

Tracing Networks of Cuneiform Scholarship with Oracc, Gkab, and Google Earth

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Oracc: Facilitating the Online Dissemination of Cuneiform Text

Since the cuneiform script began to be deciphered in the mid-nineteenth century, it has by and large remained the preserve of a small group of specialists. A few writings from the ancient Middle East have penetrated popular consciousness — the Laws of Hammurabi, the Epic of Gilgamesh, and perhaps the Babylonian Epic of Creation — and, particularly since James B. Pritchard's pioneering *Ancient Near Eastern Texts Relating to the Old Testament* (1st ed. 1950 and still in print today), print anthologies have disseminated larger bodies of translations to academic, educational, and wider readerships,^{1 → x} especially through series such as *Writings from the Ancient World*, *The Context of Scripture*, and *State Archives of Assyria in English*, *Texte aus der Umwelt des Alten Testaments in German*, and *Littératures anciennes du Proche-Orient in French* as well as in a number of stand-alone works (e.g., most recently, Black et al. 2004; Chavalas 2006; Foster 2005). But anthologies are necessarily selective, subject as they are to the constraints and conventions of the commercially viable book, which makes them relatively intractable as research resources for those without access to, or expertise in, the original sources.

Since the mid-90s there have been various attempts to create online corpora of cuneiform texts, but even the most long-lived and successful — namely the *Cuneiform Digital Library Initiative* (CDLI, cdli.ucla.edu) and *The Electronic Text Corpus of Sumerian Literature* (ETCSL, etcsl.orinst.ox.ac.uk) — have their drawbacks as well as their strengths. By the end of 2010 CDLI contained records of some 250,000 cuneiform tablets, but its primary focus is providing basic reference

transliterations of inscribed objects, rather than offering a scholarly working environment for the development of analytic tools or easy comprehensibility for non-expert users. The ETCSL project (1996–2006), by contrast, produced text editions of some 400 works of Sumerian literature from the period 2100–1600 B.C., in alphabetic transliteration and English translation, with sophisticated textual search and linguistic analysis tools. There, though, the emphasis was on the reconstruction of whole compositions rather than the documentation of individual manuscript witnesses. Both projects are addressed primarily to cuneiformists rather than to a wider public.

Over the past few years, a new consortium of online projects has grown up, steered by a small group of us, who had been (and still are) closely involved with CDLI and ETCSL in various ways and wished to retain or develop the best practices of both projects, while offering new facilities for the widest possible range of users, in order to complement CDLI's central archival role as a catalogue, image database, and transliteration repository. Oracc — *The Open, Richly Annotated Cuneiform Corpus* (oracc.org) — went public in mid-2010. Developed by Steve Tinney and steered by him, Niek Veldhuis and myself, it comprises a workspace and toolkit for the development of a complete corpus of cuneiform whose rich annotation and open licensing are designed to support the next generation of scholarly research and online dissemination of data and findings. Let us look at each of those features in turn.

Oracc is *open* in several senses.² →¹ Most obviously, the data and tools it provides are released under a Creative Commons Attribution Share-Alike license (<http://creativecommons.org/licenses/by-sa/3.0/>), meaning that all users and developers are free to access, create, and re-use Oracc material without formal permission, as long as they attribute the original work to its creator(s) and funders, and release their derived work under a similarly open licensing agreement. Equally fundamentally, the Oracc Steering Committee is committed to principles of co-operative, collaborative, responsive working. Our goal is to provide standards-based, well-documented resources that are as simple, flexible and adaptable to user needs as possible, and supported by free server space, backup, and personal contact with Oracc liaison staff ([for more information, see http://oracc.org/osc-about.html](http://oracc.org/osc-about.html)).

Oracc aims to encourage the development of a comprehensive *cuneiform corpus*, as inclusive and exhaustive as possible, across languages (Sumerian, Akkadian, Hittite, Elamite, Aramaic, Old Persian, etc.), script type, time (c. 3300

B.C.–A.D. 100), place (across the Middle East from Anatolia to Egypt to Iran), and genre (from mundane [administrative](#) records to arcane scholarly works). It does so by facilitating individual corpus-based projects across the world, each with their own aims, objectives, and funding. By the end of 2010 it comprised seven major public corpora, plus a further 15 in development. While some, such as *The Digital Corpus of Cuneiform Lexical Texts* (DCCLT, oracc.org/dcclt), track particular genres through time, others such as *The State Archives of Assyria online* (SAAo, oracc.org/saao), provide access to multiple genres of texts from particular times or places. Some, such as SAAo, are re-presentations and developments of print publications; others, such as DCCLT, are born digital. Further projects, currently under development, will be released online and in print simultaneously. Minimally projects consist of alphabetic transliterations of cuneiform text corpora, with associated catalogue metadata (which may be drawn from CDLI), but Oracc also encourages the provision of translations, in any modern language — or more than one — as well as various types of annotation.

Oracc corpora can be *richly annotated* in several senses. Oracc provides various tools for the linguistic annotation of cuneiform texts, from lemmatisation (the association of individual spellings of words to dictionary head-words for the generation of language glossaries), to the analysis of number systems (in economic, mathematical or astronomical contexts, for instance), orthography (spelling habits), prosopography (patterns of naming) and social networks (who trades or trains or communicates with whom). We are also in the process of developing a range of infrastructure projects, currently planned to comprise bibliography, chronology, geography, and a global sign list of cuneiform. Finally, we also offer facilities for creating portal websites which serve as the introductory front-end to individual projects. These sites — such as the SAAo portals *Assyrian Empire Builders* (www.ucl.ac.uk/sargon) and *Knowledge and Power in the Neo-Assyrian Empire* (K&P, oracc.org/saao/knpp) — enable projects to present explanatory or supplementary material to non-specialist audiences, whether background essays, glossaries of technical terms, summaries of the project's aims and findings, or any other content.

