Reviews

Joseph Mogenet: *Le "Grand Commentaire" de Théon d'Alexandrie aux tables faciles de Ptolémée*, Livre 1. Histoire du texte, édition critique, traduction. Revues et complétées par Anne Tihon. Commentaire par A. Tihon. Città del Vaticano (Biblioteca Apostolica Vaticana) 1985, 370 pp. (Studi e testi 315). ISBN 88-210-0527-5.

Theon of Alexandria wrote three commentaries on Ptolemy's astronomy, in various sizes: too big (the commentary on the *Almagest* = *CA*), too little (the lesser commentary on the *Handy Tables* = *LC*), and just right (the greater commentary on the *Handy Tables* = *GC*). The late Joseph Mogenet planned the first printed edition of the *GC*, and achieved the classification of manuscripts and a provisional text and translation of the first volume; after his death in 1980, the task of annotation and commentary, and revising the whole, was assumed by Anne Tihon. This first volume, containing Book I of the *GC*, is an impressive work, and one of interest for historians of ancient and medieval astronomy for several reasons.

Without a doubt the most important document of Greek astronomy is Ptolemy's *Almagest*, but during late antiquity and the middle ages in Byzantium and the Arabic world its popularity was rivaled by that of the *Handy Tables* (*HT*) that Ptolemy extracted from the *Almagest* and modified for more convenient use and refined theory. Yet no reliable edition of the *HT* exists, and there is uncertainty about the degree to which the extant manuscripts, from the ninth century and later, reflect Ptolemy's intentions. Even the earliest copies are anonymous, and do not have Ptolemy's own introduction (which is a fairly uninformative document). Papyrus fragments of tables related to our *HT* but with major variations raise the possibility that the arrangement and contents of the *HT* were more fluid in the first centuries than the medieval tradition would suggest. Indeed, the *HT* as we have them are often described as Theon's recension, albeit on slight grounds.

Written in the late fourth century, two hundred years after Ptolemy, Theon's commentaries are of obvious value for tracing the early history of the *HT*. This is true especially of the *GC*, for while the short *LC* merely gives instructions for using the tables, the *GC* has the ambitious programme of explaining how the tables were constructed, particularly in relation to the *Almagest*. In the *GC*'s five books Theon dealt with the tables in roughly the order of topics in the *Almagest*. The first, edited here, explains the tables of important cities, right and oblique ascensions, mean motions for sun and moon, and solar and lunar equations. Book 2 takes up the tables for parallax and the computations of syzygies, and the eclipse tables are discussed in Book 3. Books 4 and 5, which dealt with the fixed stars and the planets, are missing except for the beginning of Book 4; their loss is to be regretted, because some of the most interesting divergences between the *Almagest* and *HT* are in the planetary tables.

Theon probably knew little more about the construction of the *HT* than he could deduce from the tables themselves – in his preface he writes that he knows of no previous work on the subject. The problem that he faced was therefore one often presented to modern investigators of medieval tables, and it is interesting to see how well Theon fares. In the tables discussed in Book 1, the changes from the

Almagest are modest, in most cases changes in the intervals of tabulation. Where the intervals are made smaller, Theon observes that the additional tabulated values are not derived directly from Ptolemy's geometrical models, but interpolated by a curious quasi-linear scheme; the equation tables, parts of which are refined from tabulation at 6° intervals to 1° intervals, call for a two-stage interpolation. The other changes are minor and easily described, except for the lunar mean motion tables, where the change of epoch from the era Nabonassar to the era Philip entails an adjustment for the equation of time. While Theon explains this adjustment correctly, it has to be noted that the role of the equation of time in the change of epochs was described in an anonymous text as early as about A.D. 213. Theon's descriptions of the tables are generally in agreement with the extant *HT*, except that he makes no mention here of the combined tables for the mean motions and equations of sun and moon such as we find in the manuscripts; but this variation is referred to in the *LC*. Throughout, the tables are treated as Ptolemy's, with no hint that Theon or his predecessors might have altered them.

The present edition of Book 1 maintains the high standard of accuracy and lucidity that one has come almost to take for granted from these editors. The text depends on one ninth-century manuscript, and has needed a fair amount of emendatorial repair. The burden of explicating Theon's often taxing prose is divided between the literal and well annotated translation and a very detailed, thorough commentary (roughly twice the text's length). Among the introductory material, the chapter on the history of the *GC*'s survival is an exemplary blend of sure exposition of fact and cautious conjecture. A few details invite specific comment:

(p. 69) The order of Theon's writing is doubtful. To judge by their prefaces, the *GC* probably followed the *CA*, and the *LC* definitely followed the *GC*. However, the *GC* refers more than once to the *LC* (cf. pp. 123 and 134), and a passage in Book 3 of the *CA* refers to the *GC*, which in turn refers to the passage in the *CA*. It stands to reason that Theon would have made revisions in his own copies of his commentaries over the years, and our texts of the *GC* and Book 3 of the *CA* do not therefore represent their first 'published' form. The colophon of Book 3 of the *CA* identifies our text as descended from an authorized copy (ἔκδοσις) proofread (παραναγνωσθεῖσα) by Theon's daughter Hypatia, and while the frequent assertion that Hypatia *revised* Book 3 is not well founded, her involvement at all suggests a late date in Theon's career.

