a}$ INTER**M371** M297 1N$_{39b}$
Scheil (1935:no. 340)	O0106	M377 M254$_{c}$ INTER**M371** M297 1N$_{30c}$
Scheil (1905:no. 205)	O0103	M102$_{d}$ M318$_{a}$ INTER**M371** M297 M150$_{d}$ 1N$_{1}$
Scheil (1935:no. 4758)	O0102	M175 M181 M124$_{c}$ X M297 INTER**M371** M297 M377 X X M124 M226$_{f}$ M101 X X 1N$_{1}$
Scheil (1923:no. 112)	O0109	M387$_{l}$ M372$_{a}$ M388 X M229$_{m}$ INTER**M371** M317 1N$_{1}$
Scheil (1923:no. 112)	O0113	M112$_{o}$ M388 M24$_{c}$ M3$_{b}$ INTER**M371** M317 1N$_{1}$
Scheil (1923:no. 112)	R0102	M51 M388 M218 M229N INTER**M371** M317 1N$_{1}$
Scheil (1923:no. 112)	R0114	M51 M388 M302$_{e}$ M3$_{b}$ INTER**M371** M317 1N$_{1}$
Scheil (1923:no. 112)	R0116	M387 M372$_{a}$ M388 M296$_{c}$ M1 INTER**M371** M317 1N$_{1}$
Scheil (1935:no. 472)	O0109	M32 INTER**M371** M317 1N$_{1}$
Mecquenem (1949:no. 024)	O0103	M291 INTER**M371** M320 1N$_{1}$
Scheil (1923:no. 345)	O0101	M9 M318$_{b}$ INTER**M371** M321$_{a}$ [ ]
Scheil (1905:no. 212)	O0103	M342$^{?}$ M388 M4 M235$_{a}$ INTER**M371** M346 2N$_{14}$ 2N$_{1}$
DE (1989:no. 11)	O0111	M388 M206$_{b}$ INTER**M371** M346 7N$_{1}$
DE (1989:no. 11)	O0116	M388 M72 INTER**M371** M346 6N$_{1}$
Scheil (1905:no. 240)	O0103	M110 INTER**M371** M346 M24 M434 M68$^{?}$ M266 M241 1N$_{39b}$
Scheil (1923:no. 292)	O0221	M388 M387 M263$_{a}$ M110 INTER**M371** M352 M3$_{b}$ 1N$_{1}$
Scheil (1905:no. 213)	O0104	M149$_{a}$ M246$_{g}$ M9 INTER**M371** M376 4N$_{14}$ 5N$_{1}$ 1N$_{?}$
Scheil (1905:no. 311)	O0108	X M24 INTER**M371** M376 M370 X [ ]
Scheil (1935:no. 129)	O0102	M305 M388 M222 INTER**M371** M387 M20 M263$_{a}$ 8N$_{1}$
Scheil (1923:no. 159)	O0103	M195 M388 INTER**M371** M387 X [ ]
Scheil (1905:no. 222)	O0102a	M365 M388 M57 M318$_{a}$ INTER**M371** M388 4N$_{1}$ [ ]
Mecquenem (1949:no. 037)	O0109	M377$_{e}$ M390 INTER**M371** M388 M377$_{e}$ X X [ ]

