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★**Mathématiques égyptiennes. (French) [Egyptian mathematics]**
Recherches sur les connaissances mathématiques de l'Égypte pharaonique. [Research on the mathematical knowledge of Pharaonic Egypt]
With a preface by Jean-Claude Goyon.
Le Léopard d'Or, Paris, 1993. ii+209 *pp*. 150 F. *ISBN* 2-86377-118-3

The book under review deals with the mathematics of the Rhind Mathematical Papyrus (RMP), the Moscow Mathematical Papyrus (MMP), and the mathematical papyri from Kahun and Berlin—all dating from the Middle Kingdom or copied from a Middle Kingdom original. A single parallel is quoted from a Ptolemaic demotic papyrus, but with this exception the theme of the book is thus "the mathematics of Middle Kingdom mathematical papyri". In comparison it may be remembered that R. J. Gillings [*Mathematics in the time of the pharaohs*, The MIT Press, Cambridge, Mass.-London, 1972; MR0469613 (57 #9396)] included computational ostraca, temple accounts, etc.

The whole exposition is based on actual texts—even the presentation of the basic arithmetical algorithms. The texts that are used are rendered in hieroglyphic transcription (all originals are in hieratic writing), phonetic transliteration and French translation. The hieratic text itself is never shown. Critical points in the translation are regularly discussed with reference to the hieroglyphic and/or phonetic text.

After introductory matters, Chapter II deals with basic techniques: The number system; algorithms for addition, subtraction, multiplication, and division; fractions and reduction; the role of the fraction $2/3$; $2{:}\,N$-tables; the use of "red auxiliary numbers". Chapter III, "La géométrie", treats metrology (length, area, volume, capacity, weight); triangle; rectangle and trapezium; circle and "ellipse"; simple volumes; pyramid slope and volume of the truncated pyramid; and the "nebet" (hemisphere or semicylinder with quadratic base?—the author opts for the former interpretation without presenting decisive arguments). More than half of Chapter IV, "Procédés équivalents aux équations et séries" is (justly!) taken up by the various problem types that can be translated $a \cdot x = b$ ("h"-problems, filling problems, etc.); after that come [homogeneous] "second-degree equations", square root, series of fractions to be completed, equal and unequal division. Chapter V presents four "particular problems".

The book takes up discussion with select earlier workers, and does present a couple of interesting new interpretations. On the whole, however, it presents the state of the art as it has looked without fundamental change since the early 1930s. As such, the book is a welcome tool for readers more fluent in French than in English, or who have no easy access to the second part of the Chace edition of RMP [*The Rhind Mathematical Papyrus. II*, Math. Assoc. Amer., Oberlin, OH, 1929; JFM 55.0594.01] and Struve's edition of MMP [*Mathematischer Papyrus des Staatlichen Museums der Schönen Künste in Moskau. Band 1*, Springer, Berlin, 1930].

A number of serious shortcomings must be mentioned, however, at least in representative selection. On the purely technical level, a faulty word processing program and insufficient proofreading repeatedly causes the hieroglyphic/phonetic column to be mixed up with the translation (and other problems); the strokes that should indicate which lines serve in multiplications and divisions are systematically absent, even though the explanation refers to them (p. 20).

That numbers are often omitted in the translation is probably a human error, but since they will be found in the hieroglyphics the problem is only annoying, as are in general the fairly copious typographical errors. That references make use of the standard abbreviations of *Lexikon der Ägyptologie* is unkind to readers with no easy access to that tool, but the rampant errors in the bibliography (for some reason concentrated in German names and titles) are worse. Which newcomer to the field would be able to identify PMD=*Papyrus mathématique démotique* (p. 192) or R. A. Parker, PMD (p. 139 n. 4) as Parker, *Demotic mathematical papyri* [Brown Univ. Press, Providence, RI, 1972; Zbl 283.01001]?

In principle, the constant reference to original texts is praiseworthy; but in some instances the reviewer would have been unable to understand the points made without recourse to the complete text from which a short passage was excerpted; in general, the reviewer did not always feel sure he would have understood what was explained if he had not been familiar with the topic already.

The discussion is often superficial, and compares badly with (say) Peet or Neugebauer. Where Eric Peet [*The Rhind mathematical papyrus*, 108, Univ. Press Liverpool, London, 1923; per revr.] suggests that a solution has been found "empirically" and explains the plausible very simple heuristics, the present author (p. 163) finds it sufficient to "admirier cet 'empirisme' qui relève du génie" without further explanation. Even though the precise meaning of the "red auxiliaries" has been debated since 1881, the author (p. 31) finds it self-evident that the red 8 (etc.) written under $1/7$ (etc.) means $8/56$ (etc.). She seems unaware of the alternative interpretation, according to which the Egyptians took the fractions of a convenient "reference magnitude" (in case 56)—an interpretation which fits the recurrent use of the method of a single false position and the organization of the multiplication and divisions algorithms much better than an implicit denominator.

At the "metamathematical" level, problems become greater. The author seemingly does not know the difference between a paradigmatic example and a general rule, nor between a rule given without argument and theory (p. 171). Borrowing and overstating the thesis of a Greek "geometric algebra" she claims that the solution of the second-degree equation was the basis of all Greek geometry—but not knowing that this claim refers to the techniques of application with excess and deficiency, she believes that the technique is nothing but that of the simple Egyptian homogeneous problems (p. 131).

Several of these problems derive from the overly patriotic character of the book combined with a conception of mathematics where comparison with the Greeks (as viewed by us) is all that counts. Others come from the ahistorical presupposition of much Egyptology, according to which everything in Egyptian culture must go back at least to the beginning of the Old Kingdom if nothing else is proved (cf. pp. 11 and 189f); in this case, too, the case is overdone, as when the Byzantine-Egyptian Papyrus Akhmīm (with its $M : N$ labels, unthinkable in Middle Kingdom mathematics) is taken as proof that no change worth speaking of took place until the 6th century CE (p. 11), or when the late invention of the "Horus eye fractions" as hieroglyphic versions of age-old hieratic units (a fact well described by Peet, p. 26 n. 1) is overlooked (p. 38). Even though Karl Sethe's *Von Zahlen und Zahlworten bei den Alten Ägyptern, und was für andere Völker and*

Sprachen daraus zu lernen ist [Trubner, Strasbourg, 1916; per revr.] is listed in the bibliography and referred to recurrently, the author has taken no advantage of the possibilities offered by this work to distinguish at least hints of development.

Reviewed by *Jens Høyrup*