We provide all Oracc corpora and Oracc-hosted portal sites with visitor access statistics so that project directors can report to their funders or institutions on the range and depth of their online outreach. For instance, in January 2011 SAAo had

some 370 unique visitors from 32 countries, making nearly 1,300 visits between them and accessing an average of 20 pages each. During the same month one of its portals, K&P, had nearly 3,300 visitors from 105 different countries, who made a total of 4,500 visits and accessed around 3 pages each time. Given that 370 would be a generous estimate of the number of professional cuneiformists worldwide, and 3,300 a similarly generous estimate of the number of their graduate students, it is clear that Oracc corpora and associated portal sites are enabling cuneiform texts to reach a more global — and educationally diverse — audience than ever before.^{3 → 2}

GKAB: Researching the Ancient Dissemination of Cuneiform

Scholarship

One of Oracc's core projects is *The Geography of Knowledge in Assyria and Babylonia, 700–200 BC* (GKAB, oracc.org/cams/gkab), funded by the UK Arts and Humanities Research Council (2007–12) and jointly directed by Tinney and myself at the Universities of Pennsylvania and Cambridge. Its core aim is to investigate the generation, replication, dissemination, and consumption of scholarly knowledge in cuneiform culture. Questions about the ownership and accessibility of knowledge, the circumstances and environments in which it flourishes or perishes, the socio-political influences and impacts of its transmission and reception, are all central to the history and sociology of science. GKAB addresses these ideas in relation to ancient Assyria and Babylonia in the first millennium B.C., while exploring the potential and limitations of applying and adapting methodologies designed to analyse modern techno-science for the study of ancient scholarship (Robson 2011). GKAB's central dataset comprises online editions of nearly 1,500 scholarly manuscripts, a major component of the Oracc-hosted *Corpus of Ancient Mesopotamian Scholarship* (CAMS, oracc.org/cams). Learned writings are probably (almost) as old as cuneiform script itself (Veldhuis 2006), but GKAB focuses on the tablets found in and around just four discrete buildings from a 500-year period of the first millennium B.C., all formally excavated and at least minimally published but none hitherto subjected to holistic study and analysis.^{4 → x}

Such collections are commonly called “libraries” in Assyriological parlance (e.g., Clancier 2009; Pedersén 1998). I have addressed the

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thorny question of what constitutes a cuneiform library elsewhere (Robson 2013; Robson and Stevens 2012); here I shall simply avoid the term wherever possible.

From the ninth to seventh centuries B.C., Assyria was by far the most powerful empire of the Mediterranean and Middle East. The ideology of empire centred on the symbiotic relationship between the king and the great god Aššur: military conquest was both an act of devotion and confirmation of Aššur's support. But Assyrian kingship depended not solely on piety and military might. A retinue of scholarly advisors guided royal decision-making through the observation and analysis of omens, and the performance of appropriate rituals (Radner 2011). The scholars in turn depended on a wide range of scholarly works written on cuneiform tablets, from astronomy to mythology, kept both in private households and in institutions such as temples and palaces. Two of the GKAB corpora stem from seventh-century Assyria, one belonging to a temple in the royal city of Kalhu, close to the capital Nineveh, and the other deliberately hidden outside a private house in the western provincial town of Huzirina several hundred miles away.

After Assyria fell in 612 B.C., Babylonian scholarly activity continued to flourish and develop under the patronage of wealthy urban temples in the south. Here scholarship was adapted to new purposes of maintaining the intellectual integrity and social status of native religion in the face of new ways of thinking and believing. The courts of Achaemenid (c. 540–330 B.C.) and Seleucid (c. 330–130 B.C.) rulers no longer supported cuneiform scholarly traditions. New genres came into being; others were adapted or survived relatively unchanged; still others disappeared completely. Temples were the last bastions of cuneiform scholarship until at least the final centuries B.C. The GKAB project focuses on three assemblages of scholarly tablets from the southern city of Uruk. Two are from successive strata of a well-to-do house in the southeastern corner of the city, occupied consecutively by two apparently unrelated families of *mašmaššus* (“incantation priests”) in the late fifth and late fourth centuries B.C. The third, which I shall not discuss further here, has been reconstructed from tablets excavated from a second-century storeroom in one of the city's central temples, together with tablets stemming from illicit diggings in the vicinity in the early twentieth century (on the tablets from this temple, see Robson 2013).

By looking at similarity and difference across the five groups of tablets, and by drawing on appropriate comparanda from other places and periods, the GKAB

project is addressing some fundamental questions about the changing meanings and functions of literate scholarship in first-millennium cuneiform culture. Of particular relevance to the geography of knowledge are questions concerning the relationship(s) between scholarly practice, familial inheritance and royal power; and the survival, adaptation, development of learning in face of political change.

These are novel topics for Assyriological study. Since A. Leo Oppenheim's articulation of the notion of a "stream of tradition" (Oppenheim 1960), it has been commonplace to posit a stable corpus of scholarly writings which was relatively accessible to all learned men, through copying and commentary, as part of their formal education throughout the first millennium B.C. At mid-century this was a reasonable inference from the evidence then available, which was weighted heavily to the famous and gargantuan "Library of Assurbanipal" from seventh-century Nineveh in the absence of the large number of smaller, formally excavated assemblages that have since become available.^{5 → x} This is not the place for a longer discussion of the relevant historiography and excavation/publication history of the material (Robson 2011) or an up-to-date survey of excavated assemblages of cuneiform scholarship from the first millennium B.C. (Robson and Stevens 2012). However, it is now clear that this apparently archetypal "Library of Assurbanipal" is in fact atypical in several key ways (Robson 2013). First, containing tens of thousands of manuscripts it was about fifty times the size of any other scholarly tablet collection now known.^{6 → x} For example, the so-called *āšipus*' house in seventh-century Assur and the Ebabbar temple in sixth-century Sippar each held a collection of about 800 tablets (Pedersén 1998: 135–136, 194–197). Second, it was assembled, at least in part, through coercion and conquest, while most scholarly communities — without world-class armies at their disposal — had to rely on the more normal means of inheritance, collection and copying. Third, at its apogee, it was directly shaped by the close involvement of two of the most powerful men in the ancient world: the Assyrian king Esarhaddon (r. 681–669 B.C.) and his son Assurbanipal (r. 669–c. 630 B.C.).

Further, it is only since Oppenheim's day that the mechanisms and motivations behind the dissemination of knowledge have been the subject of sustained academic study. Most relevant for our purposes here is the work of sociologist of science Bruno Latour, who articulated several related concepts that have opened up new lines of geographical research:

If techno-science may be described as being so powerful and yet so small, so concentrated and yet dilute, it means it has the characteristics of a *network*. The word network indicates that resources are concentrated in a few places — the knots and the nodes — which are connected with one another — the links and the mesh: these connections transform the scattered resources into a net that may seem to extend everywhere [Latour 1987: 180; [emphasis added](#)].