5) *M371 in final position, sorted according to preceding signs*

Scheil (1923:no. 120)	O0132	X $M3_b$ FINAL**M371** $1N_1$
Scheil (1935:no. 286)	O0103	M9 FINAL**M371** $1N_1$
Scheil (1923:no. 292)	O0182	M9 FINAL**M371** $2N_{39b}$
Scheil (1923:no. 240)	O0110	M4 M9 FINAL**M371** $1N_1$
Scheil (1905:no. 362)	O0103	$M29_a$ M9 FINAL**M371** [ ]
Scheil (1923:no. 194)	O0103	$M96^?$ X $M251_b$ M9 FINAL**M371** $1N_1$
Scheil (1905:no. 272)	R0114	M120 M9 FINAL**M371** $3N_1$
Scheil (1935:no. 0333)	O0110	$M124_a$ $M48_c$ M9 FINAL**M371** $1N_1$
Scheil (1923:no. 270)	O0102	M218 X M9 FINAL**M371** [ ]
Scheil (1905:no. 271)	O0103	$M251_c$ M9 FINAL**M371** $4N_{39b}$
Scheil (1905:no. 267)	O0105	$M318_b$ M9 FINAL**M371** $2N_1$ $3N_{39b}$
Scheil (1905:no. 293)	O0106	$M325^?$ M9 FINAL**M371** $2N_{14}$
Scheil (1923:no. 435)	O0107	X M9 FINAL**M371** [ ]
Scheil (1905:no. 311)	O0107	$M124_a$ M370 $M24_a$ FINAL**M371** [ ]
Scheil (1905:no. 4997)	O0112	M388 M373 $M24_a$ FINAL**M371** $1N_{14}$
Scheil (1923:no. 053)	O0102	M9 $M24_d$ FINAL**M371** $1N_1$
Scheil (1923:no. 299)	O0103	$M24_d$ FINAL**M371** [ ]
Scheil (1923:no. 230)	O0105	M32 FINAL**M371** $1N_1$
Scheil (1923:no. 436)	O0109	M32 FINAL**M371** $1N_1$
Scheil (1905:no. 293)	O0116	$M251_c$ M32 FINAL**M371** $1N_{14}$ $1N_1$
Scheil (1905:no. 206)	O0104	M24 M33 FINAL**M371** $1N_{39b}$
Scheil (1923:no. 073)	O0108	M33 FINAL**M371** $1N_{14}$
Scheil (1935:no. 5222)	R0101	X M33 FINAL**M371** $1N_1$
Scheil (1923:no. 120)	O0119	$M387^?$ $M387^?$ M388 M272 M66 FINAL**M371** $1N_1$
Scheil (1905:no. 342)	O0103	M263 $M94_o$ FINAL**M371** [ ]
Scheil (1923:no. 246)	R0101	M99 FINAL**M371** $1N_1$
Scheil (1923:no. 387)	O0106	M99 FINAL**M371** $1N_1$
Scheil (1923:no. 279)	O0113	$M124_a$ M57 M99 FINAL**M371** $1N_1$
Scheil (1905:no. 267)	O0109	M131 M99 FINAL**M371** $1N_1$ [ ]
Scheil (1905:no. 362)	O0106	X M99 FINAL**M371** $2N_1$ $1N_{39b}$
Scheil (1935:no. 330)	R0103	M1 M388 M99 X FINAL**M371**
Scheil (1905:no. 353)	O0103	M104 FINAL**M371** $1N_2$
Scheil (1923:no. 144)	O0106	M110 FINAL**M371** $1N_1$
Scheil (1905:no. 286)	O0108	X $M110_a$ FINAL**M371** $9N_1{}^?$
Scheil (1923:no. 435)	R0103	X M352N $M387_a$ M122 FINAL**M371** $1N_{45}$ $6N_{14}$
Scheil (1923:no. 292)	O0121	$M124_b$ FINAL**M371** $1N_1$
Scheil (1923:no. 031)	O0108	M153 $M145_a$ FINAL**M371** $2N_1$
Scheil (1905:no. 300)	O0108	X $M145_a$ FINAL**M371** $2N_1$
Scheil (1935:no. 5040)	O0103	M146 FINAL**M371** [ ]
Scheil (1923:no. 073)	O0112	M146 FINAL**M371** $1N_1$
Scheil (1923:no. 093)	O0105	M153 FINAL**M371** $1N_1$
Scheil (1905:no. 276)	O0107	X M218 FINAL**M371** $3N_1$
Scheil (1935:no. 4835)	O0104	M296 M388 M96 M225 FINAL**M371** $1N_1$
Scheil (1905:no. 350)	O0103	X $M229_o$ FINAL**M371** $1N_{14}$

Scheil (1905:no. 258)	O0103	[ ] X M4 M233$_c$ FINAL**M371** 5N$_1$
Scheil (1905:no. 212)	O0104	M139 M4 M235$_a$ FINAL**M371** 9N$_1$
Scheil (1905:no. 276)	O0108	M251$_i$ FINAL**M371** 1N$_{8a}$
Scheil (1935:no. 054)	O0108	M254$_c$ FINAL**M371** 1N$_1$
Scheil (1923:no. 292)	O0171	M370 M288 FINAL**M371** [ ]
Scheil (1923:no. 446)	R0102	M291 FINAL**M371** [ ]
Scheil (1935:no. 272)	O0105	M9 M318$_b$ FINAL**M371** 1N$_{14}$ 4N$_1$
Scheil (1935:no. 272)	O0108	M24$_d$ M318$_b$ M318$_b$ FINAL**M371** [ ]
Scheil (1935:no. 400)	O0108	M24$_d$ M318$_b$ M318$_b$ FINAL**M371** 1N$_1$
Scheil (1923:no. 094)	O0109	M387$_a$ M388 M9 M318$_b$ FINAL**M371** 1N$_1$
Scheil (1935:no. 181)	O0104	M9 M318$_c$ FINAL**M371** 1N$_{14}$
Scheil (1935:no. 052)	O0105	M29$_a$ M377$_e$ M347 FINAL**M371** [ ]
Scheil (1923:no. 446)	O0104	M347 FINAL**M371** 1N$_1$
Scheil (1905:no. 272)	O0109	M377$^?$ M347 FINAL**M371** 1N$_1$
Scheil (1935:no. 054)	O0111	M354 FINAL**M371** 1N$_1$
Scheil (1935:no. 252)	O0109	M219 M380 FINAL**M371** 2N$_1$
Scheil (1905:no. 276)	O0105	M386$_a$ M380 FINAL**M371** 2N$_1$ 1N$_{8a}$
Scheil (1923:no. 392)	O0102	X M380 FINAL**M371** 3N$_1$
Scheil (1935:no. 330)	O0105	M254$_a$ M380$_b$ FINAL**M371** 3N$_{14}$ 2N$_1$
Scheil (1923:no. 073)	O0107	M263 M381 FINAL**M371** 3N$_1$
Scheil (1935:no. 284)	O0107	M387$_c$ FINAL**M371** 1N$_1$
Scheil (1923:no. 016)	O0106	M357 M388 M262 M390 FINAL**M371** 1N$_1$
Scheil (1905:no. 274)	O0105	M68 M409 FINAL**M371** 2N$_1$
Scheil (1923:no. 292)	O0138	M124$_a$ M430 FINAL**M371** 1N$_1$
Scheil (1905:no. 4997)	O0106	M388 M24$_c$ M460 FINAL**M371** 1N$_{14}$ 1N$_1$

