Mathematics in Ancient Iraq

A Social History by Eleanor Robson

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Eleanor Robson, *Mathematics in Ancient Iraq: A Social History*. Princeton and Oxford: Oxford University Press, 2008. xxvii+441 pp. Bibliography, indexes of tablets and subjects. ISBN 978-0-691-09182-2. Cloth.

Since Moritz Cantor, typical general histories of mathematics have contained an initial presentation of "Babylonian mathematics". As a rule, the tenor of these presentations have agreed with the overall view of the authors of what constitutes *mathematics*, and what constitutes *history of mathematics*. Accordingly, Morris Kline [1], strongly engaged in ancient Greek and post-Renaissance rigorously demonstrative mathematics, dismissed anything pre-Greek as not really mathematics; Dirk Struik [2], highly aware of the connectionm between mathematics and its technological context, was much more balanced (and even started with a chapter on what would nowadays be labelled "ethnomathematics" and what he designated "stone age mathematics"; still, as concerns the mathematical substance of the Babylonian tradition Struik had only skimmed the 1941 edition of Neugebauer's *Exact Sciences in Antiquity*, and his general historical framework dissolved any specificity of the Babylonian world in a postulated "continuity and affinity of the Oriental civilizations", regarding the distinction between "Egyptian, Babylonian, Chinese, Indian, and Arabian cultures" as "mechanical divisions" (p. xii).

The majestic source collections of Neugebauer [3], Thureau-Dangin [4] and Neugebauer & Sachs [5] certainly give a much more differentiated picture of Babylonian mathematics.[1] However, none of them try to present a *history* (neither "internal" not in broader context) – as Neugebauer says explicitly [3: 79], "development of the consequences that can be drawn from the text material is not among the aims I have set myself". In recent decades, much work has also been published about the mathematics of single periods or about specific aspects of Mesopotamian mathematics (now transcending the period where the concept "Babylonian" is adequate). All in all, the only genuine history of Babylonian / Mesopotamian mathematics was published by Kurt Vogel in 1959 [7] and aimed at the gymnasium level.[2] Given both this target group (with all respect for the German *höhere Schule* and for Vogel's historical insight) and the immense progress in Assyriological knowledge and understanding attained since then, this book is obviously outdated by now.

This situation has now been happily changed by Eleanor Robson. Her book, though claiming to be a "social history", is indeed more than that – rather a basic history of

[1] I allow myself not to include in this list E. M. Bruins' and M. Rutten's publication of the important mathematical texts from Susa [6], since the picture this publication offers is often terribly distorted by Bruins' editorial commentary.

[2] A. A. Vajman's book from 1961 [8] is probably also to be understood as history; however, in the moment of writing I do not have it at hand for inspection under this perspective; in any case, my once poor Russian has probably deteriorated to the point where I should not make any judgment.

mathematics as embedded in its social context and function. Without using space on discussions of the most sophisticated topics, she gives the reader a good account of almost everything mathematical going on in the region between the outgoing fourth and the late first millennium (BCE, as all unqualified dates in what follow) in as far as it is documented in surviving sources – the most obvious exception being the techniques of mathematical astronomy, examination of which might indeed be an overwhelming task.

In her delimitation of "mathematics", Robson comes closer to Dirk Struik than to Morris Kline; often, she broadens the subject to "numeracy" and presents, for instance, the contents of private household computations. This notwithstanding, a large part of her evidence consists of those texts which are conventionally considered as "mathematical": those connected to the school training of scribes.

Robson also deviates from the standard conceptualization of the region she looks at: neither "Babylonia" – which is only meaningful from the moment Babylon becomes an important polity in the early second millennium and would in any case exclude the Assyrian north – nor "Mesopotamia", a word borrowed from classical Greek (with a cognate in Biblical Hebrew) and unconnected to the geographical realities of our own days. Instead, her title speaks of Iraq, which emphasizes that this present-day country corresponds grossly to an area which was as much of a cultural unity some 4000 years ago as was "Italy" around 1100 CE. I suspect (and sympathize with) an implicit argument against those who claim Iraq to be merely an artificial, post-WWI-creation which is better cut into three statelets whose oil resources it would be easier to grab.

