Conformément aux observations d'Hipparque: le Papyrus Fouad inv. 267 A
by Jean-Luc Fournet and Anne Tihon, with Raymond Mercier

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P.Fouad 267A is one of the most important new pieces of documentary evidence concerning the Greco-Roman astral sciences to be published in this century, and one of the more historically interesting single pieces of papyri of this type that is currently known. It provides a glimpse into aspects of astronomical theory and astrological practice of the second, or early third, century that we do not have from any other source. Hence, Fournet and Tihon's book, which contains a text, French translation, and study of *P.Fouad* 267A, will be of great interest to anyone working on the history of Greco-Roman astronomy.

The book has the following sections:

(1) papyrological information: physical description, dating based on orthography, discussion of the attested abbreviations, individual characteristics of the writer—including orthography, morphology, and syntax (J.-L. F.) [9–17];
(2) color photographs of recto and verso (J.-L. F.) [20–21];
(3) facing diplomatic and normalized transcriptions (J.-L. F.) [22–25];
(4) a French translation (A. T. with J.-L. F.) [26–30];[1]
(5) critical notes on the edition, keyed to the lines, including references to similar instances and parallel cases (J.-L. F.) [31–41];
(6) critical notes on the translation, keyed to the lines, including references to similar usages in known works (A. T.) [42–52];

[1] A preliminary English translation had already been given by Tihon 2010, and now a new English translation based on the full edition in this book has been provided by Jones 2016.

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(7) and interpretation of the text, sectioned into themes loosely following the organization of the material in the papyrus itself (A. T.) [59–107];
(8) complementary notes, of a few pages each on average, treating topics introduced in the papyrus such as the epoch of Hadrian, a cycle of 30,000 years, an observation by Hipparchus, different lengths of the year, and two very useful tables that summarize all of the numerical and chronological information contained in, and immediately derivable from, the papyrus (A. T.) [11–137];
(9) a conclusion (A. T.) [141–144];
(10) a glossary of Greek terms [144–151];
(11) a reconstruction of different tables that might underly the three computations of solar longitude found in the papyrus along with an analysis of possible solar models underlying the numbers found in the ancient source (R. M. in English) [156–175];[2]
(12) a bibliography, color photographs of details, an index, and a table of contents [177–190].

P.Fouad 267A is a single leaf from an unprovenanced codex, 15cm by 13.4cm, from which both the top and the bottom are missing. It is dated after AD 130 to the later second or third century [9–12].[3] To this we may now add *PSI* 1674 (inv. 2006), which was recognized by M. Stroppa as being related to *P.Fouad* 267A, and has now been studied and edited in Fournet and Tihon 2018.[4] *PSI* 1674 is a 5cm by 5.8cm piece of the same codex folio, which was originally located above *P.Fouad* 267A. *PSI* 1674r contains four partial lines of a text originally found above that in *P.Fouad* 267Ar, lines that are written in a formal, bookish script, whether by the same hand as wrote *P.Fouad* 267A or another. These lines include some words otherwise found in astrological writings [Fournet and Tihon 2018, 99].

P.Fouad 267Ar appears to begin with a new section written in a different and more private, or informal, script. It is titled 'On the Sun' and discusses solar theories and some details of the instructions that an unnamed 'he' set out for

[2] Mercier's tables, and the models he used to derive them, have been discussed and questioned by Jones 2010b and 2016, and Duke 2015. (Despite the published dates, Jones 2016 appeared before Duke's review.)

[3] On the basis of a new part of the papyrus, the authors prefer a date in the third century [Fournet and Tihon 2018, 100].

[4] A short notice announcing the find, along with a partial English translation, had appeared two years before this [Tihon and Fournet 2016].

computing solar position for a given nativity according to three methods, or models, that use, or one of which uses, an epoch prior to a dated observation by Hipparchus. This is followed by tables that set out three computations of mean motions.

The mean longitude of the sun is calculated according to three different years—a sidereal year, called 'from a point' («ἀπὸ σημείου»), of 365 4′ 309′, or $365\frac{1}{4} - \frac{1}{309}$, days;[5] a 'uniform' year («ὁμαλός»)[6] of 365 4′ days; and a tropical year (ἀπὸ τροπῶν) of 365 4′ 102′ days.[7] The text then mentions a correction for precession from the 'time of Hipparchus', as well as a shift from the epoch of the table to the 'observation made by Hipparchus'. The date of Hipparchus' observation is preserved and converts to 26 June 158 BC, making this an otherwise unattested observation of a summer solstice.