If we in turn understand the scholars of cuneiform culture as actors in a Latourian network, it becomes apparent why earlier generations of Assyriologists perceived the intellectual world those scholars created as ubiquitous, monolithic and self-sustaining.

But for Latour, people are not the only actors in the network; objects are too, and in particular inscriptions (whether computer printouts or cuneiform tablets) are “immutable and combinable *mobiles* ... conveniently at hand and combinable at will, no matter whether they are twenty centuries old or a day old” (Latour 1987: 227; [emphasis added](#)). In other words, writing travels as much as people do, taking established knowledge to new places, and enabling new knowledge to be created through acts of editing and rewriting. In order for this to happen the messy observables of the real world have to be reduced and simplified into manageable scientific (or scholarly) data: “*Metrology* is the name of this gigantic exercise to make of the outside a world inside which facts and machines can survive” (Latour 1987: 251; [emphasis added](#)). The final act in the transformation of new knowledge into established truth is to “black box” it, or erase all traces of the process of production: “The word black box is used by cyberneticians whenever a piece of machinery or a set of commands is too complex. In its place they draw a little box about which they need to know nothing but its input and output” (Latour 1987: 2). According to the *Oxford English Dictionary Online*, the term “black box” was originally Royal Air Force slang for “a navigational instrument in an aircraft,” later extended to denote any “device which performs intricate functions but whose internal mechanism may not readily be inspected or understood” (OED Online 2013).^{7 → x} Cuneiform scholars, we can now see, were masters of black-boxing: almost no evidence remains of how their learned writings came to be.

By taking a Latourian view of the production and dissemination of scientific knowledge, and by plotting the origins of people, writings, and deities on Google Earth, we are able to see afresh the means and routes by which scholarship travelled

around the buildings and communities studied by the GKAB project. Here I focus on just three of them, which — as we shall see — are sufficient to challenge the old assumption that all cuneiform “libraries” served essentially the same functions for essentially the same sorts of people.

Kalhu: An Assyrian Royal City

The city of Kalhu on the Tigris (**biblical Calah, modern Nimrud**) was the Assyrian imperial capital for much of the ninth and eighth centuries, and continued to function as a royal city until its fall in 614 B.C.^{8 → x} (**on the archaeology of Kalhu, see Curtis et al. 2008; Mallowan 1966; Oates and Oates 2001**). A short walk from the palace was a temple named Ezida, dedicated to the god of wisdom Nabu. Fully half of the 250-odd scholarly tablets found in a room immediately opposite his shrine bear omens, incantations and rituals — for advising the Assyrian king on political decision-making and for helping him to maintain his relationship with the gods. A further quarter comprise hymns and lexical works (standardised lists of words and cuneiform signs), while the majority of the remainder comprise medical, literary and calendrical writings (**on the scholarly tablets from Kalhu, see Black 2008; Pedersén 1998: 151–152; Wiseman and Black 1996; and <http://oracc.org/cams/gkab/kalhu>**). The generic profile of the collection is very similar to that of the libraries at Nineveh (Robson 2013).

Some thirty scholarly tablets of the Kalhu Ezida **corpus** have extant or partially surviving colophons, from which at least fifteen names of scholars can be identified. Many of them belong to just two dynasties of Assyrian royal scholars. The earliest comprises several generations of the descendants of Ištaran-šumu-ukin, a tenth(?)-century *āšip šarri* (“royal exorcist”):

- Ištaran-mudammiq, *šaggamaḥḥu* (“**senior** exorcist”) of king Assurnāṣirpal II (r. 883–859 B.C.), son of Tappuya, *šatammu* (“temple administrator”) of Der and grandson of the *šatammu* Huzalu; owner of an ominous calendar for the month of Tašritu (CTN 4, 58; duplicate KAR 147, with the same colophon, found in Assur);

- Ištaran-mudammiq's grandson (name missing), son of Nabu-mudammiq; owner or copyist of a compendium of incantations called *Utukkū lemnūtu* 'Evil demons' (CTN 4, 103); possibly Babilaya (see below) or a brother of his;
- Ištaran-mudammiq's great-grandson Marduk-..., the *tupšar šarri* ("royal scribe"), and *ummānu* ("scholar") of king Adad-nerari III (r. 811–783 B.C.); son of the *āšip šarri* Babilaya; owner of a tablet of celestial omen series *Enūma Anu Ellil* (CTN 4, 8, dated 787 B.C.).

By the late eighth century, it appears that the Ištaran-šumu-ukin family had been ousted or **superseded** by the descendants of Gabbu-ilani-ereš, *ummānu* of Assurnāširpal II (and thus Ištaran-mudammiq's contemporary):

- Adad-šumu-ušur, chief *āšipu* of king Esarhaddon and son of the famous scholar Nabu-zuqup-kena; owner of a tablet from the terrestrial omen series *Šumma ālu* (CTN 4, 45);
- a son (name missing but possibly Šumaya) of his brother Nabu-zeru-lešir (?), Esarhaddon's chief scribe; copyist of an ominous calendar (CTN 4, 59) "for the prolongation of his life;"^{9→?}
- further sons or descendants of Nabu-zuqup-kena are mentioned in colophons of two tablets of physiognomic omens *Alandimmū* and another of unidentified omens (CTN 4, 74; 78; 89).
- Nabu-le'i, son of Adad-šumu-ušur's close associate, Esarhaddon's chief lamenter Urad-Ea; scribe of a hitherto unidentified ritual (CTN 4, 187), which he "copied like its original for him to see".

Nabu-zuqup-kena himself, chief scribe to kings Sargon II (r. 721–705 B.C.) and Sennacherib (r. 704–681), wrote over sixty surviving scholarly tablets, nearly two-thirds of which explicitly state that they were written in Kalhu (Hunger 1968: 90–95, nos. 293–311, of which nos. 293–294 and 305 name Kalhu). However, the tablets themselves belong to the Kuyunjik collection of the British Museum, most likely meaning that they were excavated by Layard and his associates from the royal citadel of Nineveh. Likewise, his sons Adad-šumu-ušur and Nabu-zeru-lešir are well attested in Assyrian court correspondence from Nineveh, sometimes in collaboration with

Urad-Ea and other colleagues.^{10 → ?} Adad-šumu-ušur also worked at Kalhu, where he is documented performing a ritual against two types of fungi that had infested Ezida (SAA 13, 71).^{11 → x} Coincidentally or not, a tiny fragment of *Šumma ālu* (“If a city”)

Tablet XIII, containing omens about fungus growths, is amongst the extant scholarly tablets from the Kalhu Ezida (CTN 4, 36).

