



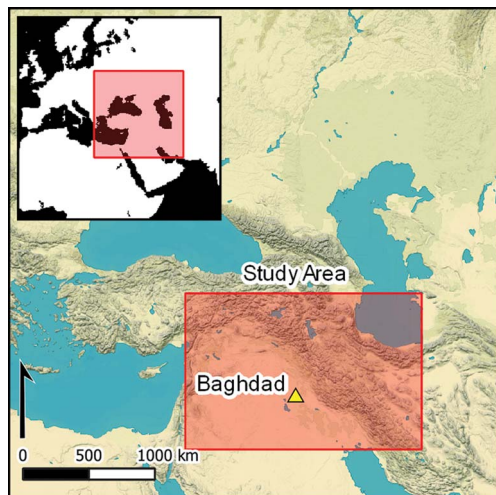
Research Article

Seals and signs: tracing the origins of writing in ancient South-west Asia

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Administrative innovations in South-west Asia during the fourth millennium BC, including the cylinder seals that were rolled on the earliest clay tablets, laid the foundations for proto-cuneiform script, one of the first writing systems. Seals were rich in iconography, but little research has focused on the potential influence of specific motifs on the development of the sign-based proto-cuneiform script. Here, the authors identify symbolic precursors to fundamental proto-cuneiform signs among late pre-literate seal motifs that describe the transportation of vessels and textiles, highlighting the synergy of early systems of clay-based communication.

Keywords: South-west Asia, Uruk, Susiana, proto-cuneiform, seal iconography, signs

Introduction

The origins of writing in South-west Asia are often sought in the accounting systems that developed over the course of the fourth millennium BC, which physically documented transactions using tokens, tags and bullae (clay balls), numerical tablets and seals (Nissen *et al.* 1993). Proto-cuneiform, first attested on clay tablets at the city of Uruk in southern Iraq c. 3350–3000 BC (Table 1, Uruk IV and III script phases), is a complex accounting system with hundreds of iconographic signs, many of which still defy interpretation. Elaboration of tokens, long used throughout South-west Asia, may have both stimulated the development of proto-cuneiform and served as models for several signs (Schmandt-Besserat 1992: 140–49) but token-to-sign comparisons, numerical notations aside, are rarely demonstrable (Englund

Received: 4 August 2023; Revised: 24 May 2024; Accepted: 7 June 2024

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Table 1. Periodisation of the fourth millennium BC in Mesopotamia. Absolute and relative dating between sites is problematic (Dahl *et al.* 2013).

Date (BC)	Northern Mesopotamia	Southern Mesopotamia	Writing	
2900		Jemdet Nasr	Uruk III script phase (<i>c.</i> 3200–3000 BC)	
3100				
3400	LC-5	Late Uruk	Uruk IV script phase (<i>c.</i> 3350–3200 BC)	<i>Proto-literate</i>
3600	LC-4	Middle Uruk	Uruk V earliest numerical and	<i>Pre-literate</i>
3900	LC-3		numero-ideological tablets (<i>c.</i> 3500 BC)	
4200	LC-2	Early Uruk	Cylinder seals introduced (<i>c.</i> 3700 BC)	
4400	LC-1	Terminal Ubaid		

We refer to Late Chalcolithic 4 (LC-4)/Uruk V/Susa Acropole 1.18 dating or earlier as pre-literate and LC-5/Susa Acropole 1.17a–b, with Uruk IV script as proto-literate. Many seals are difficult to date as securely pre- or proto-literate.

1993; Zimansky 1993) and the origin of sign forms is likely to be diverse, emerging from the multimedia environment of visual expression (Michalowski 1990: 59).

Specific symbolic precursors to signs, apart from tokens, have not been the subject of concerted research, despite the potential importance that their identification could have for our understanding of the evolution of symbol systems and writing. Visual parallels to sign forms have been sought in the Uruk Vase of the Uruk IV period (see Table 1; Cooper 2008; Hockmann 2009; Selz 2022) and broadly contemporaneous cylinder seal images. While Uruk-period seal imagery might be seen as a semiotic “forerunner to script” (Pittman 2023: 238), with clear parallels between some seal and sign forms, relationships remain difficult to define (Pittman 1994: 190–91) and it is possible that the ‘pictography’ observed in seals is unrelated to the development of writing (Glassner 2003: 166–77).

In this article, we present a more nuanced perspective on the origins of the script through the exploration of promising correlations between proto-cuneiform signs and earlier, pre-literate seal motifs from sites associated with the Uruk phenomenon of the late fourth millennium BC. Our analysis offers evidence for the contribution of seals and sealing practices to the incipient use and form of proto-cuneiform signs. The motifs we discuss showcase the common interest of seal-bearing administrators and scribes in documenting the movement of textiles and vessels within or between cities.

Information technologies and the Uruk phenomenon

Proto-cuneiform appears in the latter part of the Uruk phenomenon, an almost millennium-long sharing of material culture from south-west Iran to south-east Türkiye (Figure 1). Urban complexity developed substantially during this period, although trajectories varied even in neighbouring regions (Rothman 2001; Postgate 2002). In southern Iraq, where cities were bolstered by irrigation agriculture and marsh resources (Pournelle & Algaze 2014), Uruk became a centre of immense importance with the Tigris and Euphrates rivers facilitating the long-distance movement of people and goods. Exports from Uruk may have included dried fish and textiles (Crawford 1973), and communities were established far to the

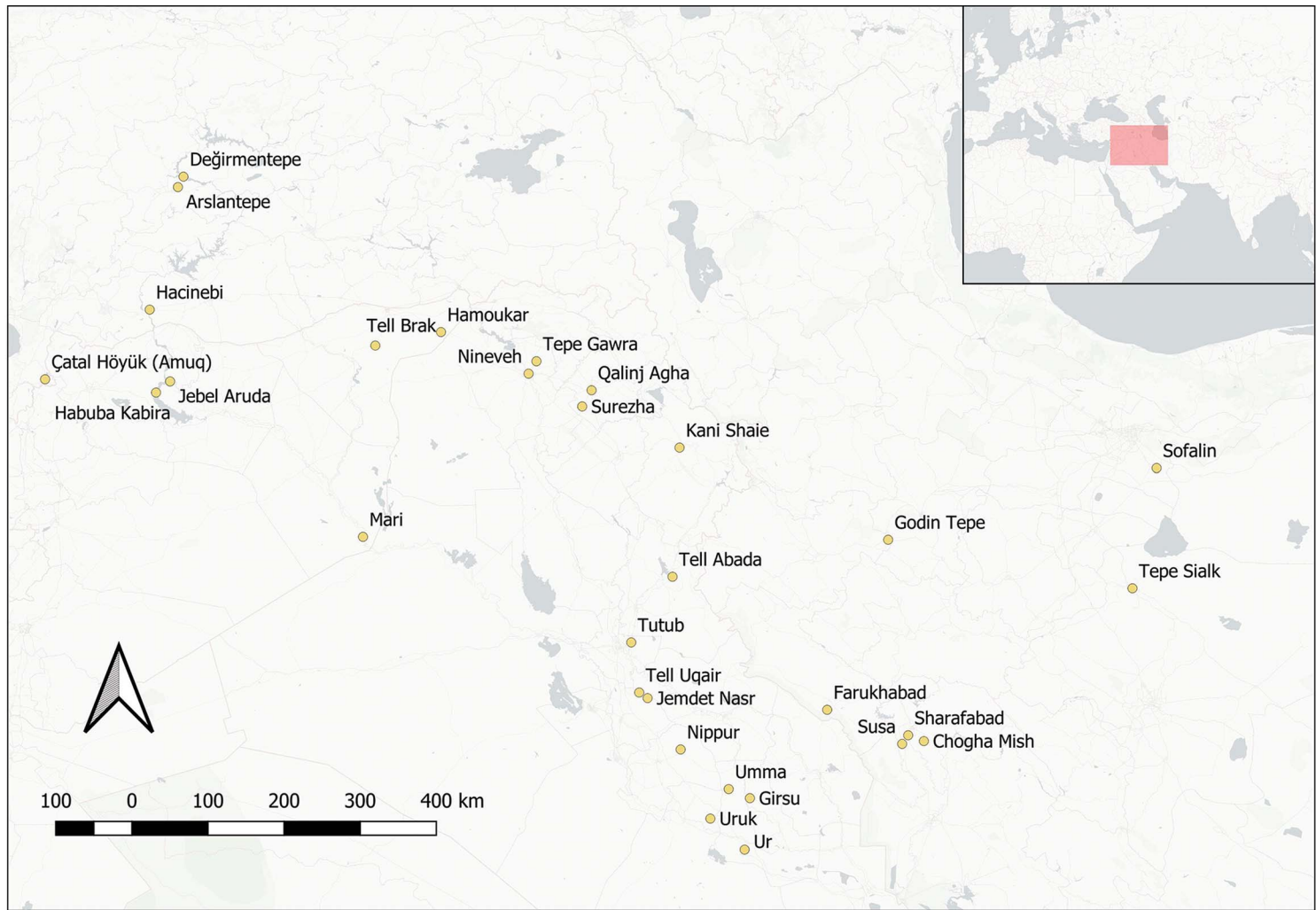


Figure 1. Map of archaeological sites with pre- and proto-literate seals corpora included in this study. For further details, see OSM (figure by authors).