Fig. 5.20 Example of graphotactical analysis of the proto-Elamite sign Meriggi 371.

At first sight, the sign sequences in entries including M371 seem without recognizable structure or repetition, and in fact there is no immediately striking pattern in the data. This may be an indication that we have been too optimistic in anticipating fixed sign sequences representing, for instance, linguistically meaningful personal names, other proper nouns, or even phonetic elements of spoken language. With a range of between one and fourteen, and a mean of around five non-numerical signs in this long list, any existing pattern should emerge. Nonetheless, interesting elements in the writing system do appear. For instance, three texts in §2 (Scheil 1905:no. 343, 1923:no. 121, 1935:no. 5019) contain the sign M371 twice, separated by just one sign. In each case, this is the sign M9, consisting of two horizontal strokes and possibly denoting as in Babylonia a sense of "doubling" (cf. Scheil 1923:no. 157, obv. vii for the same phenomenon in intermediate position). In the case of M371 in intermediate position, the list exhibits a strong relationship between the referent of M371 and those of a number of other signs, including M9 (double stroke, also found regularly in the position immediately preceding M371 when the latter is in final position, §5), M288 (the "GUR" sign as a general representation of a measure of grain), and M388 ("KUR" representing a male dependent laborer). We also do not need the explicit proof of Scheil (1923:no. 112) rev. 16 (**M387** $M372_a$ M388 $M296_c$ M1 **M371** M317 $1N_1$) with both M387 ("100" in the proto-Elamite decimal system, used ideographically) and M371 in the same line to dispose of the idea that the two signs might be graphic variants, based on a possible association between M388 and M376 (three circular impressions connected by incised strokes) and, for instance, between KUR_a and $3N_{57}$ in the proto-cuneiform texts.[43] A simple comparison of the sign sequences, above all the sign clusters in which M371 is found, makes their association, let alone an allographic relationship between the two, highly unlikely. Further short patterns of sign sequence are in these lines; we are hopeful that a comparison of all such patterns in the proto-Elamite corpus will allow us to formulate some general rules of sign application and so to begin an informed speculation about the nature of the ideographic writing system and its possible relationship to the language of proto-Elamite scribes. For it seems unlikely that they, or their archaic Babylonian brethren, should have been entirely successful in hiding their linguistic affiliation behind the evident formulaic bookkeeping symbols of our earliest texts.

Current work on the proto-Elamite corpus thus can draw on both internal data from the Persian documents, and on comparative data from Babylonia. The Babylonian comparisons pose again the question of the ultimate relationship between the two writing systems. Clearly, proto-Elamite must be reckoned among those cases of secondary script origin known from many non-literate regions in contact with literate cultures. Yet it is too facile to declare that Susa imported this idea of writing, along with some few direct loans, at a time when Babylonia had passed into a second writing phase at least several generations after the origin of proto-cuneiform in Uruk IVa. It is evident from our data that those elements which are direct, or nearly direct, loans from Babylonian tradition, for instance the numerical sign systems used in grain measures, point to a period within, or at the beginning of, and not at the conclusion, of the initial writing phase Uruk IVa. Moreover, the examples of numero-ideographic accounts demonstrate that both centers employed the same signs at the earliest phase of writing development. At this moment, direct loans from Babylonia were frozen in the proto-Elamite system, whereas they were still subject to paleographic variation in Babylonia. In the case of the number sign N_{39}, Uruk scribes of the Uruk IV period had not agreed upon one or the other of two possible forms, N_{39a} () and N_{39b} (; this latter sign form might derive from the use of thumbnails to represent units smaller than the basic unit in grain metrology notations during the period of numerical tablets). By the beginning of the following period Uruk III, standardization had dictated the use of only N_{39a}. Persian accountants chose the equally plausible variant N_{39b} from the Uruk IV pool of signs.

This and other comparable agreements in the proto-Elamite syllabary point to a rapid development of a full writing system once its advantages in the administration were understood. One of the more important tasks ahead of us will be an attempt to eliminate from the current proto-Elamite sign list as many of the very numerous variant forms as possible. We count over 1,900 discrete signs in 26,320 sign occurrences in our transliteration data set, clustered around approximately 500 basic forms. Of the 1,900 forms, however, more than 1,000 occur just once, another 300 only twice in the texts. These numbers are a clear indication that the writing system as it has been transmitted to us was in a stage of flux, in which a scribal tradition had been unable to care for standardization of characters. Nonetheless, these numbers also tell us that the proto-Elamite system, like that of Babylonia, probably consisted of a mix of ideograms and syllabograms and comprised altogether between 600 and 900 discrete signs.