By contrast, the only other well documented scholar in the temple conspicuously never mentions his family:^{12 → ?}

- Banunu, an *āšipu*, is copyist and/or owner of four scholarly tablets: a prayer of divination “from a Babylonian original” (CTN 4, 61); the ritual *Mīs pī* “Mouth opening” (CTN 4, 188); medical recipes (CTN 4, 188); and the medical plant list *Uruanna* (CTN 4, 192). In the colophons of the second and third he exhorts, “Do not disperse the *gerginakku* (library); taboo of Ea, king of the Apsu”.^{13 → x} The copyist of a cultic commentary (CTN 4, 185), whose name is now missing, also asks for that tablet [not to be removed] “from the *gerginakku* (library) of the temple.”

It is possible, but by no means certain, that this is the same Banunu who, in the aftermath of Assurbanipal’s conquest of Babylonia, was assigned oversight of the governor of Nippur’s son in the Succession Palace at Nineveh after he had finished copying out *Enūma Anu Ellil* (“the Series”) (SAA 11, 156; Parpola 1983).

The Ezida at Kalhu was not the only Assyrian royal temple to Nabu, god of wisdom. In 717 Sargon began construction work on a new capital city, Dur-Šarruken (modern Khorsabad), some 30 miles upriver of Kalhu. Within the citadel, adjacent to the palace and linked to it by a private walkway, he commissioned a bigger and better Ezida. This new temple was furnished with two rooms fitted with pigeonholes for storing tablets, one in the outer courtyard and one in the courtyard closest to Nabu and Tašmetu’s shrines (Loud and Altman 1938: 56–64, pls. 2, 12–29). Sargon endowed the temple with 4,000 homers of land, regular offerings of sheep, and daily provisions of bread and beer for an *āšipu* and *lahhinu* (“temple steward”) (SAA 1: 88, no. 106, and 102–105, nos. 128–129). At least one set of new writing boards was commissioned, containing the celestial omen series *Enūma Anu Ellil* (Wiseman 1955), and further library holdings may also have been moved there from Kalhu.

Dur-Šarruken was functional and occupied by 707 B.C. but abandoned just two years later, following Sargon's inauspicious death in battle. His son and successor Sennacherib moved the court to Nineveh, an ancient Assyrian city between Dur-Šarruken and Kalhu, where a temple of Nabu had been founded by Adad-nerari III in 788 and restored by many successive kings (Reade 1998–2001: 410). Almost nothing of it now survives except the 60 m square foundation platform. However, a number of scholarly tablets in the Kuyunjik Collection of the British Museum bear colophons dedicated by Aššurbanipal to the *gerginakku* (“library”) of the Ezida “that is in the middle of Nineveh” (Hunger 1968: 101–102, nos. 327–328, 105–107, nos. 338–339), so it is clear that it had a significant scholarly function. Presumably the holdings of the abandoned Dur-Šarruken Ezida were moved here, or back to Kalhu, or both, for Kalhu remained a royal city — and its Ezida remained active — until the very end of empire.^{14 → x} For instance, one Nabu-sakip made a private benefaction of two slaves and seven homers of land to the Kalhu Ezida in 621 B.C. (SAA 12, 96), just seven years before it fell to the Medes and Babylonians.

In sum, the scholars of the Kalhu Ezida were — perhaps unsurprisingly — deeply embedded in a tightly-knit Assyrian royal knowledge network (Figure 1). For the most part descended from eminent scholarly dynasties, they were so closely tied to their divine and royal patrons that they and their writings, indeed their very institution, moved as the court relocated following political imperatives. Coincidentally or not, it was only Banunu, with no family to speak of, who copied a text “from a Babylonian original” — the sole extant acknowledgement of scholarship beyond the Assyrian court.

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Huzirina: A Provincial Town in the Assyrian West

The nearly 400 tablets found buried outside a domestic dwelling in the provincial Assyrian town of Huzirina (modern *Sultantepe*), near Harran, comprise a striking contrast to those found in contemporary royal cities such as Kalhu^{15 → x} (on the archaeology of Huzirina, see Lloyd 1954; Lloyd and Göcke 1953). As well as hymns, incantations and rituals, there is a preponderance of literary works in the assemblage

but very few omen collections (on the tablets, see Gurney 1952; Gurney and Finkelstein 1957; Gurney and Hulin 1964; Pedersén 1998: 178–180; <http://oracc.org/cams/gkab/huzirina>). Compared to the Kalhu tablets, the Huzirina manuscripts tend to be very poorly executed (Gurney 1952: 26). Nearly 60 of them have surviving colophons, together attesting to the activities of around 25 different scribes (Hunger 1968: 110–120, nos. 351–408). As in Kalhu, they can be differentiated into two distinct groups. The first is a priestly family, descended from one Nur-Šamaš (Gurney 1997), and their associates:

- Qurdi-Nergal, *šangû*-priest of the gods Zababa and Bau of Arbela, Harran, and Huzirina; a *šamallû agašgû* (“novice apprentice”) in 701 B.C., when he wrote a bilingual listing of the incantation series *Utukkū lemnūtu* (STT 2, 192);
- his son Mušallim-Bau, a *šamallû (agašgû)*, who copied various incantations and rituals, an ominous calendar and a medical text (STT 2, 179; 199; 299; 305 and maybe STT 1, 64);
- his descendant Ninurta- [...], a *šamallû šehru* (“junior apprentice”), son of the *šamallû šehru* Nabu-zer-kitti-lešir, who copied a calendar of incantations (STT 2, 300) in 619 B.C.;
- the *šamallû* (“apprentice”) and eunuch Nabu-ah-iddin, copyist of four incantations and rituals (STT 2, 161; 172; 237; 247) who sometimes writes *ana tāmarti* (“for the viewing of”) Qurdi-Nergal;
- Nabu-ah-iddin’s *mār mummu* (“pupil”), the *šamallû šehru* Nabu-rehtu-ušur, who copied the literary work *The Poor Man of Nippur* (STT 1, 38) in 701 B.C. *ana tāmarti* (“for the viewing of”) Qurdi-Nergal, writing: “Do not disperse the library (*gerginakku*); taboo of Ea, king of the Apsu,” just like Banunu of Kalhu.