north, east and west for the import of wood, stone and metal, resources scarce in the south (Algaze 1989; Oates 1993; Butterlin 2003).

Across the wide area of the Uruk phenomenon, seals and clay accounting technologies were a key cultural touchpoint; the shared symbolic conventions supported networks of elites both locally and inter-regionally (Sauer & Sørenhagen 2016). Trace element and isotopic analyses indicate the local scale of clay vessel production and practices for sealing and also the long-distance movement of the vessels and their seals (Minc & Emberling 2016).

Stamp seals were used on clay for administrative purposes from the late seventh millennium BC in northern Mesopotamia and were widely adopted and adapted in the following millennia. By the mid-fourth millennium, the cylinder seal was in use in Iran, Iraq and Syria (Pittman 2023). In addition to sealing lumps of clay to secure containers and doors, seals covered the surface of clay balls (bullae)—which could bear numerical impressions and enclose tokens—and were eventually used on blank or numerical tablets. Cylinder seals and impressed objects with Uruk-related iconography appear in Iran, Iraq, Syria and Türkiye.

Seals were used in myriad ways, identifying institutions or production units, the senders of goods, specific administrative events, or products and their destinations (Le Brun & Vallat 1978; Brandes 1979; Dittmann 1986, 2013; Nissen *et al.* 1993; Pittman 1994, 2018, 2023). Although some motifs illustrate production and exchange, seals represent cultural ideals as much as realities (Breniquet 2016a). Sealing facilitated control over products, with the shared iconography of the Uruk period suggesting “an inter-related if not integrated administrative system” (Pittman 1994: 191) involving goods and people who are themselves sometimes depicted on seals.

Shared seal imagery may have contributed to the maintenance of inter-regional connections as a form of fourth-millennium ‘commodity branding’ (Wengrow 2007), and the movement of goods stored or transported in sealed vessels may have helped construct the social world (Collins 2001; Englehardt 2013; Balke & Tsouparopoulou 2016). People are sometimes depicted on seals in front of elaborate buildings—probably temples—receiving products, suggesting that some commoditisation practices involved the movement of goods through sacred institutions. Although seals in this period did not (with rare exception) bear proto-cuneiform inscriptions, a ‘priest/ruler’ figure appearing in ritual scenes on seals has been linked to the title *En* which appears in proto-cuneiform texts as the sign *EN*. The proto-cuneiform sign is also used to characterise products, for example possibly marking an ‘*EN*-quality textile’. In many cases, goods listed on clay tablets are understood as ‘offerings’ to deities represented by their cult symbols (Szarzyńska 1997: 58–77).

Inter-related systems of symbols

Although seals are widespread, proto-cuneiform is attested only in southern Iraq. The earliest currently known proto-cuneiform tablets are associated with the archaeological level Eanna IVa at Uruk, approximately Late Chalcolithic (LC-5) in broader regional terms (Table 1). The stimulation for this innovation remains enigmatic, though it is possible that the growth of the urban population at Uruk may have created organisational challenges that proto-cuneiform addressed (Algaze 2008: 139–41; Nissen 2016).

The development of proto-cuneiform signs relied on pre-literate administrative practices, including numerical notations (Englund 2006: 28–30), while extending their recording potential (Nissen 2011). The practice of sealing tablets and other clay devices continues after the introduction of proto-cuneiform, though a smaller number of tablets are sealed (Matthews 1993). Motifs on tablet seals are difficult to correlate with tablet contents, an undertaking that is further hampered by poor understanding of the script. A single Uruk IV tablet, in which the script and seal impression both reference boars (Brandes 1979: 29–30), provides marginal evidence for the use of signs to reiterate seal information. Nonetheless, iconographic and use patterns may hint at shifting functions for seals after writing was invented (Scott 2018; Pittman 2023), perhaps implying that writing adopted some functions formerly performed by seals.

Many of the approximately 800 proto-cuneiform signs remain poorly understood, with the iconic referent of more than half either contested or unidentified. Proto-cuneiform signs mentioned in this article are listed in Figure 2. All proto-cuneiform signs may depict objects, even if we cannot recognise each one (Englund 1998: 55), or there may have been any number of “totally abstract signs” (Nissen 2016: 44). Schematic signs, such as UDU (‘sheep, wool’), may have been inspired by token traditions (Schmandt-Besserat 1992), but there has been no systematic assessment of the extent to which earlier or contemporaneous visual arts or other symbolic systems are recognisable in the sign shapes.

Most signs are probably functional, indicating products, offices, people, administrative processes or events like festivals (Englund 1998; Johnson 2015). This recalls the functions

Proto-cuneiform signs and proposed meanings					
	DIN	type of wine?		HI	egg? sweet? testicle?
	E₂	household, temple		MUŠ₃	goddess Inana's cult icon
	EN	chief administrator, priest/ruler		NAGA, EREŠ₂ NISABA₂	alkaline plant (soapwort)? administrator? city of Eresh, goddess Nisaba
	GAN	vessel in a net, vessel delivery?		NI	dairy oil container?
	ZATU 191-4	netted vessels with inscribed signs		UDU	sheep, wool, small livestock
				ZATU595 ŠEŠ	god Nanna's cult icon
	GIŠ	wood, tree		ZATU523 URI₃	architectural standard, generic cult icon

Figure 2. Images and suggested meanings of proto-cuneiform signs mentioned in the article. Signs are referenced by their conventional label derived from later Sumerian or when especially contested or unknown, by their ZATU number (Green & Nissen 1987). For further details, see OSM. (Sign and tablet images courtesy of the Cuneiform Digital Library Initiative (<https://cdli.mpiwg-berlin.mpg.de/>) (figure by authors).

proposed for Uruk seal motifs, although Pittman (2023) contends that seals in this period did not identify specific individuals. Where identifiable, proto-cuneiform administrative content further highlights the inter-related functions of these two information technologies. Proto-cuneiform tablets, like sealing practices, were primarily used to track goods. Some pre- and proto-literate seal iconography, particularly from the Susiana region in Iran (Pittman 2013), depicts agricultural and textile production, grain storage and animal husbandry, all of which are also important themes in proto-cuneiform texts.

Comparing seals and signs

Interpreting seal images and signs and understanding their connection is challenging. Simple comparisons of shape lack a sound methodological basis. For example, the ‘loops’ extending from human heads in a late pre-literate seal impression from Susa, the administrative capital of Susiana, have been interpreted as strings of dried fruit related to a proto-cuneiform sign (Le Brun & Vallat 1978: 26–7) or a belt loom (Breniquet 2008: 313). Equally a proto-cuneiform ‘house’ sign ($E_2/ZATU129$) with parallels in seal imagery may depict either a temple façade (e.g. Charvát 1998: 23) or a loom (Glassner 2003: 153), or it may be deliberately ambiguous, drawing on associations between weaving and important households (Breniquet 2008: 306–12).