Chronologically, the proto-Elamite system fits well into the development and expansion of Babylonian proto-cuneiform. We may picture the Uruk expansion into Persia and Syria during the fourth millennium, characterized in the history of writing by the appearance of a systematic means of accounting through manipulation of small clay counters whose form indicated both numerical and ideographic qualities. This administrative tool crossed the barrier into transaction representation on one two-dimensional surface, namely on numero-ideographic tablets, when Uruk tradition was still strong in Persia, but the succeeding withdrawal of Babylonian influence, occasioned by developments in the south of Mesopotamia we cannot see, left Persian scribes to their own devices. An apparently continuous administrative apparatus, and a highly adaptable bureaucracy, formed the basis for the development of the proto-Elamite writing system that on its surface seems very foreign, but that on closer inspection reflects much of its Babylonian heritage.

In the meantime, debates continue about the populations which might have been in contact with or even existing within the region of ancient Persia. Given later linguistic evidence, it is likely that an indigenous, Elamite-speaking population was living there in the latter half of the fourth millennium. And clearly elements from the Babylonian south must have had close, possibly adversarial contact with local peoples. There may, however, have been much more population movement in the area than we imagine, including early Hurrian elements and, if Whittaker (1998:111–147), Ivanov, and others are correct, even Indo-Europeans.[44]

Notes

Vector images of proto-Elamite texts included in the present study are for the most part based on the hand copies of their original editors. Tablets in the figures have been collated according to inspections of originals (with sincere thanks due to Beatrice André for her permission to collate the published proto-Elamite texts and to inspect the unpublished Susa tablets housed in the Louvre) or photos. In the illustrations, areas shaded but not enclosed within a line represent surface abrasions, those also within a contour line represent broken surfaces that therefore contain no traces of damaged signs. The question of original tablet orientation will, for reasons given in previous publications, not be addressed here; all copies (unless otherwise noted, at 75 percent of original size) depict tablets as prescribed by publication conventions, that is, rotated 90° counter-clockwise from their original position. Transliterations of numerical notations are based on the treatment of their respective number sign systems by Damerow and Englund (1989:18–28).

1. This initiative (supported by the National Science Foundation under Grant #0000629) represents a natural expansion of the goals of the project Archaische Texte aus Uruk, directed over the last twenty-five years by Hans Nissen of the Free University of Berlin. The CDLI (http://cdli.ucla.edu/) studies all available Mesopotamian administrative texts of the late fourth and the third millennia BC. Babylonia and the Susiana were bound by a close interrelationship during this period, seen above all in the evident borrowings of Babylonian cultural diagnostic ware, including the writing tradition, by Persia. Since the time of the early excavations of both regions, researchers have as a consequence included both proto-Elamite of the late fourth and early third millennia BC, and linear Elamite of the late Old Akkadian period, in their discussions of cuneiform development. The web data set of the CDLI will soon include a full presentation of the proto-Elamite material, drawing on the files and publications of the collaborators Damerow and Englund (1989) and Friberg (1978–1979), and on the electronic transliterations, based on the sign list of Meriggi (1971–1974; the list proper was published in vol. II), now completed by staff member Jacob Dahl. Sign designations, for instance "M388," follow the numbering of the Meriggi list.
2. Together those represent the last phase of the Late Uruk period in Mesopotamia and date to *c.* 3200–3000 BC. Lawler (2001b:32–35, 2001c:36–38) has reported on recent excavations in Iraq, and the wholesale plunder of both Umma, modern

Djokha, and the neighboring Umm al-Aqirib. The history of the 2003 invasion and subsequent occupation of Iraq by US–British forces, with apparent wholesale plunder of established and recent excavation sites, is now being written. According to M. van Ess in Lawler (2001a:2419), the chronology of the proto-cuneiform periods in Uruk might have to be adjusted two centuries backward based on radiocarbon dating of Uruk charcoal remains. See below, n. 36, and J. Cooper's contribution in this volume.

