Astronomical Diaries and Related Texts from Babylonia: Volume VI. Goal Year Texts by Hermann Hunger, Including Materials by Abraham J. Sachs

Vienna: Österreichische Akademie der Wissenschaften, 2006. Pp. xviii+ 471 (with 73 plates). ISBN 978–3–7001–3727–6. Cloth € 95.20

Reviewed by
John M. Steele
University of Durham
j.m.steele@durham.ac.uk

The Astronomical Diaries and Related Texts from Babylonia, a series of editions and translations of Late Babylonian astronomical tablets by Hermann Hunger and the late Abraham Sachs, has been one of the most significant contributions to the study of ancient astronomy over the past two decades. Volumes 1–3 (published in 1988, 1989, and 1996) contain editions of all known datable Astronomical Diaries: texts that record the night-by-night observations made by Babylonian astronomers, and the primary source for all other types of Late Babylonian non-mathematical astronomical texts. Volume 5 (published in 2001) contains editions of tablets that report lunar and planetary observations and predictions. By and large, the astronomical data in the lunar and planetary texts was, we believe, abstracted from the Astronomical Diaries. The volume under review, volume 6 (published in 2006), contains all known datable and undatable Goal-Year Texts. Planned future volumes will include the undated Astronomical Diary fragments (volume 4) and the Normal Star Almanacs and Almanacs (volume 7). When complete, this series will contain editions of more than two thousand Late Babylonian astronomical texts, more than half of the known corpus of cuneiform texts concerning astronomy.

The Babylonian Goal-Year Texts contain lunar and planetary data taken from the Astronomical Diaries that was to be used in making predictions for a coming 'Goal' year. The principle behind these predictions is that after a certain number of years, individual phenomena for each planet repeat on about the same day in the Babylonian calendar and at about the same location in the sky. For

ISSN 1549–4497 (online) ISSN 1549–4470 (print) ISSN 1549–4489 (CD-ROM)
Aestimatio 4 (2007) 142–145

example, first visibilities of Saturn happen roughly every 13 months, separated in longitude by about ⅓ of a zodiacal sign in longitude. However, after 59 years, the first visibility of Saturn will once again occur on roughly the same day in the Babylonian calendar (allowing for the possibility of a one month correction to take into account intercalation) and at about the same celestial longitude. Therefore, by simply going back 59 years from the Goal Year for which predictions are sought, and copying the Saturn data for that year, it was possible to predict the Saturn phenomena in the Goal Year. By going back different numbers of years for the different planets, all planetary phenomena for a coming year could be predicted.

On pages ix–xiii of the book under review, Hunger provides a short but clear account of the contents and purpose of the Goal-Year Texts. Goal-Year Texts are divided into 10 sections:

1. Greek Letter Phenomena (first visibilities, first stationary points, acronychal risings, second stationary points and last visibilities) of Jupiter from 71 years before the Goal Year,
2. Passages of the Normal Stars by Jupiter from 83 years before the Goal Year,
3. Greek Letter Phenomena and passages of Normal Stars by Venus from 8 years before the Goal Year,
4. Greek Letter Phenomena and passages of Normal Stars by Mercury from 46 years before the Goal Year,
5. Greek Letter Phenomena and passages of Normal Stars by Saturn from 59 years before the Goal Year,
6. Greek Letter Phenomena of Mars from 79 years before the Goal Year,
7. Passages of Normal Stars by Mars from 47 years before the Goal Year,
8. The sums of the lunar six intervals[1] ŠÚ+*na* and ME+GE_6 for the second half of the year 19 years before the Goal Year,
9. Reports of observed and predicted eclipses of the Sun and Moon from 18 years before the Goal Year and
10. Lunar six data from 18 years before the Goal Year.

[1] On six occasions during a month, the Babylonians measured the time interval between the Sun's crossing the horizon and the Moon's crossing the horizon. Each such series of measurements constitutes what is now called a lunar six.

Generally sections 1–6 are on the obverse and sections 7 to 10 are found on the reverse. Sections 8–10 are always given in three columns, to be read from left to right.

For each of Venus, Mercury, and Saturn, only one section was given, as the individual Goal-Year periods work well for both synodic phenomena (Greek Letter phenomena) and sidereal phenomena (passages by Normal Stars). However, for Jupiter and Mars, different Goal-Year periods were used in each case for synodic and sidereal phenomena in an attempt to make more accurate prediction. Evidence from procedure texts, and from analysis of Almanacs and Normal Star Almanacs, which are believed to contain the results of Goal-Year predictions, indicate that small corrections of a few days were applied when using the Goal-Year material to make predictions.

Predicting lunar phenomena using the Goal-Year Texts was somewhat more involved than for the planetary data. The lunar six data was predicted using values of the same lunar six interval from 18 years earlier plus a correction of either plus or minus ⅓ of the sum of two of the lunar six from either 18 years or 18 years + 6 months earlier [Brack-Bernsen and Hunger 2002]. This explains the presence of the sums ŠÚ+*na* for the second half of the year 19 years before the Goal Year.

Lunar and solar eclipses were predicted using a scheme based upon the Saros cycle [Steele 2000]. The lunar and solar eclipse data recorded in the Goal-Year Texts provided the data necessary for predicting the time and likely visibility of the predicted eclipses.[2]

Hunger has identified and edited 178 Goal-Year Texts in this volume. Of these, 95 have been dated either from preserved dates in the text or astronomically by Hunger. The remaining 83 are largely small fragments, generally containing only lunar six data. Until recently, no techniques have been available for dating lunar six data. However, Huber has developed a statistical method which has proved effective in dating many lunar six tablets [Huber and Britton 2007, Huber and Steele 2007]. It is to be hoped that application of Huber's method to some of the undated Goal-Year Texts may prove fruitful.

2 For two possible methods for predicting the time, see Brack-Bernsen and Steele 2005.

Hunger's editions are a model of accuracy and his translations uniformly clear and consistent. I have come across only two trivial typographical errors: in Obv. 11' of No. 16 [65], the star MÚL *ár šá* ALLA *šá* ULU is wrongly translated as δ Scorpii instead of δ Cancri; and at Rev. 19 of No. 73, 'Month XI' should read 'Month IX' and 'Month IX' should read 'Month XI'. Both of these mistakes are easily corrected by the reader from either the transliteration or the context.

The publication of the Goal-Year Texts opens up for study an important aspect of Babylonian astronomy, the prediction of planetary and lunar phenomena using Goal-Year periods. Important work has been done on Goal-Year methods for predicting lunar phenomena in the past decade, but little has been published on the Goal-Year techniques for the planets since Kugler's pioneering works in the early part of the 20th century. The publication of these texts is already stimulating new research in this area.

BIBLIOGRAPHY

Brack-Bernsen, L. and Hunger, H. 2002. 'TU 11: A Collection of Rules for the Prediction of Lunar Phases and of Month Lengths'. *SCIAMVS* 3:3–90.

Brack-Bernsen, L. and Steele, J. M. 2005. 'Eclipse Prediction and the Length of the Saros in Babylonian Astronomy'. *Centaurus* 47:181–206.

Huber, P. J. and Britton, J. P. 2007. 'A Lunar Six Text from 591 B.C.' *Wiener Zeitschrift für die Kunde des Morgenlandes.* 97:213–218.

Huber, P. J. and Steele, J. M. 2007. 'Babylonian Lunar Six Tablets'. *SCIAMVS* 8:3–36.

Steele, J. M. 2000. 'Eclipse Prediction in Mesopotamia,' *Archive for History of Exact Sciences* 54:421–454.