Apart from Qurdi-Nergal’s family and immediate associates, tablets from the Huzirina cache record over twenty further writers, including:

- Adad-mušammer, a *šamallû šubultinbi* (“young apprentice”), son of the scribe Nergal-tukulti; copyist of the literary *Gilgamesh Letter* (STT 1, 40);

- Bel-le’u-ušur, a *šamallû šubultinbi*, son of Marduk-ban-apli, scribe of the *turtannu* (“field marshal”), who copied out a now unidentifiable text (STT 2, 342);
- Iddi-Meslamtaea, a *šamallû*, son of the *šangû*-priest Ašu, copyist of three manuscripts of *Utukkū lemnūtu* (STT 2, 159; 174; 177), a god list (STT 2, 377), and Tablet 2 of the literary work *Ludlul bēl nēmeqi* “Let me praise the lord of wisdom” (STT 1, 33) in and around 701 B.C.;
- Mutaqqin-Aššur, a *šamallû daqqu* (“tiny apprentice”), son of a scribe from Assur, grandson of the *šamallû šubultinbi* Šamaš-šum-iddina, and great-grandson of Nabu-kabit-ahhešu, a scribe from the Babylonian city of Kutha; copyist of a blessing for the city of Assur (STT 1, 87);
- Nabu-ibni, a *šamallû ligimû* (“youthful apprentice”), son of the Assyrian scribe Aplaya, who wrote out an unidentified medical work (STT 1, 92);
- Nabu-šum-iškun, son of Kandalanu, senior scribe of the *turtannu*, who copied Tablet 1 of the myth *Erra and Išum* (STT 1, 16) and a set of *namburbû*-incantations and rituals against ants and other pests (STT 2, 242);
- Šum-tabni-ušur, a *šamallû šehru*, son of Nabu-tukulti, *asû* (“physician”) and servant of the crown prince, who copied a literary work (STT 1, 36) and *Abnu šikinšu*, a treatise on the healing properties of stones (STT 1, 108) in the late eighth century.

It is notable that all but one of these men (Nabu-šum-iškun) describes himself as a *šamallû* (“apprentice”) of some sort; and that at least nine more such apprentices are attested amongst these tablets,^{16 → ?} plus five whose names are now missing.^{17 → ?} Two men, Iddi-Meslamtaea and Šum-tabni-ušur, are contemporaries of Qurdi-Nergal, writing in the late eighth century B.C. Almost all have good connections to the scholarly or administrative life of the empire. Bel-le’u-ušur and Nabu-šum-iškun are sons of scribes of the *turtannu*, Assyria’s senior military officer and governor of a neighbouring province whose capital was Til-Barsip (Radner 2006–8: 48). Šum-tabni-ušur is the son of a crown prince’s (i.e., Sennacherib’s?) *asû* (“physician”); Iddi-Meslamtaea is a *šangû*-priest’s son; Mutaqqin-Aššur and Nabu-ibni trace their descent

to scribal families of the cities of Assur and/or Kutha. Their now-anonymous fellow-copyists seem to have similar pedigrees, including descent from a *šangû*-priest and a *bārû* (“diviner”).

While it is of course possible that Qurdi-Nergal and his descendants acquired some or all of these men’s tablets through purchase, inheritance or exchange, their social homogeneity and mediocre scribal ability together suggest an alternative explanation. Stefan Maul (2010: 208) has recently used colophons from an assemblage of several hundred scholarly tablets, found in a seventh-century house in the imperial city of Assur, to show that it accrued during the course of scholarly training of four generations of a family of *mašmaššus* (“incantation priests”) associated with the temple of the city god Aššur. In the second generation, for instance, Kišir-Aššur’s titles evolved from *šamallû šehru* through *šamallû*, *šamallû mašmaššu šehru* (“junior apprentice incantation priest”), *mašmaššu šehru* (“junior incantation priest”) and *mašmaššu* to *mašmaššu bīt Aššur* (“incantation priest of Aššur’s temple”). He also notes the presence of thirteen tablets with colophons of men that apparently do not belong to Kišir-Aššur’s family, but who are all designated as *šamallû* or *šamallû šehru* too (Maul 2010: 216). Many further tablets without colophons are written in immature script, replete with errors and erasures (Maul 2010: 217). The parallels with Huzirina are compelling. Both houses, it appears, were centres of scholarly apprenticeship which attracted advanced (but not always entirely competent) learners from outside the resident family. It may be that Qurdi-Nergal’s family took in paying pupils to supplement their temple income, ¹⁸→ x documented by two fragmentary records of endowments to the temples of Zababa and Bau, and Ištar, found at Huzirina (SAA 12, 48; 91 = STT 1, 44; 2, 406+407). The Huzirina students were predominantly the sons of provincial officials, priests and scholars who — with the possible exception of Šum-tabni-ušur — had no direct connections to the Assyrian royal family or the inner circle of court scholars of the Ezida at Kalhu, although some belonged to families from the city of Assur (Figure 2).

<<Insert Figure 2 about here>>

It is not only the human actors in the Huzirina network that were not integrated into contemporary royal scholarship. While four Huzirina tablets are said to be copies from Babylon, or from the goddess Gula’s temple there (STT 1, 73; STT 2, 136; 232; 323), none claims to be from any city of the Assyrian imperial heartland.

And while Nabu was clearly central to the royal scholarly network, in Huzirina it was the divine couple Zababa and Bau of Arbela, Harran, and Huzirina, the deities served by Qurdi-Nergal and his family.¹⁹→^x

However, the colophons do invoke a similar range of gods to curse or bless those who would steal or protect the tablets. In the very fragmentary Kalhu tablets only Ea and Šamaš are currently legible (CTN 4, 27; 116; 188). At Huzirina, Šamaš is invoked five out of fifteen times (STT 1, 71; 84; 92; 2, 215, 394) and Ea three times, always in conjunction with Nabu (STT 1, 38; 40; 192). Nabu is summoned a further three times, once together with Marduk (STT 1, 108; 2, 247; 256), while Iddi-Meslamtaea calls twice on Lugalira (STT 1, 33; 2, 159), and there are single occurrences of Adad and Zababa (STT 1, 56; 2, 199). But with the exception of the last, these deities do not seem to have particular geographical significance here but rather stand for the general or specific realms of learning with which the colophon writers wished to be associated.