3. See Englund (1988:131–133, n. 9, and 145–146, n. 18, 1998:73–81). A troubling tendency to simplify this discussion to a matter of tendentious speculation can be discerned in the more recent publications of some close to, and many at a fair distance from, the topic. Krebernik (1994:380–385) gave a measured appraisal of possible rebus values of signs in the proto-cuneiform repertoire in his review of M. Green and Nissen (1987); the phonetic readings identified by Steinkeller (1995:689–713, 1995–1996:211–214) are, on the other hand, heavily speculative and in some instances reckless. When, however, these identifications reach the level of treatments twice removed from the original documents, for instance that of Glassner (2000), we are confronted with such statements as "MAŠ+GÁNA – the two signs form a ligature – is *incontestably* [emphasis mine] a loan from the Akkadian *maškanu*, 'area of threshing, small agricultural establishment'" (Glassner 2000:210), which, although a direct borrowing from Steinkeller (and, incidentally, an indirect borrowing from M. Green, one of the original editors of the sign list [Green and Nissen 1987]), is nonetheless an indication of an unnecessarily cavalier attitude toward the proto-cuneiform texts. We need to be aware that the self-indulgent transmission of fantastical etymologies from publication to publication can engender an environment of mistrust with respect to the rigor of a field otherwise prone to great attention to detail.
4. Isolatable personal names are most evident, for instance, in the accounts of "dependent workers" SAL and KUR_a in such proto-cuneiform texts as Englund and Grégoire (1991:nos. 212–222), and Englund (1998:177, W 20274,2 and 23999,1). Of course, we cannot determine in any convincing way the nature of name-giving in the archaic period, particularly insofar as this conservative cultural trait is transmitted through large numbers of "dependent workers" who will have been both ethnically and linguistically diverse, yet it seems out of character that *not one* of the sign combinations evidently representing humans in these texts can plausibly be interpreted as conforming to standard Sumerian practice, whereas the numbers of personal designations from the Early Dynastic I–II period texts from Ur (*c.* 100–200 years after the end of Late Uruk [Burrows 1935]) that are susceptible to such morpho-syntactical and even phonetic analysis is not small (di Vito 1993:23–24; Englund 1998:80, n. 168).
5. Hinz (1987:644) interpreted the indigenous geographical designation *ḫa(l)tamti* identified in much later texts to mean "god's land" from *ḫal* ("land") and tamt ("[gracious] lord"); "Elam" may be an Akkadianized rendering of these terms influenced by *elûm* ("to be high"). "Proto-Elamite" is an artificial term derived

from this geographical designation usually used to describe an historical phase in the Susiana plain and the Iranian highlands situated to the east of Mesopotamia, generally considered to correspond to the Jemdet Nasr / Uruk III and ED I periods in Mesopotamia, but possibly, based on considerations discussed here, to be dated earlier, to the Uruk IVa period. It is represented in Iran by the levels Susa 16-14B (including, possibly, part of 17A) and corresponding levels from other sites (in particular Yahya IVC, Sialk IV.2, and Late Middle Banesh [Banesh Building Level II]). It may be dated to *c.* 3300–3000 BC. The complex stratigraphy of Susa and its relevance to the chronology of the proto-Elamite period will not be considered here (for the French excavations, see N. Chevalier and E. Carter in Harper, Aruz, and Tallon [1992:16–19, 20–24]; Carter and Stolper [1984:103–132]); levels determined in the acropolis excavations of 1969–1971 are cited as generally accepted standards (cf. Le Brun 1971:163–216, and Dittmann 1986a, 1986b:332–366; "Susa 17" = "Susa Acropolis I 17").

6. For proto-Elamite, there are 208 tablets in Scheil (1905), including 2 tablets edited in Scheil (1900), 490 in Scheil (1923), 649 in Scheil (1935), and 50 in Mecquenem (1949), and approximately 40 in various articles (Mecquenem 1956:202; Vallat 1971:figs. 43 and 58, 1973:103; Stolper 1978:94–96). Some 100 unpublished fragments from Susa are in the collection of the Louvre, and 20 more in the Museum of Archaeology and Ethnology of the University of São Paulo. The Teheran Museum, finally, presumably houses all Susa texts from more recent (post- 1950) excavations, the proto-Elamite texts from Tall-i Malyan, of which an unclear number remain unpublished, as well as those from Tepe Yahya and Ozbaki; the collection of the Ecole Biblique, Jerusalem, contains 9 Susa texts presumably deposited there by the Dominican and Susa epigraphist V. Scheil. One proto-Elamite text has been discovered in the estate of Edith Porada (generously reported by M. van der Mieroop; its publication is planned by J. Dahl). See Damerow and Englund (1989:2, n. 4).
7. No more than two texts from the entire collection can be assigned with any likelihood to a non-administrative, perhaps school-exercise, context (Scheil 1923: no. 328; 1935:no. 362).
8. In the absence of a better alternative, however, it has served as the provisional basis for the electronic transliterations entered by CDLI staff insofar as the non-numerical signs are concerned; numerical signs have been transliterated according to the Uruk sign list published in M. Green and Nissen (1987:335–345). See n. 1 above.
9. Meriggi followed three primary assumptions in his analysis of proto-Elamite. First, he presumed it was a genetic relative of later Elamite represented by Linear Elamite of the late Old Akkadian period (in other sources described as "proto-Elamite B"). Second, he believed that isolatable proto-Elamite personal names were written syllabically. Third, he followed an implied rule that the proto-Elamite writing system represented language in rather strict sign sequences. The consequence of this line of thought was to allow the decipherer to test in the