Nevertheless, defining context-supported correlations between seal motifs and proto-cuneiform signs can help to determine the role of seals in stimulating the invention of writing, as well as clarifying the subsequent parallel development of these recording systems. The potential for the interaction of scribes and seal carvers (Ross 2014) means that some contested proto-cuneiform signs may be understood through seal iconography, as much as texts may elucidate seal imagery. Similarities of shape may reflect shared referents to objects that provide detail on shared administrative concerns. For pre-literate motifs, comparisons might reveal functional transformations from seal to sign, where aspects of the administrative scope of a motif are carried over into writing. Signs, nonetheless, become symbols with new definitions in script (see caution in Michalowski 1994: 54–5) and such ‘symbol-hopping’ remains difficult to confirm. Contextual evidence can, however, strengthen this analysis.

Late pre-literate seal motifs and proto-cuneiform correlates

Survey of a corpus of seals from LC-1 to LC-4 contexts (*c.* 4400–3400 BC) from across South-west Asia (Figure 1) reveals a small number of convincing parallels between pre-literate seal elements and proto-cuneiform signs, supported by contextual clues (Figure 3). For example, a ‘pole and net’ sign ($ZATU639$) that appears alongside cattle signs in tablets is similar to an object sometimes shown with cattle in pre- and proto-literate seals (Figure 4).

The ‘façade and flag’/pole motif, in which the pole may be a cultic element (Dittmann 2013), is also reflected in proto-cuneiform signs (Szarzyńska 1997: 58–107). Notably, this motif was already in use shortly before the invention of writing. The façade finds parallels in the rectilinear proto-cuneiform signs, including the ‘house’ sign ($E_2/ZATU129$, Figure 3B), and the flag/pole parallels a ‘generic’ pole sign ($ZATU523/URI_3$) and the god Nanna’s cult icon ($ZATU595/\check{S}E\check{S}$, Figure 3C) (Michalowski 1993: 120–1; Steinkeller

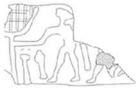
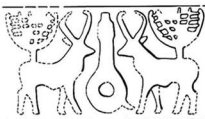
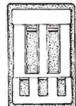
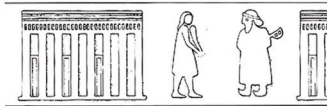
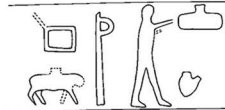
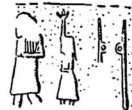
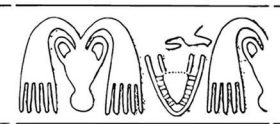
Pre-literate (LC 1-4)	Late Uruk (LC 5)	Proto-Cuneiform Signs
 Urkesh - sealing	 Chogha Mish - sealing	 ZATU639
A Net (or standard?)  Uruk - bulla  Uruk - sealing  Susa - sealing	 ZATU 591~b UR₃  ZATU 129 E₂ ?	
B Building façade  Uruk - stamp seal  Jebel Aruda - sealing  Uruk - sealing	 ZATU523  ZATU595	
C Reed poles  Uruk - sealing  Susa - tablet	 ZATU662  ZATU688	
D Vessel in a net & fringed cloth, textile  ZATU190 GAN		

Figure 3. Comparisons of proto-cuneiform signs with pre-literate seal elements. Signs are rotated for comparison with iconography. For further details, see OSM (figure by authors).

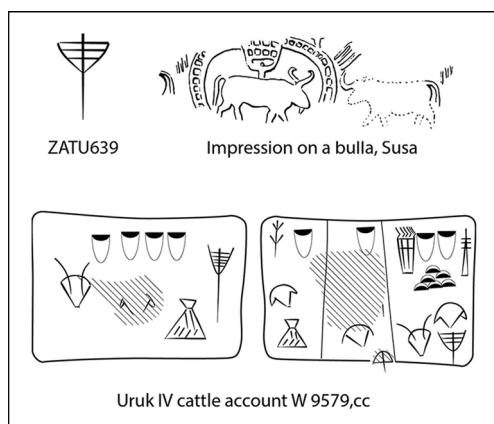


Figure 4. ZATU639 is comparable in both shape and context to an impressed bulla from Susa. For further details, see OSM (figure by authors).

1998; cf. Green & Nissen 1987). In seals, products are often depicted being carried towards the façade and, in an example from Jebel Aruda in northern Syria (Figure 3C), a pole appears beside a human and objects including a zoomorphic vessel resembling cosmetic or essence containers from Susa (Alvarez-Mon 2020: pl. 21–22). Such portrayals suggest that seals tracked the movement of valued goods.

A compelling case for the transformation of pre-literate administrative symbols into proto-cuneiform signs can also be made for a related pair of motifs—the fringed cloth (Figure 5) and the vessel in a net (Figure 6). These appear widely among the ‘inter-regional’ motifs (Dittmann 1986; Pittman

2013) on clay sealings, bullae and numerical tablets (see online supplementary material (OSM) Appendix 1). Their presence on numerical tablets, in particular—a document type marking the transition between pre-literate accounting and proto-literate writing—argues for a trajectory of symbolic representation from seals to inscribed signs. Comparable shapes may be seen in the proto-cuneiform textile or fringed cloth sign ZATU662 (and perhaps others, e.g. ZATU663, Figure 5), and what we identify here as a netted/suspended vessel sign (ZATU190 and ZATU191–194, Figure 2).

The fringed cloth (ZATU662) and a similar shape (ZATU644) are used at Susa and Uruk in two ‘numero-ideographic’ tablets and are thus early signs that appear to have been schematic from the outset. It is possible that some late pre- or proto-literate tokens of the ‘paraboloid’ group (Schmandt-Besserat 1992: 146/31.21–22) are related representations (Figure 5D). In fact, triangular tokens may be reflected in several different proto-cuneiform textile-related signs, but specific correlations are difficult. The sign we identify with fringed cloth, originating in seal motifs, could represent a hide/pelt or a woollen skirt related to later depictions of Sumerian attire (Szarzyńska 2002), the so-called *kaunakes* (Breniquet 2016b).

Similarly shaped textile signs may have had different meanings (Figure 5): a v-shape with single dissecting line (ZATU644) is interpreted as Sumerian *sumun* or ‘old’ (for heirloom garments?) (Szarzyńska 1997: 154–67), while a different v-shape (ZATU186) is securely identified as a forerunner to *gada*, ‘linen’ (possibly depicting a flax-airing tool used in the production of linen, Englund 1998: N. 353). The collection and redistribution of garments, both domestically and for trading abroad, was an important activity in urban households of early Mesopotamia from the Late Uruk period onwards (Englund 1998: 150–53).

We suggest that ZATU190 (Figure 6) depicts a ‘netted-vessel’ comparable to the common seal motif (Boehmer 1999: 29–33). The sign is recognisable as a vessel enclosed in a net (represented by cross-hatching) and either set in a base or fitted with ropes for suspension (sometimes without the hatching). Although the conventional proto-cuneiform sign label is GAN, this is probably an anachronism derived from the later cuneiform sign form (Deimel