Uruk: A Venerable Babylonian City under Achaemenid Rule

When the Achaemenid Persians conquered Babylonia in 539 B.C., Uruk was already about 3,000 years old. At its economic, social, and intellectual heart was a huge temple complex which had served the great sky-god An (later Anu) and his daughter the irresistible Inana (Ištar) since at least the fourth millennium B.C. Substantial property, investments and commercial activity, as well as a flourishing offering culture, meant that — in the medium term at least — the Uruk temples could withstand the loss of royal interest and favour that came with the end of indigenous rule. Indeed they continued to support a substantial community of learned men for several hundred years. A family of *mašmaššus* (“incantation priests”) associated with the temples, the descendants of one Šangi-Ninurta, occupied a house in southeast Uruk until about 420 B.C., when they left behind a handful of legal records and some 190 scholarly tablets, including 56 with colophons (on the archaeology of this house, see Schmidt 1979).²⁰→^x Medical recipes, healing rituals and incantations, medical and terrestrial and birth omens predominate, as might be expected of a family of healers, but mathematical and metrological works also feature (on the tablets, see Clancier 2009: 47–72, 387–405; Hunger 1976; Pedersén 1998: 212–213; von Weiher 1982, 1988, 1993, 1998; <http://oracc.org/cams/gkab/achaemenid>). As in Huzirina, we can

clearly identify a core group of family men plus their direct associates:

- Šamaš-iddin, *mašmaššu*, writer of nine scholarly tablets: four incantations and rituals, including *Lamaštu* and *Bīt rimki* (“Bath house”); two collections of medical recipes; two commentaries on the medical omen series *Sakikkū* (“Ailments”); and the mathematical compilation *Zēru u qanū* (“Seed-measure and reed-measure”) (SpTU 1, 44; 48; 3, 66; 84; 100; 4, 127; 128; 5, 254; and Friberg et al. 1990: no. 483);
- Šamaš-iddin’s son Anu-ikšur, *mašmaššu (šehru)* (“(junior) incantation priest”) of Anu, writer of 24 scholarly tablets: 18 for himself — 11 commentaries, three ritual series, three sets of medical recipes and a list of ingredients (SpTU 1, 28; 31–33; 38; 45, 47; 49–51; 56; 60; 72; 83; 2, 8; 3, 99; 5, 241; 248) — plus four for his father: two incantation series, the lexical text *An = Anum*, and a collection of medical recipes (SpTU 1, 59; 126; 3, 69; 5, 242);
- Anu-ikšur’s son Anu-ušallim, scribe of two tablets from the omen series *Šumma izbu* and *Alandimmū* (SpTU 3, 90; 4, 151) for his father;
- Šamaš-iddin’s other son Rimut-Anu, a *mašmaššu*; copyist of a list of diseases, a set of metrological tables and the so-called *Āšipu’s Handbook* (SpTU 4, 152; 172; 5, 231) some time during the reign of Darius (r. 522–486 B.C.);
- Belu-kašir, son of Balaṭu, apparently not a family member, who copied a list of diseases (SpTU 1, 43) for Rimut-Anu;
- Nadin, family relationship unclear, who compiled a set of arithmetical tables (SpTU 4, 174), also for Rimut-Anu;
- and two tablets — part of the lexical commentary *Mur-gud* and an extract from the birth omen series *Šumma izbu* (SpTU 1, 60; 23, 116) written by members of the Šangi-Ninurta family whose names are now lost.

A further five tablets, which are probably to be associated with this tablet collection on stratigraphic grounds, bear colophons of men who cannot be directly linked to

members of the Šangi-Ninurta family:

- Anu-apal-iddin, son of Anu-šum-lišir, descendant of Kuri, copyist of a tablet of the anti-witchcraft ritual *Maqlû* (“Burning”) (SpTU 3, 47A);
- GUBšu-Šamaš, a *mašmaššu šehru* and son of Ibni-Ištar, descendant of Gimil-Nanaya, who copied a tablet of the purification ritual *Bīt rimki* (SpTU 3, 67) for the *mašmaššu* Ištar-nadin-ahi, son of Arad-Gula, descendant of Gimil-Ištaran;
- Sin-banunu, a *mašmaššu* and son of Ile’i-Marduk, copyist of a *namburbû*-ritual against the evil of birds entering the home (SpTU 3, 80);
- Šamaš-ah-iddin, writer of a commentary on the medical omen series *Sakikkû* (SpTU 1, 39);
- UB-ia-..., writer of a commentary on celestial and physiognomic omens (SpTU 1, 84).

Whether or not these tablets were produced in the Šangi-Ninurta family’s house or elsewhere, it is clear from their contents, and from the professions of their copyists, that they were kept or acquired because they were all directly relevant to the family’s core intellectual interests (and presumably livelihood), namely healing and

purification.^{21 → x} Presumably this is how they earned their livelihood as well, but it is also likely that the Šangi-Ninurta family held prebends, or rights to shares in temple income. Unfortunately none of the legal documents found in their house (many of which are fragmentary) mentions any of our men.

It is striking that whereas the Huzirina scribes tend to emphasise their geographical origins and/or their relationships to politically powerful patrons, the Uruk *mašmaššus* give only their paternity and profession. This may suggest that their scholarly network operated on a much smaller geographical scale, an impression also given by the origins of the tablets and writing boards from which they copied. Two of Šamaš-iddin’s *Bīt rimki* tablets are said to be “a copy of a writing-board, property of the Eanna temple” in Uruk (SpTU 3, 66; 4, 127) and Anu-ikšur and Rimut-Anu both had occasion to work from “Urukean copies” (SpTU 1, 59; 3, 90; 4, 172; plus SpTU 1, 71, unsigned). There are just two extant exceptions to this localism: Anu-ikšur

copied a section of *Maqlû* from “a tablet from among the old tablets of Meslam.” a temple at Kutha (SpTU 5, 241), and Sin-banunu’s *namburbû* stems from “a writing board from Babylon” (SpTU 3, 80) (Figure 3).

<<Insert Figure 3 about here>>

_____ The divine world in which the *mašmaššus* operated was also much reduced. Sixteen of the seventeen tablets that invoke deities in colophons call on the city god Anu, plus the goddess Ištar of Eanna (mostly written by Šamaš-iddin and non-family men) or Anu’s divine spouse Antu (mostly by Anu-ikšur).²² Only one, by Anu-ikšur, summons Gula, the goddess of healing traditionally associated with the Babylonian city of Isin (SpTU 1, 47). Nabu, the god of wisdom so prevalent in Assyrian scholarly life, is nowhere to be seen.