proto-Elamite corpus syllabic readings of signs derived from a list of graphically comparable signs of both periods. See Meriggi (1971–1974, I: 172–220, 1975:105). Although a graphotactical analysis of the proto-Elamite script would seem to deliver some data of statistical interest (see Fig. 5.20), the results of Meriggi's efforts offer little encouragement. There are numerous exceptions to an implied rule of standardized sign sequence, as noted already by W. Brice (1962–1963:28–29 and 32–33). Further, seeming graphic correspondences are notoriously inaccurate and can only be pursued as an avenue of decipherment within the framework of a continuous writing tradition such as that of Babylonia, but even then must be considered highly tentative. Certainly, the use of signs must be shown to derive from comparable text genres and from within parallel contexts in the texts. Given the span of over 800 years unaccounted for between proto- and Old Elamite; given the fact that Linear Elamite was employed only following a period of Old Akkadian domination to record local royal events; and given the high probability of the use in proto-Elamite personal names of logographic signs whose later syllabic values might be seen in the Linear Elamite period, there is, as Gelb (1975:95–104) has also stated, little reason to be optimistic about an eventual language decipherment of proto-Elamite.

10. Notations in the metrological cereal capacity system Š# (see the discussion below) form a notable exception to this rule. The entire notation was encased in a rectangle of etched strokes; longer notations in Š# which could not be accommodated in the remaining space at the bottom of a column were moved to the next column, thus leaving a space in the preceding one.
11. See, for example, the treatment of Scheil (1905:n. 4997) in Nissen, Damerow, and Englund (1993:78–79).
12. Damerow and Englund (1989:15) have noted that the semantic structure of the proto-Elamite texts proves their close conceptual relationship to the proto-cuneiform corpus. Generally, proto-Elamite headings correspond to proto-cuneiform account colophons; entries in proto-Elamite documents correspond to "cases" of proto-cuneiform texts (Fig. 5.3b). It must be kept in mind, however, that the semantic hierarchy of proto-cuneiform texts is frequently represented directly by the graphical arrangement of cases and subcases, while the hierarchical structure of individual proto-Elamite entries is already on the whole a semantic construction. This latter contrast between the semantic and the syntactical structure of the two writing systems – the more developed separation of semantics and syntax evident in the proto-Elamite texts – is a strong indication of the antecedence of the proto-cuneiform corpus.
13. Englund (1994:pl. 26), W 7204, d edge i 1: ⸢5N_{23}⸣ [ ], W 20649 (unpublished), obv. i 1: [ ] ⸢1N_{23}?⸣ 2N_{34} ⸢3N_{14}⸣ [ ]; Damerow and Englund (1987:pl. 60), W 22115,9 rev. i 2: 1N_{23} 1N_{48}; Cavigneaux (1991:143), W 24189, obv. ii 2: 7N_{23} [ ] ⸢BU_a⸣ X [ ] and obv. ii 3: 3N_{23} [ ] 1N_1 X [ ]; an unpublished tablet from the current antiquities market, finally, has rev. iii 1: 2N_{23} 6N_{34} $IŠ_a$ X A

[ ] (this tablet carries the CDLI identifier "P006379"). In the absence of either a meaningful numerical sign sequence including N_{23} (proto-Elamite: "100") – N_{23} in the examples listed above should not be followed by N_{34} ("60" in the sexagesimal system) or N_{48} ("600") – or, for instance, of numerical notations including $6 + N_{14}$ ("10") that cannot be explained as having derived from the capacity or the area systems, no proto-cuneiform notations can be considered likely decimal qualifications.

14. The main reason for this difficulty is the interruption of the paleographic tradition in Elamite sources: later Elamite texts, with the exception of the few Old Elamite linear texts, were written with Babylonian cuneiform. The most successful method in the semantic decipherment of proto-cuneiform signs, namely the establishment of paleographic continuity between archaic and later periods, is thus not applicable in proto-Elamite research. Most of the proto-Elamite ideograms, moreover, are of a substantially more abstracted form than proto-cuneiform ideograms, whose pictographic character is often helpful in semantic analysis; the semantic analysis of proto-Elamite is consequently largely dependent on the examination of contextual sign usages. Proto-Elamite texts do, however, exhibit the same close connection between numerical systems and the nature of the objects quantified by numerical notations. This connection may well help in future research to establish more correspondences between proto-Elamite and proto-cuneiform ideograms than has been possible heretofore (see below, Fig. 5.14).
15. See Damerow and Englund (1987:121–123 and, for instance, 149, n. 20 and 150–151 n. 32).
16. The derived system S′, whose function in archaic Mesopotamian documents has not been satisfactorily explained, seems not to have been used in proto-Elamite texts.
17. Although formally the notation could derive from the bisexagesimal systems, for which see directly, there are sufficient indications that all such vessels were counted sexagesimally.
18. Possible representations of high-status humans include the signs M57, M72, M149, M291, M317, M320, and M376 (Fig. 5.14). Affiliation of particular representations to the category of sexagesimally counted high-status humans must be demonstrated through the identification of clearly sexagesimal notations on the one hand, and of semantic subsets and sets qualified by general ideograms on the other. For example, the mentioned texts (Scheil 1905:no. 213 and 1935: no. 317 [Fig. 5.5]) record in numerous obverse entries groups of objects designated M149 and M376; in the former account, subtotals of the reverse face distinguish between the two objects in numerical notations that both appear to derive from the sexagesimal system, while in the latter the two are subsumed under the collective ideographic designation M376 clearly counted sexagesimally. Such texts as Scheil (1905:no. 315) contain combinations of the sign M376 with both M72 (female laborer) and M388 (male laborer) in sequences comparable to that