A set of computations of the three solar longitudes are made for a nativity (γένεσις) with a date stated both in a year of Hadrian and a year 'according to the Egyptians', which, however, are one day off from each other, but which should both convert to 8/9 Nov AD 130, the date actually used in the computations [64–65; Jones 2016, 83]. The tables that set out these calculations, the values of which were drawn from tables of mean motion, make it clear that that the epoch of the mean motion tables was 37,500 years before the date of Hipparchus' solstice observation of 158 BC, and that they were laid out in periods of $10{,}000^{\mathrm{y}}$, $1{,}000^{\mathrm{y}}$, 25^{y} 1^{y}, and so on—making these tables inefficient for most practical astrological calculations, but reminiscent of Ptolemy's claim that people tried to exhibit uniform circular motion 'through the so-called eternal table-configurations' («διὰ τῆς καλουμένης αἰωνίου κανονοποιίας») [Heiberg 1898–1903, 2.211].

This is followed by *PSI* 1674v, in the same hand as found in *P.Fouad* 267A, which, although heavily abraded and quite fragmentary, mentions a number of topics that we might expect to read between the recto and verso of *P.Fouad* 267A—a table of rising times, an observation by Hipparchus, tropical position, solar anomaly, the sexagesimal value of a sidereal longitude

[5] I use a standard notation for proper parts, such that $n' = \frac{1}{n}$, often written as $\bar{n}$ in scholarship on Egyptian sources. Such is the text, but there is probably some error here, since this value better suits the tropical year [70: Jones 2016, 81].

[6] This word is used by Ptolemy to denote mean motion—which, since all three of these years are mean, in Ptolemy's usage, makes its meaning, or its astronomical function, here somewhat uncertain.

[7] Again, our author has apparently confused the sidereal and tropical years [70: Jones 2016, 81].

that can be (and indeed had been [82; Jones 2016, 80]) recomputed from the values given in *P.Fouad* 267Av, hourly motion, and so on.

Finally, this continues in *P.Fouad* 267Av, which is also difficult to interpret but deals, after a tantalizing possible mention of the name 'Menelaus' [37], with a correction to the tropical longitude and a computation of the duration of nighttime in equinoctial time-degrees, using a table of rising times for the latitude of Alexandria tabulated at intervals of 1° [85–94]. This is followed by a computation involving the solar declination, followed by an obscure computation that involves entering a table whose title contains the word «μεσημβρινός» ('having to do with the meridian'), the meaning of which is unclear [94–98] but which may have been astrological.

There can be no doubt, from both papyrological and technical perspectives, that *PSI* 1674 belongs to the same codex, and that *PSI* 1674v belongs between *P.Fouad* 267Ar and *P.Fouad* 267Av and helps to flesh out our understanding of this material. Together, *P.Fouad* 267A and *PSI* 1674 provide us with an intriguing glimpse of theory and practice in the astral sciences that, although contemporary with, or more likely later than, Ptolemy's work, seem to be uninfluenced by either the *Almagest* or the *Handy Tables*.

Along with the many, and still not fully resolved, theoretical questions that this material raises, we have a number of interesting practical and historical questions that can be directed to these documents. We are interested to know who wrote this material, when, and to what end. Originally, Fournet and Tihon considered *P.Fouad* 267A to be lecture notes written shortly after AD 130 [12, 16–17, 141–144], and they were followed in this by Jones [2016, 78]. But in their publication of *PSI* 1674, they point out that this is less certain, and argue for a later date for the codex [Fournet and Tihon 2018, 100]. Nevertheless, the many errors and oddities of *P.Fouad* 267Ar + *PSI* 1674v + *P.Fouad* 267Av, of which only a few have been mentioned here, still make it unlikely that this is copy of a treatise, or indeed a copy of some previous work. Perhaps we have here a workbook of a practicing astrologer, in which astrological treatises, or passages thereof, and methods for computing positions are variously set out. Or perhaps an astrologer copied out a method of computing positions onto a final, or empty, leaf of a codex in which a treatise had been written. Then, the example nativity of AD 130 may have been taken from a book that our astrologer was studying, or was perhaps used as an example in a private lesson that our astrologer was trying to follow—not very successfully.

In any case, this book by Fournet and Tihon is a fine piece of scholarship on an obscure and difficult but important piece of original evidence. It will be of great interest and value to anyone working on the exact and astral sciences in the Greco-Roman world.

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