Conclusions

By taking a Latourian view of cuneiform scholarship — widened to include divine as well as human and inanimate actors — and by mapping it with tools such as Google Earth, we begin to glimpse the complexities and variety under the apparently smooth surface of the “stream of tradition.” The three ancient knowledge networks surveyed here each have their own distinctive characteristics, stemming from their very different scholarly and socio-political functions. The Ezida temple in seventh-century Kalhu was but one node in a network of [scholarly](#) repositories serving an elite group of learned men who guided Assyrian royal decision-making, and who followed king and court from city to city in the imperial heartland. The priestly household at Huzirina, by contrast, offered a gentlemanly education to the young men of empire: the offspring of scholars and provincial officials, who were proud of their origins but who aspired, perhaps, to climb further up the Assyrian social scale through acquisitions of the classics of Babylonian literature. Their network is conspicuously excluded from access to the royal cities, although it is otherwise impressively extensive. In the *mašmaššus*’ house in fifth-century Uruk, however, we see a dramatic shrinking of the intellectual landscape that may be the outcome of late Achaemenid attitudes to Babylonian autonomy (Waerzeggers 2003–4). While family-based learning continued in much the same way as before, scholars, apprentices, and their

writings seem to have travelled rarely beyond the city limits or across professional divides.²³ → x However, the Urukeans' geographical horizons were to open up again to some extent during the Seleucid period, when the Ekur-zakir family of *mašmašus*, who by then were occupying the Šangi-Ninurta family's house, had access to originals from the Babylonian cities of Nippur and Der (SpTU 2, 34; 4, 125; 185) and even possessed a 300-year-old tablet from Nineveh, bearing a colophon of Assurbanipal (SpTU 2, 46).

It has also become clear that the distinction Assyriologists have traditionally made between familial and institutional tablet collections (e.g., recently [Clancier 2009: 17, 319](#); Pedersén 1998) is not particularly meaningful: scholarly dynasties could be associated with particular institutions over many generations, and it is likely that tablets and writing boards moved as freely as their owners between homes and workplaces. Indeed, we now see that people, objects, and institutions were all surprisingly mobile. Individuals and groups could travel for long distance in pursuit of teachers, clients, and patrons, taking memorised as well as recorded knowledge with them. Perhaps too they travelled in search of particular learned works, for, as I have discussed elsewhere (Robson 2011, [2013](#)), access to scholarly writings was patchy and unreliable. Instead, the composition of learned collections, while demonstrably shaped by the core intellectual interests of their creators (and deformed by the [subsequent](#) loss of perishable media), is decidedly uneven. This appears to reflect the eclectic, opportunistic acquisition of tablets and writing boards across a wide range of genres which rarely, if ever, resulted in ownership of a complete run of multi-tablet series.

Our sobering conclusion must then be that no person or community in the first millennium B.C., even the royal scholars of Nineveh, had access to as much of the so-called “stream of tradition” as we do today. And our understanding of it will only grow with the expansion of online corpora such as those that Oracc facilitates. But while previous generations understandably took their panoptic view of the whole to be a fair reflection of ancient knowledge worlds, Oracc's annotational and analytical power facilitates a more nuanced chronological, geographical and social partition of first-millennium intellectual space. At the same time it breaks down the genre-based barriers erected by Assyriology over the twentieth century, allowing us new glimpses of the interrelations between different types of scholarly endeavour and some of the

means by which intellectual communities cohered. But this is just the beginning: as the online Assyriological knowledge network grows and strengthens, we will be afforded many further insights — many as yet unimaginable — into the fragility and power of cuneiform scholarship in the ancient Middle East.

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Notes

- x1 Series such as Writings from the Ancient World, The Context of Scripture and State Archives of Assyria in English, Texte aus der Umwelt des Alten Testaments in German, Littératures anciennes du Proche-Orient in French; and stand-alone works such as, most recently, Black et al. 2004, Foster 2005, and Chavalas 2006.
- 2 > 1 Oracc's name is a tongue-in-cheek homage to the BBC TV science fiction series Blake's 7 (1978–81), about a small group of renegade freedom fighters and their portable super-computer Orac, who battle against the evil and oppressive Terran Federation.
- 3 > 2 The USA and UK each accounted for 31% of visits to K&P in January 2011. But also in the top ten countries were the Philippines (no. 8, at 1.3%) and India (no. 10, at 1.1%), where no Assyriology is taught at university level. For SAAo, by contrast, the top ten for January 2011 were all North American or European countries where Assyriology is a university subject. However, the total of 33 countries included Singapore, Croatia, Brazil,

Syria, Slovakia, Greece, Yemen, and Iran.

- x4 Such collections are commonly called “libraries” in Assyriological parlance (e.g., Pedersén 1998; Clancier 2009). I have addressed the thorny question of what constitutes a cuneiform library elsewhere (Robson 2013; Robson and Stevens 2012); here I shall simply avoid the term wherever possible.
- x5 See Robson 2011 for a longer discussion of the relevant historiography and excavation/publication history and Robson and Stevens 2012 for an up-to-date survey of excavated assemblages of cuneiform scholarship from the first millennium B.C.
- x6 The so-called *āšipus*’ house in seventh-century Assur and the Ebabbar temple in sixth-century Sippar each held a collection of about 800 tablets (Pedersén 1998: 135–136, 194–197).
- x7 “The word black box is used by cyberneticians whenever a piece of machinery or a set of commands is too complex. In its place they draw a little box about which they need to know nothing but its input and output” (Latour 1987: 2). According to the *Oxford English Dictionary Online*, the term “black box” was originally Royal Air Force slang for “a navigational instrument in an aircraft,” later extended to denote any “device which performs intricate functions but whose internal mechanism may not readily be inspected or understood” (“black box, n.,” *OED Online*, September 2013, Oxford University Press, <http://www.oed.com/view/Entry/282116>, electronic document, accessed September 25, 2013.).
- x8 On the archaeology of Kalhu (biblical Calah, modern Nimrud), see Curtis et al. 2008; Mallowan 1966; Oates and Oates 2001; on the scholarly tablets from Kalhu, see Black 2008; Pedersén 1998: 151–152; Wiseman and Black 1996; and <http://oracc.org/cams/gkab/kalhu>.
- 9 > 3 Šumaya son of Nabu-zeru-lešir is attested as an *āšipu* at Nineveh late in Esarhaddon’s reign (SAA 10, 257; 291). Some time in 671–669 B.C. he petitioned crown prince Assurbanipal to let him take over his dead father’s scholarly work at Kalhu, having established himself in a similar role in Tarbišū (SAA 16, 34). He and Adad-šumu-ušur witnessed a legal document together in the northern Assyrian town of Išpallure in 666 B.C. (SAA 6, 314).
- 10 > 4 Adad-šumu-usur alone: SAA 8, 160–163; SAA 10, 185–204; 206–208; 210–211;