of the same two signs with M291. M291 ( ) seems evidently, in the laborer rationing account (Scheil 1905:no. 4997; Nissen *et al.* 1993:77–79), to represent a foreman semantically corresponding to Sumerian *ugula*, a representation of two sticks. This sign M291, together with M72, M57, and M317, is also generally qualified in Scheil (1905:no. 390 [Fig. 5.5]) as a member of the class of objects designated by the sign M317 and qualified sexagesimally.

19. Totaling 20,098 units. Compare the text Scheil (1923:no. 453), in which the same sign is also qualified with a large sexagesimal notation. Two Uruk IV period accounts from the proto-cuneiform corpus contain similarly large sexagesimal notations of TI: the text Englund (1994:pl. 86, W 9656,g) with a notation on its reverse surface representing 1910+ units as a total of individual entries on the tablet obverse recording a possible distribution of TI to the administrative elites at Uruk (see Englund 1994:49), and W 21742 (Englund and Nissen 2001:pl. 79) with a notation representing 740. These numbers would tend to support the interpretation offered here of the numerical notations in Vallat (1973:103, n. 1), which could only be seriously challenged on the basis of the inclusion in the copy by the text's editors of six instead of the presumptive five N_{14} signs. If, after all, correct, $6N_{14}$ would point to a possible notation in the capacity system. The immediately following notation of eight N_1 signs would, however, exclude this interpretation (in the capacity system $6N_1 = N_{14}$). The only accounts with very large sexagesimally counted objects from Uruk record the undeciphered object DUR (later Sumerian: "rope"). See Englund (1998:117, fig. 40).
20. Fig. 5.15 below, and Nissen *et al.* (1993:75–77). The sign M388 must be interpreted to be the proto-Elamite counterpart of proto-cuneiform KUR_a ( ), both representing male dependent laborers. See in particular Damerow and Englund (1989:55–57).
21. For other examples see Damerow and Englund (1989:24, n. 75).
22. This term refers to the addition of a series of strokes to a cuneiform sign to signal a semantic variation from the meaning represented by its basic form.
23. Gender markers in Sumerian were embedded in the grammar with separate pronominal elements representing animate and inanimate subject/object, and were not evident in any known use of numerical systems, including number words.
24. For example, N_{28} impressed as a header of two subsections in the account Scheil (1905:no. 213), in Fig. 5.5. See also the impression of N_{34} on the edge of the tablet Scheil (1923:no. 421), below, Fig. 5.7.
25. Our limited understanding of the proto-Elamite object designations makes it impossible to know whether the proto-Elamite bisexagesimal system also qualified numbers of other, possibly ration products, such as cheeses and fresh fish, as was the case in proto-cuneiform texts. See Damerow and Englund (1987:132–135).
26. A calculation of the text would in fact require that the damaged part of this notation be reconstructed as N_{14} $8N_1$, since subtracting the initial grain capacity

notation from the total results in $2N_{14}$ $4N_{1}$ $3N_{39b}$, which divided by the grain product N_{30c} ($\frac{1}{6}$ N_{39b}) results in 498 units. A correction of the total to ... $4N_{39b}^{!}$ would allow a reconstruction of ... $2N_{14}$ [$4N_{1}$] in the same entry.