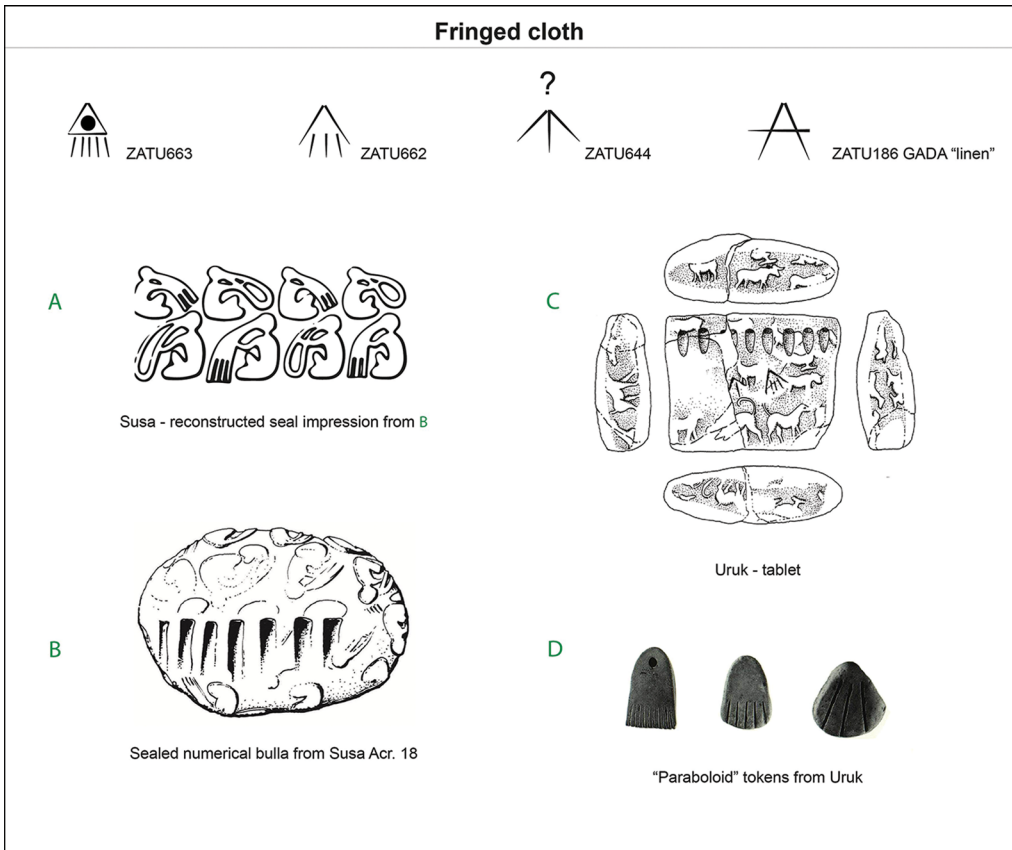


Figure 5. Comparison of the 'fringed cloth' motif and proto-cuneiform signs. For further details, see OSM (figure by authors).

1922: no. 644) which eschews clear indication of the netting and handles and prominently depicts the stand, and has the syllabic value/gan/ (cf. Akkadian *kannu*, 'pot-stand' CAD 8, 154 with possible reflex in Sumerian, Cohen 2023: 431). Similar netted vessels occur in third millennium BC seals and plaques from southern and central Iraq, where they may have contained oils (Potts 1997: 147). Variation in proto-cuneiform vessel signs may have both general and specific semantic implications; the inclusion of spouts, for example, may indicate liquid products (Englund 1998: N. 371). We can thus propose that a category of vessel signs depicting nets/suspension/stands might reflect their contents, transportation or assignment (e.g. 'vessel delivery', perhaps).

In seals, the fringed cloth and netted-vessel often appear individually or together in scenes of production, transport and presentation to a building/person, or in heraldic configurations (Figure 7, full list in OSM Appendix 1). The cloth emerges from the vessel or grows out of humans or animals. These are productive motifs with dozens of examples showing variation, and are found at pre-literate Susa and Uruk, pre- or proto-literate Jebel Aruda, Habuba Kabira and Chogha Mish, and many sites in the proto-literate period. A variation in the fringed cloth is even found at Saqqara in Egypt on a cylinder seal from the Naqada IId period

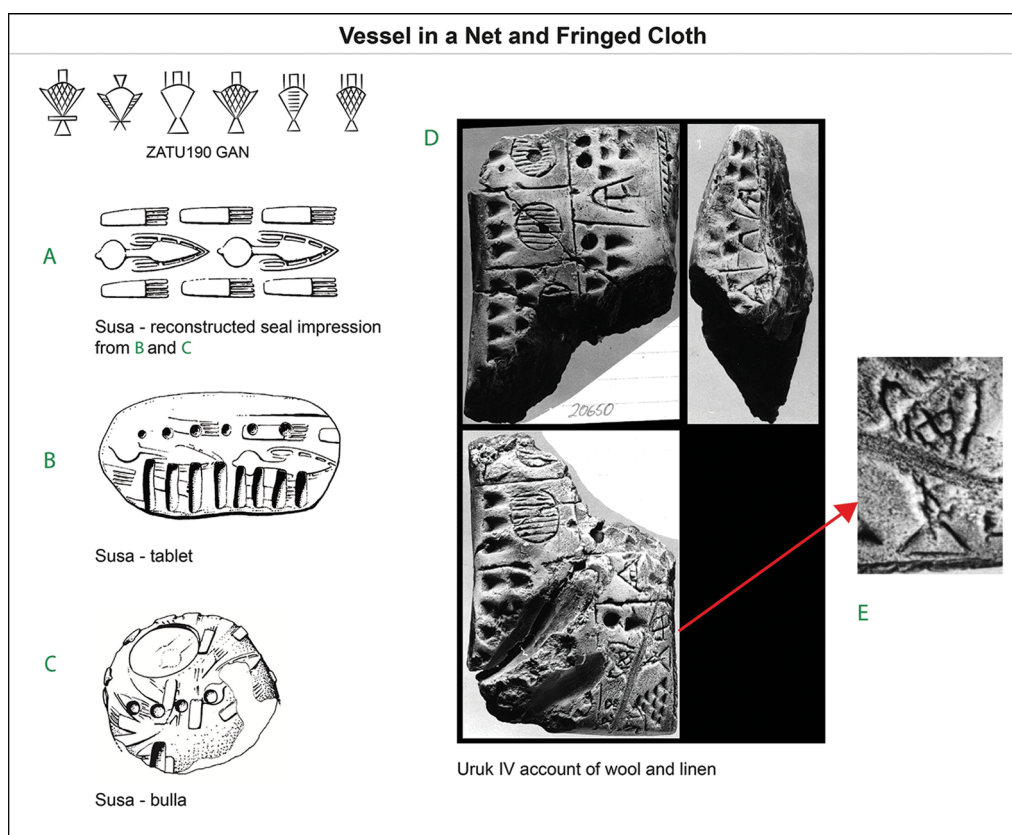


Figure 6. Examples of the netted-vessel and fringed cloth motifs from pre-literate documents (A–C) and a proto-cuneiform account of wool/garments and linen (D & E). For further details, see OSM (figure by authors).

(c. 3450–3325) (Figure 7 and ZATU688 Figure 3D), approximately contemporary with the emergence of proto-cuneiform signs.

The range of products indicated by these seal images and signs is unclear. The vessel with rope suspension may be inscribed with the NI (dairy oil, perhaps clarified butter) sign (Englund 1998: 168) (Figures 2 & 8B) or with the DIN (wine?) sign, among others. The NI sign is among the few signs that have a plausible complex token parallel that was actually found inside a bulla (from Uruk, Schmandt-Besserat 1992: 122). Dairy products represented by vessels are often recorded alongside textiles on proto-cuneiform tablets. Historically, lanolin (derived from wool) and other oils used to treat fibres are also associated with textile production. The accounting link between products in vessels and textiles can be seen in an important practice text, the ‘List of Vessels’, which first mentions containers of dairy oils followed by netted-vessels, and moves on to textile designations, starting precisely with fringed cloths (ZATU663–2). However, further clarification is still needed. An Uruk IV account of wool/garments and v-shaped textile signs, including *gada* (linen) (Figure 6D), finishes with a reference to an EN-official and UDU_a GAN_b (‘sheep/wool’, ‘netted-vessel’), which may suggest that textiles could be transported in the netted-vessels (Collon 1987: 16).



Figure 7. Distribution of netted-vessel and fringed cloth motifs. For further details, see OSM (figure by authors).

Alternately, the fringed cloth and netted-vessel might reference linen and linseed oil, noting a parallel from Egypt where the two were brought together as temple offerings (Boehmer 1999: 29–32). The fringed cloth sign ZATU662 (Figure 5) looks similar to the linen sign, and seal impressions from Habuba Kabira in northern Syria and Chatal Höyük (Amuq) in southern Türkiye show the cloth and netted-vessel motif associated with humans and a plant that may be flax (Figure 7). Flax, from which both linen and linseed oil are derived, was cultivated widely across South-west Asia in the fourth millennium BC, and its importance in southern Iraq is highlighted on the Uruk Vase (Miller *et al.* 2016). Linseed oil, derived from flax, is consumable and also a base for paints and lacquer among other uses. It has been argued that fourth millennium South-west Asia experienced a shift away from linen production towards wool, with dramatic consequences on labour, social organisation and regional trade dynamics (McCorriston 1997; Algaze 2008: 77–79). If the netted-vessel sign sometimes references linseed oil, this pushes back the earliest known textual evidence for the use of this resource (cf. Waedzolt 1985).