213–215; 217–220; 222–230; SAA 16, 167; with Nabu-zero-lešir and/or Urad-Ea (and others): SAA 10, 1; 3; 212; 232; with other colleagues, SAA 10, 24; 205; 209; 216; 221 231; 256; 259; Nabu-zero-lešir alone: SAA 10, 2; SAA 16, 50; Urad-Ea alone or with others: SAA 8, 181–183; SAA 10, 25; 338–344.

- x11 Coincidentally or not, a tiny fragment of *Šumma ālu* Tablet XIII, containing omens about fungus growths, is amongst the extant scholarly tablets from the Kalhu Ezida (CTN 4, 36).
- 12 > 5 The two remaining extant names are both very fragmentary: Bel-..., copyist of birth omens (CTN 4, 31); Nabu-..., mentioned in the colophon of an unknown incantation (CTN 4, 125); there is also a *šamallu Šehru* (“junior apprentice”), copyist of the astronomical compendium *Mul-apin* “Plough star” (CTN 4, 27), whose name is now missing.
- x13 The copyist of a cultic commentary (CTN 4, 185), whose name is now missing, also asks for that tablet [not to be removed] “from the *gerginakku* (library) of the temple”.
- x14 One Nabu-sakip made a private benefaction of two slaves and seven homers of land to the Kalhu Ezida in 621 B.C., just seven years before it fell to the Medes and Babylonians (SAA 12, 96).
- x15 On the archaeology of Huzirina (modern Sultantepe) see Lloyd and Göçke 1953; Lloyd 1954; on the tablets see Gurney 1952; Gurney and Finkelstein 1957; Gurney and Hulin 1964; Pedersén 1998: 178–180; <http://oracc.org/cams/gkab/huzirina>.
- 16 > 6 The other named scribes are the *šamallû Šehrûtu* (“junior apprentices”) Aššur-šumu-iddina, Bel-ašaredu, Išdi-ilu, Marduk-ban-..., Nabu-eṭir, Nabu-šabši, [...]-ereš, and [...]-šum-ikšur (STT 1, 57; 73; 84; 85; 2, 136; 256; 340; 368); the *šamallû* [...]-zer-ibni and Sin-šum-iddin, both sons of scribes (STT 1, 82; 109); and — with no titles given — Mannu-ki-Babili, Nabu-eṭir-napšate, Nabu-eṭiranni, Nabu-ahhe-šallim, and Sin-iddina (STT 1, 3; 10; 2, 215; 232; 241; 301; 330). In addition Bel-šar-ahhešu, a [priest] of Aššur’s temple in Assur, and Marduk-šapik-zeri, an *āšipu* from Babylon, are mentioned in one colophon each, but apparently not as copyists or owners (STT 1, 69; 89).
- 17 > 7 A *šamallû Šehru*, son of a *šangû*-priest (STT 2, 394); a *šamallû Šehru* [with some relationship to] Iddi-Meslamtaea (STT 2, 390); a *šamallû Šehru*, son of the scribe and

bārû (“diviner”) Marduk-ban-apli (STT 1, 70); and one or more further šamallû (Šehr(ūt)u) (STT 1, 55; 66; STT 2, 343).

- x18 Two fragmentary records of endowments to the temples of Zababa and Bau, and Ištar, were found at Huzirina (SAA 12, 48; 91 = STT 1, 44; 2, 406+407).
- x19 However, the colophons do invoke a similar range of gods to curse or bless those who would steal or protect the tablets. In the very fragmentary Kalhu tablets only Ea and Šamaš are currently legible (CTN 4, 27; 116; 188). At Huzirina, Šamaš is invoked five out of fifteen times (STT 1, 71; 84; 92; 2, 215, 394) and Ea three times, always in conjunction with Nabu (STT 1, 38; 40; 192). Nabu is summoned a further three times, once together with Marduk (STT 1, 108; 2, 247; 256), while Iddi-Meslamtaea calls twice on Lugalira (STT 1, 33; 2, 159) and there are single occurrences of Adad and Zababa (STT 1, 56; 2, 199). But with the exception of the last, these deities do not seem to have particular geographical significance here but rather stand for the general or specific realms of learning with which the colophon writers wished to be associated.
- x20 On the archaeology of this house, see Schmidt 1979; on the tablets, see Clancier 2009: 47–72, 387–405; Hunger 1976; Pedersén 1998: 212–213; von Weiher 1982, 1988, 1993, 1998; <http://oracc.org/cams/gkab/achaemenid>.
- x21 It is also likely that the Šangi-Ninurta family held prebends, or rights to shares in temple income, but unfortunately none of the legal documents found in their house (many of which are fragmentary) mentions any of our men.
- 22 > 8 Anu and Ištar: SpTU 1, 48; 59; 3, 69, 84 (Šamaš-iddin), SpTU 1, 45; 5, 241 (Anu-ikŠur), SpTU 1, 39 (Šamaš-ah-iddin) and SpTU 3, 74A (Anu-apal-iddin); Anu and Antu: SpTU 1, 126; 5, 254 (Šamaš-iddin), SpTU 1, 33; 2, 8; 3, 90; 5, 242; 248 (Anu-ikŠur); Anu and [...]: SpTU 4, 152 (Rimut-Anu).
- x23 The Urukians’ geographical horizons were to open up again to some extent during the Seleucid period, when the Ekur-zakir family of *mašmaššus*, who by then were occupying the Šangi-Ninurta family’s house, had access to originals from the Babylonian cities of Nippur and Der (SpTU 2, 34; 4, 125; 185) and even possessed a 300-year-old tablet from Nineveh, bearing a colophon of Assurbanipal (SpTU 2, 46).

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Matthew Rutz 9/25/13 5:06 PM

Comment [2]: ignore: we are still deciding on how to cite RIA consistently

SpTU = Hunger 1967; von Weiher 1982, 1988, 1993, 1998

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