(p. 98, l. 17) There is no need to alter μεσουρανήσεις, which means "right ascensions" here.

(p. 107, ll. 9–12; p. 169) Instead of the elaborate editorial alterations made in this passage, merely delete γραμμικώτερον οὐκ (a misguided reader's insertion) and punctuate for the sense, "For those for which it is possible, (the table) has the tabulations at equal increments since it makes no difference (to do so) compared to geometrically derived values; for those for which it is not (possible), (the table has them) in a way more nearly geometrical".

(p. 111, l. 17) Instead of the deletion, insert after μοῖραι the words πρὸς β' ἑξηκοστά, οὕτως β' and correct the next words to πρὸς δ', καὶ ἐπεὶ τρεῖς. Translation (p. 173, ll. 16ff): pour la raison d'égalité, les degrés sont aux secondes comme les secondes sont aux quartes; et puisque les trois sont en proportion ...

(p. 123, ll. 2–14; pp. 181–182; pp. 288–300) Four passages have been bracketed as interpolations with insufficient reason. Passage *b* (in the editors' notation) is Theon's reference to his *LC*, and while it presumably belongs to his revisions of the *GC*, it should not therefore be bracketed so long as the revised *GC* is the only text available to edit. If *b* stands, so must

passage *a* which contains it, and which is suspect only because it digresses. Passages *c* and *d* are of great interest as mentioning a certain Serapio who gave refined instructions for using the *HT* table of the equation of time. Translated in the most natural way, they read: "For this reason, Serapio in his own commentary on the *Handy Tables* subtracts from the corresponding minutes in the table of right ascensions ...". Serapio's commentary would have been just a set of instructions like Theon's *LC* and Ptolemy's introduction, to both of which Serapio's work is contrasted, so that there is no contradiction with Theon's assertion in the *GC* preface that he had seen no earlier work like the *GC*. Probably passages *a–d* are all one addition that Theon made to the original *GC*. A similar addition on p. 134, referring to the *LC*, is properly left unbracketed in the edition.

(p. 218) The dedicatees, Eulalius and Origenes, are addressed as ἑταῖροι: these must be peers, not pupils of Theon, and the preface is much more modest in tone than those of the *CA* and *LC*, addressed to Theon's pupil Epiphanius.

(p. 297) Zenodorus almost certainly lived in the early second century B.C., and so is probably not among Ptolemy's early commentators.

Concerning the edition in general, the reporting of manuscript *M*, which contains some excellent conjectures but has no independent authority, could have been more selective without much loss of information and with some gain in legibility. The convention of adopting insertions in *M* without using angle brackets is confusing since these restorations are conjectural. The book's arrangement, with text, translation and commentary in separate sections, inconveniences the reader, especially since textual remarks are often made in footnotes of the translation. However, the book is very well produced, and I have detected few misprints, none significant. The reservations listed above are of very slight importance indeed in proportion to the whole accomplishment of this generous book; the present edition will certainly not have to be superseded for a long time. One can only be grateful to the editors for taking on this labour, and look forward to the remaining volumes.

Alexander Jones

B. R. Goldstein, *The Astronomy of Levi ben Gerson (1288–1344)*. A critical edition of chapters 1–20 with translation & commentary, Berlin etc. (Springer Verlag) 1985, 310 pp., DM 238. (Studies in the History of Mathematics and Physical Sciences, vol. 11). ISBN 3-540-96132-1.

The book of B. R. Goldstein is the 11th volume of the series *Studies in the History of Mathematics and Physical Sciences* being the continuation of *Abteilung* B of the series *Quellen und Studien für Geschichte der Mathematik, Astronomie und Physik* edited by O. Neugebauer in 1929–1938. (The continuation of the Abteilung A of this series is *Sources in the History of Mathematics and Physical Sciences* published by the same Publishing House.)

Levi ben Gerson was a well known mathematician, astronomer, philosopher and biblical exegete who worked in the 14th century in southern France. He was known also as Leo Balneolis (he originated from Bagnols), Leo Gersonides and Ralbag (an abbreviation of Rabbi Levi ben Gerson). He lived in Orange near Avignon where his brother Solomon was a physician of the pope Clement VI. The works of Levi ben Gerson were written in Hebrew. Among them were the *Commentaries on the Introductions of the Book of Euclid* (*Beyur ptikhat sefer Iqlidus*) – i.e. the commentaries on Euclid's *Elements*. The section of this work devoted to the theory of parallels was published in Russian in vol. 11 of *Istoriko-matematicheskie issledovaniya* (*Historico-mathematical researches*). The astronomy is explained in the first part of the 5th book of