Despite the uncertainties, a relationship between these motifs and signs is demonstrable through several close associations (Figure 8). The netted-vessel sign is found alongside the façade and flagpole, echoing combinations in seals (Figure 8B & D). A delivery of dairy oils is documented on an Uruk III tablet in association with the signs E₂ GAN (‘house’, ‘netted vessel’)—perhaps a ‘vessel delivery’ to an institution/temple. The account also references a household by a flag/pole on a hut (ZATU648, Englund 1998: 102; compare Figure 9G) and lists an EN-official associated with a textile (ZATU753), which is seen elsewhere with the fringed textile (Figure 8C). These sign correlations are mirrored in a Susian seal impression on a numerical tablet and a bulla which combines a façade, flag/pole, netted vessel and fringed textile motif (Figure 8A & D).

Thus, a picture emerges in which seals and texts operate synergistically to document the delivery of similar products to temple households. Crucially, these seal motifs pre-date the introduction of proto-cuneiform and appear on transitional types of records (bullae and numerical tablets). Their adoption in script draws a specific continuity between pre-literate symbol systems and the invention of writing.

Symbol-sharing in the proto-literate period

More broadly, there is the potential for considerable interplay between seals and early script in the late fourth millennium BC (Figure 9). For example, a vessel sign with a cloth covering (ZATU506) has a clear proto-literate seal parallel (Figure 9G). This sign may reference a type of priest (Selz 2022: 220; cf. Greco 2014: 368–74), perhaps in charge of certain consumables (Englund 2001: 25), and may belong to a similar administrative context as the netted vessel sign.

Plant shapes reveal connections between script and seals beginning with the proto-literate material (Figure 9B & C), and the water in a boar-hunting scene parallels the proto-cuneiform sign ZATU1 (Figure 9F). Stylistic similarities are also suggestive: compare, for example, the bovine head on a seal impression from Nineveh and ZATU219 on an Uruk IV tag (Figure 9A). Elements in seals that find comparison with signs are often built into scenes in natural ways, such as the mace and bow(?) among kneeling prisoners that might

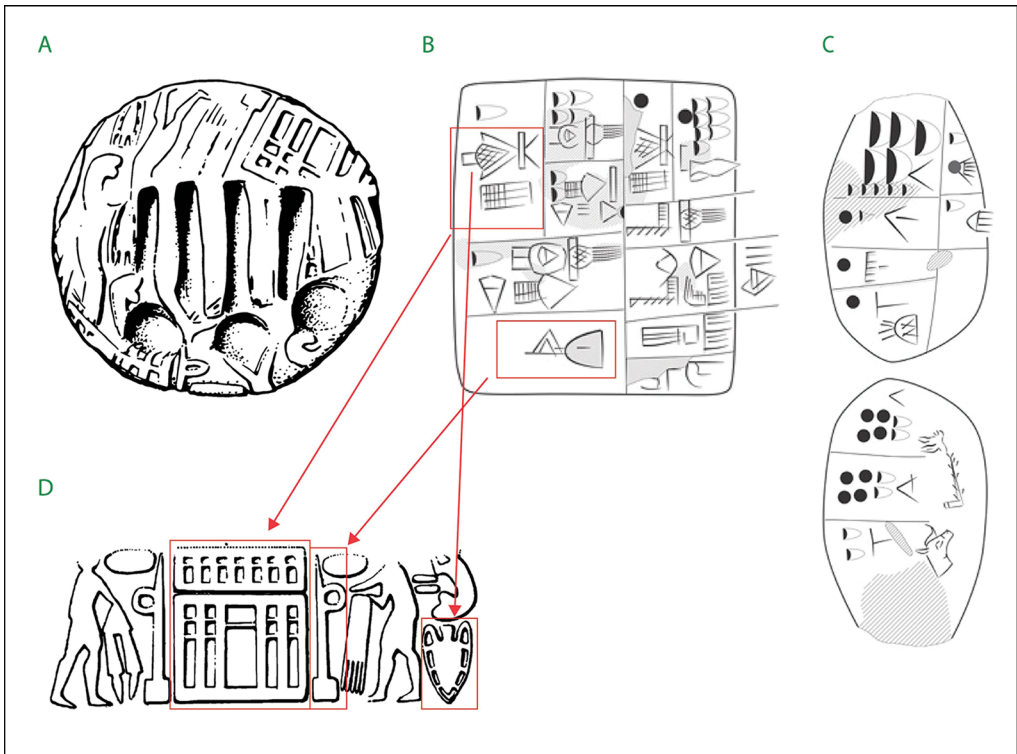


Figure 8. Comparison of inter-regional motifs from pre-literate seal imagery and proto-cuneiform tablets. For further details, see OSM (figure by authors).

parallel a rare proto-cuneiform sign (ZATU359, [Figure 9E](#)). Combining contextual evidence from seals and signs may even aid further interpretation. The undeciphered sign ZATU675 ([Figure 9D](#)) appears to be a schematic representation of an object in a proto-literate seal from Uruk, perhaps a cult statue (cf. also ZATU25, Green & Nissen 1987: 320).

Many seal-sign comparisons draw on seal motifs first found in the proto-literate period. Reed poles (ZATU523 and ZATU595, [Figures 2 & 3C](#)) appear already in late pre-literate seals but the pole with shawl or tassel, representing the goddess Inana (MUŠ₃/ZATU374, [Figure 9B](#)), is not found in seals before the proto-literate period. Seals and signs may also represent architectural embellishments with cultic significance (van Dijk-Coombes 2024; cf. Szarzyńska 1997) ([Figure 9G](#)). A ‘heap’ or mountain corresponding to ZATU328/LAM appears in an impression on an uninscribed proto-literate tablet from Uruk. The motif later proliferates, especially in the proto-Elamite seals and writing from Iran ([Figure 9H](#)). The introduction of these new motifs into seals alongside the invention of writing shows how seals and writing reflect each other in stylistic preferences.

Despite this reflexivity, seals and script retain their independence. With few exceptions (Matthews 1993; Nissen *et al.* 1993: fig. 18; Pittman 2023: fig. 9.14) seals do not contain signs. Images of humans and quadrupeds illustrate one of many ways in which the systems adopt different iconographic strategies: whole figures are frequently represented in seals, whereas proto-cuneiform depicts only separate body parts. In script, tools can represent