The large majority of known properly mathematical texts are from the Old Babylonian period (2000–1600, according to the "middle chronology") – mainly its second half. Until the 1970s, the only other known mathematical texts were from the Seleucid era (third and second centuries), apart from a few tables of reciprocals tentatively ascribed to the Ur III period (21st century). As a rule, these texts had been bought by museums on the antiquity market, and neither place of origin nor precise date were known – which obviously contributed to making any writing of history impossible (just imagine how it would be to write the history of early Modern mathematics from nothing but a pêle-mêle of undated and unlocated mathematical manuscripts ranging from Cardano to Abel, and from school to academy level!). Since then, a small number of mathematical texts from the late fourth, the third and the mid-first millennium have been discovered; some terminological grouping of the Old Babylonian corpus has been achieved; and Eleanor Robson herself has found firm evidence that the tables of reciprocals in question are indeed of Ur III date. Still, most presentations of "Babylonian / Mesopotamian mathematics" concentrate on the periods from which most texts are known – these, at least, allow us to make a portrait of the mathematical culture of specific moments or periods (actually, only of the Old Babylonian period).

Robson has chosen a radically different way, forcing the presentation into a different scheme allotting more or less equal space to each approximate half-millennium. Occasionally, this compels her to treat under a half-millennium where other material is scarce a topic which might just as well or more naturally have been dealt with elsewhere (e.g., “tabular accounting”, reaching from the third into the first millennium, dealt with in the context of the later second millennium). On the whole, however, the system works astonishingly well; this is evidently only possible because Robson is not a historian of mathematics who has specialized in cuneiform mathematics but a fully trained all-round Assyriologist (first trained as a mathematician, however).

Robson offers a picture where numeracy (and, when this word is adequate, mathematics) is always bound up with the scribal function (the treatment of symmetry and general visual culture as aspects of geometry being partial exceptions).[3] Until the mid-second millennium this compound is further linked to state administration and to the idea of mathematically determined social justice guaranteed by the king – even much later, the iconography of rulers exhibits the measuring rod and rope as royal insignia, but for how long their role in the division of land was really remembered is doubtful (not to speak of “just” distribution).[4]

From the Old Babylonian period through the earlier first millennium, documents also reflect the application of scribal mathematics in private merchant households. However, in the final phase, first in the Assyrian north, everyday administration, statal as well as private, was increasingly performed on ephemeral supports (wax tablets, papyrus, parchment), and probably in Aramaic; when its outcome needed duration, however, for instance in contracts, it might be transferred (without the calculations[5]) to clay and written in either Akkadian cuneiform or in alphabetic Aramaic; in the south, Robson can still point to a mid-first–millennium cuneiform curriculum encompassing metrological lists and tables of square numbers (and hardly much more mathematics) as well as tablets reflecting household numeracy (money, interest, metrology, land measurement). As the two (Assyrian and Babylonian) dialects of the Akkadian language died as vernaculars after the mid-first millennium, cuneiform culture was upheld only

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[3] The use of numeration as a literary device in epics and royal inscriptions hardly counts as an exception to the rule, both literary genres being products of scribal culture.

[4] Venerated symbols, as we know, often survive their original meaning – how many Christians remember today that “God’s lamb” does not stand for the tenderness of the Saviour but for the butchered sacrificial animal whose blood buys off the wrath of the heavenly Father?

Contrary to Robson, I doubt that Old Babylonian scribal calculators saw work on adwanced “algebraic” problems dealing with areas as connected to their administration of royal “justice”. No second-mellinnium source I know of (and none cited by Robson) contains any hint of such a view.

[5] This was no new trend. Intermediate calculations are almost exclusively known from the school genre – “good scribes never showed their working”, as Robson observes (p. 78) in the context of the 21st century, where wax tablets are first spoken of.

by a narrow environment of scholar-scribes, identifying themselves as exorcists, copyists of omen series, incantation- and lamentation-priests, and the like. As Robson shows, they belonged to a small, interconnected circle of (real, namely blood-, not apprenticeship-cum-adoption–based) families. This environment also created the mathematical astronomy; finally, it produced the small number of surviving Seleucid non-astronomical mathematical texts.

An appendix of 46 pages lists all published mathematical texts.

Robson's work is amply richer in details than can be rendered in a review – and history can only be written on the basis of documented details, hopefully to be fitted together into a meaningful pattern of general conclusions. Nothing comparable has been made before, and for the present reviewer it has been a great pleasure to read the book, from which I have learned much. But although clay tablets survive the millennia better than most other media, readers should remain aware that only a small part of the evidence we would like to have has survived; that much less has been excavated – and that many of the tablets that *have* been excavated are still waiting to be read. As Assyriologists sometimes say, the best place to dig is in the Museum cellars. Any pattern that can be constructed on the basis of the evidence we do possess is therefore a *re*construction, an extrapolation building in part on what its author sees as reasonable assumptions. It is therefore no wonder that some of Robson's general conclusions can be disputed, just as she herself objects to some of the conclusions drawn by previous workers – including some of those of the present reviewer.