27. This sign M36 forms a functional equivalent to the sign GAR in the proto-cuneiform corpus which is the pictographic representation of the Late Uruk beveled-rim bowl serving as a rationing unit of one man-day in archaic administration. Its pictographic referent might be a measuring can with a handle used in ration distribution, presumably into the same beveled-rim bowls (BRBs) as in Uruk, since they are found in comparable numbers at Susa and other Late Uruk Persian settlements.
28. For some preliminary identifications, see Damerow and Englund (1989:26–27, n. 86).
29. See Damerow and Englund (1989:18–20) for a short description of the history of research in the decipherment of the proto-Elamite grain capacity system, long believed to reflect a decimal structure in archaic Persia, but also in Babylonia, where there was in fact no decimally structured numerical system whatsoever. Assyriological adherence to this indefensible decimal interpretation of the Late Uruk grain capacity system remained unbridled until the Swedish mathematician Jöran Friberg (1978–1979) demonstrated the relationship $N_{14} = 6$(not 10!)N_{1} in grain notations of both administrative centers.
30. Note that the sign N_{30c} in the proto-Elamite corpus misled Damerow and Englund (1987) in their treatment of the proto-cuneiform systems to include this sign as a variant of the sign N_{30a} (, N_{30c} absent the central impression). Through the appearance of the text Nissen, Damerow, and Englund (1991:14, no. 4.3) – and now confirmed in unpublished accounts in the Norwegian Schøyen collection – N_{30c} has been shown to represent in proto-cuneiform documents a measure of grain equivalent to $\frac{1}{10}$, and not $\frac{1}{6}$, of the measure represented by the sign N_{39}, as is the case in archaic Persia.
31. The reverse side of the text (Scheil 1923:no. 419), with a discrete notation including signs with both two and three additional bars, suggests that the number of bars employed with a notation in the proto-Elamite system Š'' was optional. We have followed Vaiman (1974:21–22) in this interpretation of the sign as a measure for emmer wheat. See Damerow and Englund (1987:139–140), Englund (1998:120), etc.
32. Cf. Beale (1978:289–313), with a range of around. 0.4–0.9 liters for archaic Persia.
33. The same argument is made to manipulate the absolute volume of the Old Sumerian sìla upward. See Englund (1990:xv–xvi).
34. See Damerow and Englund (1987:142) for a discussion of the same phenomenon in the ED I texts from Ur. If true and if the equivalence of $2N_{39b}$ to 1 unit of M56 represents seed grain, then the land measure would correspond to approximately $\frac{1}{2}$ to 1 Babylonian *iku*, based on a seeding rate of around 10–20 *sìla*/liters per *iku*.

35. For publications, see Le Brun (1971:163–216, 1978a:61–79, 1978b:57–154, 1978c:177–192), Stève and Gasche (1971), Dollfus (1971:17–162, 1975:11–62), Sumner (1974:155–180, 1976:103–114 and pls. I–III), Lamberg-Karlovsky, in Damerow and Englund (1989:v–xiii). The proto-Elamite component of the Yahya excavations has in the meantime been published (Lamberg-Karlovsky and Potts 2001). Glassner (2000:54–66) offers an excellent review of the pertinent excavations.
36. Englund (1994:12–16). See now D. Sürenhagen (1993:57–70, 1999), according to whom the earliest phase of the proto-cuneiform system of writing is pushed back to the Uruk V period and thus possibly a century or more earlier than commonly accepted. Recently performed radiocarbon datings in Heidelberg (Lawler 2001a:2419) might result in even greater adjustments in our chronology. These considerations are to be noted with regard to the recent publications of G. Dreyer (J. Baines, this volume, and Lawler [2001a:2418–2420]) concerning the age of the inscribed Egyptian tags from predynastic Abydos.
37. This judgment is based on the form of the signs as shown in photos available to me. Through inspection of the originals it should be possible to determine the material of the stylus by examining the butt end, and often simply the lateral surface of the individual impressions. Such wedges on proto-cuneiform tablets often exhibit the grain of the original stylus and thus indicate the use of wood or reed (we can assume that some professionals carried styli made of ivory or precious metal; note the description in Gudea Cylinder A iv 25 // v 22 of the silver stylus used by the goddess of writing, Nisaba: gi dub-ba kù NE-a šu im-mi-du$_8$// gi dub-ba kù NE šu bí-du$_8$-a).
38. This method of record-keeping is a good indication that, like Babylonian texts, the proto-Elamite accounts were stored with this information immediately visible, in baskets or shelves akin to modern filing cabinets.
39. Note also the signs N_8 and N_8 *inversum* () representing half of a discrete unit in the sexagesimal system; the latter sign is not found in proto-cuneiform documents.
40. The sign from Godin Tepe has been discussed by Michel, McGovern, and Badler (1993:408A–413A) and Badler (2000:48–56), who proposed an identification with the cuneiform sign representing a jar of beer. Archaic pictography, however, would support an identification of the sign with a jar of butter oil, if the numerical notation is in fact sexagesimal; it cannot, though, be ruled out that this sign has no clear referent, and that the notation in fact derives from the grain capacity system.
41. See Ismail (1996) and Lebeau and Suleiman (1997).
42. The list in Fig. 5.20 has been cleansed of uninformative attestations with breaks and otherwise disturbed lines. The fullness of the remaining entries will hopefully be excused in the interest of a complete representation of the context of one proto-Elamite sign. DE = Damerow and Englund; O0101 = "obverse face, column 1, line 1" (generally including just one column on tablet surfaces,

see above, "Description"); INIT = initial position, INTERM = intermediate position, FINAL = final position; X = unidentifiable sign, $^{?}$= conjectural.

43. And compare with the following (Scheil 1923:no. 120, obv. 19, Scheil 1923: no. 159, obv. 3, Scheil 1923:no. 248, obv. 10, etc.).
44. Rubio (1999:1–16) has reviewed recent publications, and the pioneering initial work by Landsberger on possible substrate lexemes in Sumerian, and concludes that the fairly extensive list of non-Sumerian words attested in Sumerian texts did not represent a single early Mesopotamian language, but rather reflected a long history of *Wanderwörter* from a myriad of languages, possibly including some loans from Indo-European, and many from early Semitic.