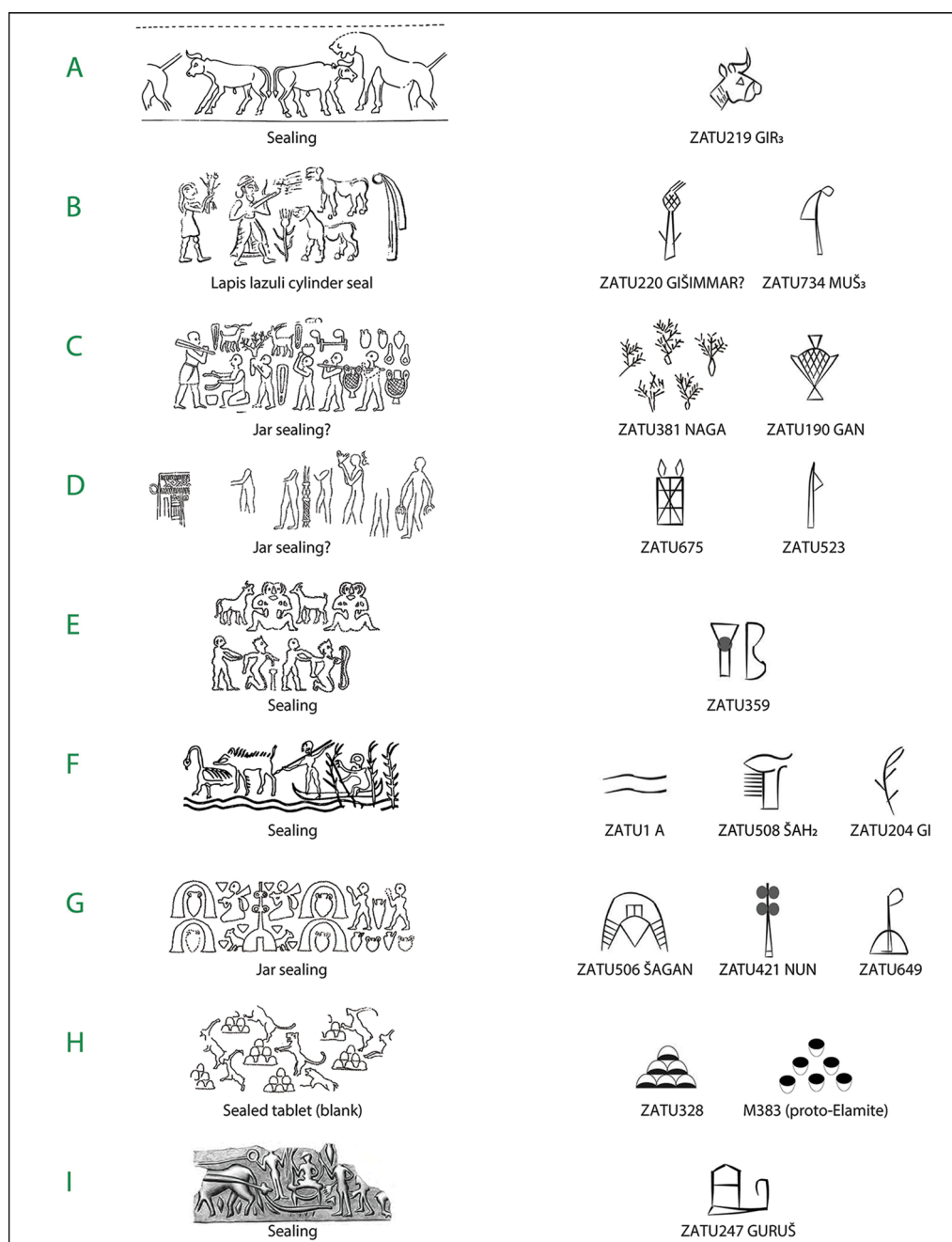


Figure 9. Examples of parallels between proto-literate seals and signs. For further details, see OSM (figure by authors).

humans (e.g. the threshing sledge for agricultural workers, Figure 9I) and women are represented by vulvas (compare an early alabaster plaque from Mari on the Euphrates in eastern Syria, Steinkeller 2019), while seals depict whole, clothed individuals.

Seals and writing in (inter-)regional context

A set of ‘city seals’, bearing symbols representing cities, appear impressed on Uruk III tablets originating from two southern Mesopotamian cities. The tablets record small numbers of commodities, including dried fruits. By the Jemdet Nasr period, therefore, seals appear to have been used in combination with proto-cuneiform tablets to record the exchange of goods, probably as cultic offerings, that maintained relationships between Uruk and other cities of southern and central Iraq (Matthews 1993; Steinkeller 2002; see also Michalowski 1993 on these seal inscriptions as a separate symbol system from proto-cuneiform). Such exchanges could be seen as a strategy for strengthening ties as inter-regional connections weakened following the Uruk phenomenon (Matthews & Richardson 2018).

Similar inter-city cultic exchanges may contribute to the invention of writing in the Uruk IV phase, but the extent is unclear. The small-scale numerical notations on bullae and numerical tablets may point towards local economic concerns (Englund 2006: 30) and a focus on agriculture and local industries in tablets may be emphasised (Nissen 2016). Yet proto-cuneiform grew from the administrative techniques that structured communities living at great distances from one another, from southern Iraq through to south-eastern Türkiye. Seal use and imagery demonstrate a shared articulation of the production and movement of commodities across this region, prominent among which are netted-vessels and cloth, sometimes in the presence of temple façades or before important individuals (Figure 10B). It is not clear whether these motifs represent commodity processing enacted locally or imply long-distance or inter-city exchanges. The modest offerings marked with ‘city seals’ suggest that even small exchanges could be inter-regional.

A striking correlation between sets of signs and pre-literate seal motifs emerges from the comparison of a jar sealing from Uruk and an Uruk IV tablet accounting 21 products or ‘vessel deliveries’ (Figure 10C). The vessels might have contained honey, syrup or wine since HI ‘sweet’ (or GIŠ) DIN are inscribed inside (Figure 10C top image, bottom right panel) (on DIN as perhaps wine see Englund 1998: n. 116; on regional trade in wine during the Uruk period see Algaze 1996). Seven deliveries are possibly associated with different officials, including one that uses a symbol later also used for the city Adab in the ‘city seals’. On the reverse, an unusual, linear summary line (cf. Green 1981) appears to mimic a rolled-out cylinder seal, offering the sequence ‘suspended vessel’–‘alkaline plant’(?)–EN (Soriga 2017). Alkaline plants are associated with textile processing, but this proto-cuneiform sign (ZATU381/NAGA) can also reference an administrative office, as well as the ancient city EREŠ₂ (location unknown).

Substituting the EN sign for a large official-looking figure (compare Steinkeller 2019), the summary line on the Uruk IV tablet therefore parallels important elements on the contemporary jar sealing (Figure 10B). An Uruk III tablet fragment similarly correlates the ‘temple vessel delivery’ (E₂ GAN) with the alkaline plant and EN (Figure 10A). Thus, although interpretative questions remain, some correspondence between seals and writing may be seen during the era of script development, when symbols and some of their semantic associations were likely reflected in signs. Correlations between tablets and seals also suggest that Uruk IV writing may have sometimes connected cities through the movement of goods in a tradition that has antecedents in seal iconography and a possible successor in Uruk III ‘city seals’.

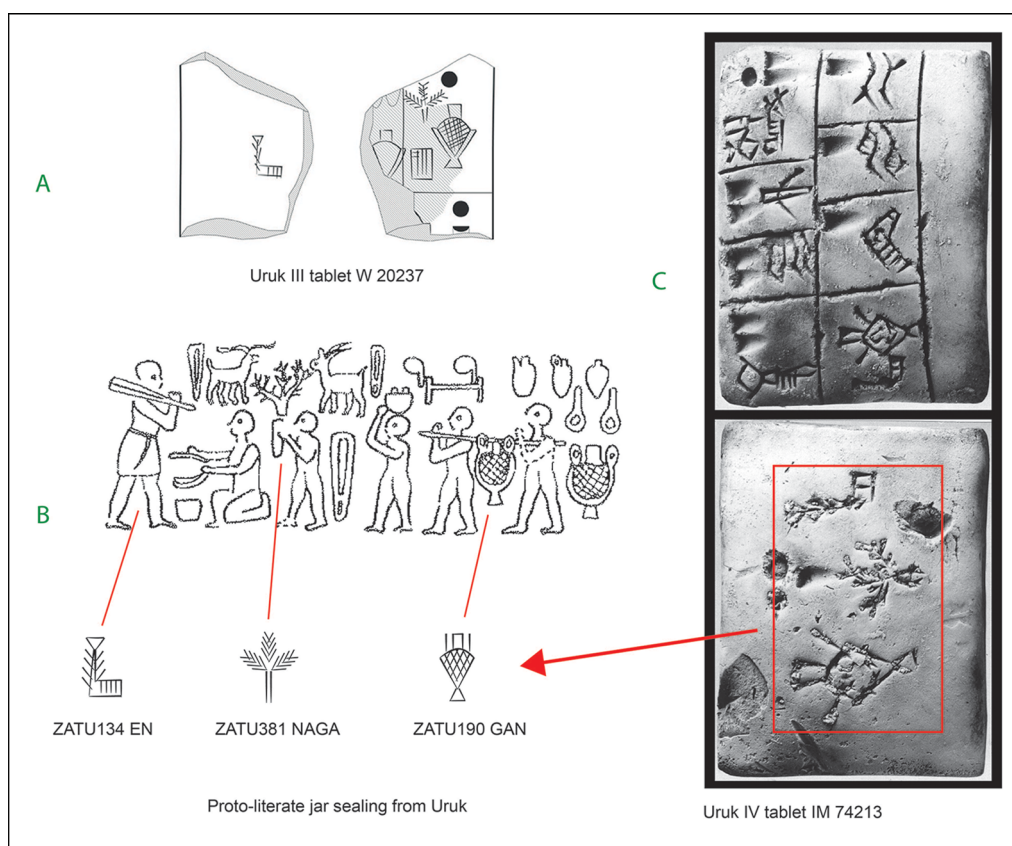


Figure 10. Comparisons between netted-vessels, a distinctive plant, and a priest/ruler(?) in proto-cuneiform (A & C) and seal imagery (B). For further details, see OSM (figure by authors).