Detailed discussions of such doubts belong in the context of Assyriological or historical journals if not in private letter exchange – just explaining to a non-specialist audience what they are about would require pages and pages of background information. I shall therefore only air such doubts as are of general character, even here without going into details with my arguments.

Robson concentrates on what can be documented in the cuneiform record itself. Although she does recognize the existence of non-literate or at least not cuneiform-literate numerate activities in the area, she tends to not take them into account in her historiography, implicitly supposing that the development of the literate mathematical tradition took place inside a closed scribal environment. This is of course no different from the way the history of other mathematical periods is mostly written; but the approach might be unduly restrictive here no less than elsewhere.

Moreover, when discussing possible links to other cultures (in particular Greek mathematics, Robson does not consider the indubitable links to Islamic practical geometry nor those to Jaina geometry[6]) she restricts herself, on one hand, to sweeping

[6] There is only a general exhortation (p. 288) to "explore [the place of cuneiform mathematics] within the sciences in the Middle East, and Asia more generally". This almost sounds as Struik's "affinity of the Oriental Civilizations".

arguments (of a kind which might prove that Descartes did not ultimately draw on medieval abbacus algebra, and which in any case collapse in front of the indubitable connection between Seleucid and Egyptian Demotic mathematics); on the other, to rather unspecific references to renowned publications that take pertinence of these for granted, in a way which unwittingly supports the myth of the Greek genius that invented everything on its own without interaction with other cultures.[7].

References

[1] Morris Kline, *Mathematical Thought from Ancient to Modern Times*. New York: Oxford University Press, 1972.

[2] Dirk J. Struik, 1948. *A Concise History of Mathematics*. New York: Dover, 1948.

[3] O. Neugebauer, *Mathematische Keilschrift-Texte*. I-III. (Quellen und Studien zur Geschichte der Mathematik, Astronomie und Physik. Abteilung A: Quellen. 3. Band, erster-dritter Teil). Berlin: Julius Springer, 1935, 1935, 1937.

[4] F. Thureau-Dangin, *Textes mathématiques babyloniens*. (Ex Oriente Lux, Deel 1). Leiden: Brill, 1938.

[5] O. Neugebauer & A. Sachs, *Mathematical Cuneiform Texts*. (American Oriental Series, vol. 29). New Haven, Connecticut: American Oriental Society, 1945.

[6] E. M. Bruins & M. Rutten, *Textes mathématiques de Suse*. (Mémoires de la Mission Archéologique en Iran, XXXIV). Paris: Paul Geuthner, 1961.

[7] Kurt Vogel, *Vorgriechische Mathematik*. II. *Die Mathematik der Babylonier*. (Mathematische Studienhefte, 2). Hannover: Hermann Schroedel / Paderborn: Ferdinand Schöningh, 1959.

[8] A. A. Vajman, *Šumero-vavilonskaja matematika. III-I Tysjačeletija do n. e.* Moscow: Izdatel'stvo Vostočnoj Literatury, 1961.

[7] I would like to add a personal historical note for the record. On p. 7, Robson suggests that “it is perhaps no coincidence that ‘Algebra and naïve geometry´, Jens Høyrup's seminal work on the language of Old Babylonian algebra” was published in 1990, the year where Neugebauer and Bruins died. Coincidence in fact it is. The manuscript was submitted in 1986 to one of the pertinent editors of *Archive for the History of Exact Sciences* (*not* van der Waerden, which I regret); after a full year this editor refused it, accompanying the refusal with a question showing he had not read until line 7 of the first page. The manuscript was then invited in 1988 by *Altorientalische Forschungen*, but typographical composition was difficult and took a long time. Preliminary presentations of my results had already appeared in *Erdem* (1986) and *Mathematische Semesterberichte* (1989). I had also sent a first extensive but very preliminary university print to Neugebauer in 1984 and received a kind but non-committal postcard together with some offprints on the calendar topic on which he was working at that moment. I am happy to be able to say that I did not celebrate the departure of a giant by kicking his teeth while standing on his shoulders (that is certainly not what Robson wants to insinuate, I should say). Nor had I been so scared by Bruins that I dared not criticize him while he was alive and spitting flames.