Conclusion: seals and the invention of writing

Seals are a key consideration on the path towards writing in South-west Asia. At times, shared seal and sign shapes may reflect common referents in the real world. Though the schematic forms of proto-cuneiform may obscure a myriad of connections with seal motifs from modern eyes, recognising commonalities can elucidate the respective cultural traditions. The fringed textiles and netted-vessels show how pre-literate motifs could be transformed into signs in script through a process in which they retained some of their semantic associations. The correlation of fringed textile and netted-vessel signs with 'façade' and 'pole' signs on tablets strengthens their connection to late pre-literate administrative traditions that connected Uruk with cities across South-west Asia, adding to our understanding of the stimuli for the invention of writing in southern Iraq. Early in the development of writing, seals and signs continued to share shapes and reflect each other, while remaining highly distinct information systems. Documenting the extent of shape sharing helps build a more integrated, cohesive and, ultimately, more compelling explanation for the development of writing. Such investigation casts light on the late fourth millennium as a time of intense technological innovation, during which different modes of communication were not only exploited in new ways but were also deployed in synergy.

Funding statement

This article is funded by the European Research Council INSCRIBE Invention of Scripts and their Beginnings, awarded to Silvia Ferrara. The project has received funding from the European Research Council (ERC) under the European Union's Horizon 2020 research and innovation program, Grant Agreement No. 771127.

Online supplementary material (OSM)

To view supplementary material for this article, please visit <https://doi.org/10.15184/aqy.2024.165> and select the supplementary materials tab.

References

- ALGAZE, G. 1989. The Uruk expansion: cross-cultural exchange in early Mesopotamian civilization. *Current Anthropology* 30: 571–608. <https://doi.org/10.1086/203786>
- 1996. Fourth millennium BC trade in greater Mesopotamia: did it include wine? in P.E. McGovern, S.J. Fleming & S.H. Katz (ed.) *The origins and ancient history of wine*: 110–118. London: Routledge.
- 2008. *Ancient Mesopotamia at the dawn of civilization: the evolution of an urban landscape*. Chicago (IL): University of Chicago Press.
- ÁLVAREZ-MON, J. 2020. *The art of Elam ca. 4200–525 BC*. London: Routledge.
- BALKE, T.E. & C. TSOUPOPOULOU. 2016. *Materiality of writing in early Mesopotamia*. Berlin: De Gruyter.
- BOEHMER, R.M. 1999. *Uruk: früheste Siegelabrollungen*. Mainz am Rhein: Philipp Von Zabern.
- BRANDES, M.A. 1979. *Siegelabrollungen aus den archaischen Bauschichten in Uruk-Warka*. Wiesbaden: Franz Steiner.
- BRENIQUET, C. 2008. *Essai sur le tissage en Mésopotamie: des premières communautés sédentaires au milieu du III^e millénaire avant J.-C.* Paris: De Boccard.
- 2016a. Weaving, potting, churning: women at work during the Uruk period, in B. Lion & C. Michel (ed.) *The role of women in work and society in the Ancient Near East*: 9–29. Berlin: De Gruyter.
- 2016b. Que savons-nous exactement du kaunakès mésopotamien? *Revue d'Assyriologie et d'Archéologie Orientale* 110: 1–22. <https://doi.org/10.3917/assy.110.0001>
- BUTTERLIN, P. 2003. *Les temps proto-urbains de Mésopotamie. Contacts et acculturation à l'époque d'Uruk au Moyen-Orient*. Paris: CNRS.
- CHARVÁT, P. 1998. *On people, signs and states. Spotlights on Sumerian society, c. 3500–2500 B.C.* Prague: Oriental Institute, Academy of Sciences of the Czech Republic.
- COHEN, M. 2023. *An annotated Sumerian dictionary*. State College (PA): Eisenbrauns.
- COLLINS, P. 2001. *The Uruk Phenomenon: the role of social ideology in the expansion of the Uruk culture during the fourth millennium BC*. Oxford: Archaeopress.
- COLLON, D. 1987. *First impressions. Cylinder seals in the Ancient Near East*. Chicago (IL): University of Chicago.
- COOPER, J.S. 2008. Incongruent corpora: writing and art in ancient Iraq, in P. Taylor (ed.) *Iconography without texts* (Warburg Institute Colloquia 13): 69–94. London: Warburg Institute.
- CRAWFORD, H. 1973. Mesopotamia's invisible exports in the third millennium B.C. *World Archaeology* 5: 232–41. <https://doi.org/10.1080/00438243.1973.9979570>
- DAHL, J.L., C.A. PETRIE & D.T. POTTS. 2013. Chronological parameters of the earliest writing system in Iran, in C.A. Petrie (ed.) *Ancient Iran and its neighbours*: 353–78. Oxford: Oxbow.
- DEIMEL, A. 1922. *Die Inschriften von Fara. I, Liste der archaischen Keilschriftzeichen*. Leipzig: J. C. Hinrichs.
- DIETMANN, R. 1986. Seals, sealings and tablets: thoughts on the changing pattern of administrative control from the Late-Uruk to the Proto-Elamite period at Susa, in U. Finkbeiner & W. Röllig (ed.) *Ĝamdat Našr: period or regional style?*: 332–66. Wiesbaden: Reichert.
- 2013. Glyptic and patterns of urbanization: a humble approach, in T.R. Kämmerer & S. Rogge (ed.) *Patterns of urban societies*: 35–138. Münster: Ugarit.

- ENGLEHARDT, J. (ed.) 2013. *Agency in ancient writing*. Boulder: University Press of Colorado.
- ENGLUND, R.K. 1993. The origins of script. Book review of 'Before writing' by Denise Schmandt-Besserat. *Science* 260: 1670–71. <https://doi.org/10.1126/science.260.5114.1670>
- 1998. Texts from the late Uruk period, in J. Bauer, R.K. Englund & M. Krebernik (ed.) *Mesopotamien: Späturuk-Zeit und Frühdynastische Zeit*: 15–233. Gottingen: Vandenhoeck & Ruprecht.
- 2001. Grain accounting practices in archaic Mesopotamia, in J. Høyrup & P. Damerow (ed.) *Changing views on Ancient Near Eastern mathematics*: 1–35. Berlin: Reimer.
- 2006. An examination of the 'textual' witnesses to late Uruk world systems, in G. Yushu & C. Yiyi (ed.) *A collection of papers on ancient civilizations of western Asia, Asia Minor and North Africa*: 1–38. Beijing: Oriental Studies Special Issue.
- GLASSNER, J.-J. 2003. *The invention of cuneiform: writing in Sumer*. Baltimore (MD): Johns Hopkins University Press.
- GRECO, A. 2014. Considerations on some digressions in the Early Dynastic lexical lists. *Orientalia* 83: 341–79.
- GREEN, M.W. 1981. The construction and implementation of the cuneiform writing system. *Visible Language* 15: 345–72.
- GREEN, M.W. & H.J. NISSEN. 1987. *Zeichenliste der archaischen Texte aus Uruk*. Berlin: Mann.
- HOCKMANN, D. 2009. Die Warka-Vase eine neue Interpretation. *Altorientalische Forschungen* 35: 326–36.
- JOHNSON, C. 2015. Late Uruk bicameral orthographies and their Early Dynastic Rezeptionsgeschichte, in R. Dittmann, G.J. Selz & E. Rehm (ed.) *It's a long way to a historiography of the Early Dynastic period(s)*: 169–210. Münster: Ugarit.
- LE BRUN, A. & F. VALLAT. 1978. L'origine de l'écriture à Suse. *Cahiers de la Délégation Archéologique Française en Iran* 8: 11–59.
- MATTHEWS, R. 1993. *Cities, seals and writing: archaic seal impressions from Jemdet Nasr and Ur*. Berlin: Mann.
- MATTHEWS, R. & A. RICHARDSON. 2018. Cultic resilience and inter-city engagement at the dawn of urban history: protohistoric Mesopotamia and the 'city seals', 3200–2750 BC. *World Archaeology* 50: 723–47. <https://doi.org/10.1080/00438243.2019.1592018>
- MCCORRISTON, J. 1997. Textile extensification, alienation, and social stratification in ancient Mesopotamia. *Current Anthropology* 38: 517–35. <https://doi.org/10.1086/204643>
- MICHALOWSKI, P. 1990. Early Mesopotamian communicative systems: art, literature, and writing, in A.C. Gunter (ed.) *Investigating artistic environments in the Ancient Near East*: 53–69. Washington: Smithsonian Institution.
- 1993. On the early toponymy of Sumer: a contribution to the study of early Mesopotamian writing, in A.F. Rainey & R. Kutscher (ed.) *Kinattātu sa darāti* (Raphael Kutcher Memorial Volume): 119–35. Tel Aviv: Institute of Archaeology.
- 1994. Writing and literacy in early states: a Mesopotamian perspective, in D. Keller-Cohen (ed.) *Literacy: interdisciplinary conversations*. New York: Hampton.
- MILLER, N.F., P. JONES & H. PITTMAN. 2016. Sign and image: representations of plants on the Warka Vase of early Mesopotamia. *Origini* 39: 53–73.
- MINC, L. & G. EMBERLING. 2016. Trade and interaction during the era of the Uruk expansion: recent insights from archaeometric analyses. *Journal of Archaeological Science: Reports* 7: 793–97. <https://doi.org/10.1016/j.jasrep.2016.03.032>
- NISSEN, H.J. 2011. Schule vor der Schrift, in G.J. Selz & K. Wagensohn (ed.) *The empirical dimension of Ancient Near Eastern studies*: 589–602. Berlin: LIT.
- 2016. Uruk: early administration practices and the development of proto-cuneiform writing. *Archéo-Nil* 26: 33–48.
- NISSEN, H.J., P. DAMEROW & R.K. ENGLUND. 1993. *Archaic bookkeeping: early writing and techniques of the economic administration in the Ancient Near East*. Chicago (IL): University of Chicago Press.
- OATES, J. 1993. Trade and power in the fifth and fourth millennia BC: new evidence from northern Mesopotamia. *World Archaeology* 24: 403–22. <https://doi.org/10.1080/00438243.1993.9980216>
- PITTMAN, H. 1994. Towards an understanding of the role of glyptic imagery in the administrative systems of proto-literate greater Mesopotamia, in P. Ferioli (ed.) *Archives before writing*: 177–203. Torino: Ministero Beni Culturali.

- 2013. Imagery in administrative context: Susiana and the west in the fourth millennium BC, in C.A. Petrie (ed.) *Ancient Iran and its neighbours*: 293–336. Oxford: Oxbow.
- 2018. Administrative role of seal imagery in the Early Bronze Age: Mesopotamian and Iranian traders on the plateau, in M. Ameri, S. Kiehl Costello, G. Jamison & S. Jarmer Scott (ed.) *Seals and sealing in the ancient world*: 13–35. Cambridge: Cambridge University Press.
<https://doi.org/10.1017/9781108160186.004>
- 2023. Iconicity, composition, and semantics: a structural investigation of pictures in an early writing environment, in I. Zsolnay (ed.) *Seen not heard: composition, iconicity, and the classifier systems of logosyllabic scripts*: 237–71. Chicago (IL): Institute for the Study of Ancient Cultures.
- POSTGATE, N. (ed.) 2002. *Artefacts of complexity: tracking the Uruk in the Near East*. Warminster: Aris & Phillips for the British School of Archaeology in Iraq.
- POURNELLE, J. & G. ALGAZE. 2014. Travels in Edin: deltaic resilience and early urbanism in greater Mesopotamia, in A. McMahon & H. Crawford (ed.) *Preludes to urbanism: the Late Chalcolithic of Mesopotamia*. Cambridge: McDonald Institute for Archaeological Research.
- POTTS, D.T. 1997. *Mesopotamian civilization: the material foundations*. Ithaca (NY): Cornell University Press.
- ROSS, J.C. 2014. Art's role in the origins of writing: the seal-carver, the scribe, and the earliest lexical texts, in B.A. Brown & M.H. Feldman (ed.) *Critical approaches to Ancient Near Eastern art*: 295–317. Boston: De Gruyter.
- ROTHMAN, M. 2001. *Uruk Mesopotamia and its neighbours*. Santa Fe (NM): School of American Research.
- SAUER, C. & D. SÜRENHAGEN. 2016. Zählmarken, Zeichenträger und Siegelpraxis: Einige Bemerkungen zu vor- und frühschriftlichen Verwaltungshilfen in frühsumerischer Zeit, in T. Balke & C. Tsouparopoulou (ed.) *Materiality of writing in early Mesopotamia*: 11–46. Berlin: De Gruyter.
<https://doi.org/10.1515/9783110459630-002>
- SCHMANDT-BESSERAT, D. 1992. *Before writing*. Austin: University of Texas Press.
- SCOTT, S.J. 2018. Slave labour: Uruk cylinder-seal imagery and early writing, in M. Ameri, S. Kiehl Costello, G. Jamison & S. Jarmer Scott (ed.) *Seals and sealing in the ancient world*: 68–80. Cambridge: Cambridge University Press.
<https://doi.org/10.1017/9781108160186.005>
- SELZ, G.J. 2022. Beyond speech: advocating a non-logocentric view on the evolution of cuneiform writing, in D. Wengrow (ed.) *Image, thought, and the making of social worlds*: 213–49. Heidelberg: Propylaeum.
<https://doi.org/10.11588/propylaeum.842.c10812>
- SORIGA, E. 2017. A diachronic view on fulling technology in the Mediterranean and the ancient Near East: tools, raw materials and natural resources for the finishing of textiles, in S. Gaspa, C. Michel & M.L.B. Nosch (ed.) *Textile terminologies from the Orient to the Mediterranean and Europe, 1000 BC to 1000 AD*: 24–46. Lincoln (NE): Zea.
<https://doi.org/10.13014/K2CJ8BNP>
- STEINKELLER, P. 1998. Inanna's archaic symbol, in K. Szarzyńska & J. Braun (ed.) *Written on clay and stone* (Szarzyńska Memorial Volume): 87–100. Warsaw: Agade.
- 2002. Archaic city seals and the question of early Babylonian unity, in T. Abusch (ed.) *Riches hidden in secret places*: 249–57. Winona Lake (IN): Eisenbrauns.
- 2019. Texts, art and archaeology: an archaic plaque from Mari and the Sumerian birth-goddess Ninhursag, in G. Chambon, M. Guichard & A.-I. Langlois (ed.) *De l'argile au numérique: mélanges assyriologiques en l'honneur de Dominique Charpin*: 977–1011. Leuven: Peeters.
- SZARZYŃSKA, K. 1997. *Sumerica. Prace sumeroznawcze*. Warsaw: Dialog.
- 2002. *Sheep husbandry and production of wool, garments and cloths in archaic Sumer*. Warsaw: Agade.
- VAN DIJK-COOMBES, R.M. 2024. *The standards of Mesopotamia in the third and fourth millennia BCE*. Tübingen: Mohr Siebeck.
- WAEDZOLT, H. 1985. Ölpflanzen und pflanzenöle im 3. Jahrtausend. *Bulletin on Sumerian Agriculture* 2: 77–96.
- WENGROW, D. 2007. Prehistories of commodity branding. *Current Anthropology* 49: 7–34.
<https://doi.org/10.1086/523676>
- ZIMANSKY, P. 1993. Book review of 'Before writing' by Denise Schmandt-Besserat. *Journal of Field Archaeology* 20: 513–17.
<https://doi.org/10.1179/jfa.1993.20.4.513>