

**ON THE TWO MIRACLES, AFFECTING THE
SUN, IN THE TIME OF JOSHUA, AND IN
THE TIME OF HEZEKIAH,
RESPECTIVELY. A LETTER TO THE REV.
JAMES CHALLIS, M.A., AND TO JOHN
COUCH ADAMS, ESQ., M.A.**

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On the Two Miracles, Affecting the Sun, in the Time of Joshua, and in the Time of Hezekiah, Respectively. A Letter to the Rev. James Challis, M.A., and to John Couch Adams, ESQ., M.A. by Edward Greswell

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EDWARD GRESWELL

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ON THE TWO MIRACLES, AFFECTING THE SUN, IN THE
• TIME OF JOSHUA, AND IN THE TIME OF HEZEKIAH,
RESPECTIVELY: AND ON THEIR EFFECT UPON
THE MEASURES OF TIME IN GENERAL, AND ON
THE LUNAR MEASURE OF TIME IN PARTICULAR,
AND ON THE PRECESSION OF THE EQUINOXES.

A LETTER

TO

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CAMBRIDGE, AND LATE FELLOW OF TRINITY COLL. CAMBRIDGE;

AND TO

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BY

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CHAPTER I.

SECTION I.

ON THE MOST ANCIENT ECLIPSES KNOWN FROM TESTIMONY.

THE Chinese profess to have kept an account of a series of solar eclipses, the first of which has been thought to go as far back as B.C. 2159, though the next in point of time to that does not go farther back than B.C. 776. The history of the ancient Indian or Hindoo Calendar enables us to recover a solar eclipse, the date of which must have been October 24, B.C. 946: and Roman tradition in like manner ascertains the fact of another, which coincided with the true date of the foundation of Rome, April 24, B.C. 750.

All these eclipses however are of one kind, solar, not lunar. The accounts of them all are defective in many circumstantial particulars, especially those of the greatest importance; the quarter where they were observed, the time of the day when they happened, the magnitude of the eclipses themselves. And this is especially true of the earliest eclipses of the Chinese; among which there are but six, from B.C. 776 to B.C. 495, which Gaubil and his associates consider themselves to have verified.

There are ten other ancient eclipses, however, ranging from B.C. 721 to B.C. 382, which are of a different character, and entitled to a very different degree of estimation: and all these are lunar, not solar. With respect to these eclipses, there is no uncertainty as to the quarter where they were observed. They were all observed in ancient Babylon. There is no more reason to doubt that they were recorded at Babylon, than that they were observed at Babylon. The history of these eclipses is briefly *this*. We have been made acquainted with the facts and the dates of these eclipses, by the *Magna Compositio* of Ptolemy: Ptolemy obtained them from Hipparchus: and Hipparchus appears to have had the particulars of them purposely copied from the accounts at Babylon, and sent down to him at Alexandria, or at Rhodes; at one of which places he is supposed to have made his own observations. These eclipses are all described by Ptolemy in the words of Hipparchus: and that the description of each was actually copied from the Babylonian accounts, and that the description of each is to be received as a faithful transcript of the original account, may be fairly inferred from the observation premised to this description in the case of the first three of the number: *Τὸ μὲν πρῶτον ἀφ' ὧν ἔχομεν ἀρχαιοτάτων ἐκλείψεων τρισὶ ταῖς ἀδιστάκτως δοκούσαις ἀναγεγράφθαι συγχρησάμενοι* — (Lib. iv. cap. v. p. 243, *Halma*): and from the similar remark which precedes the production of the three last: *Ταύτας μὲν δὴ τὰς τρεῖς ἐκλείψεις παρατεθείσθαι φησιν* (sc. ὁ Ἰππάρχος) *ἀπὸ τῶν ἐκ Βαβυλῶνος διακομισθεισῶν ὡς ἐκεῖ τετηρημένας* — (Lib. iv. cap. x. p. 275.)

The truth is, as I have seen reason to conclude, the Chaldean astronomers first began to apply themselves to the regular observation of lunar phenomena, in B.C. 746. And to facilitate this observation, and more particularly that of lunar eclipses, the Apis Cycle was adopted at Babylon, for the first time, in that very year, though this Cycle had been both known and in use in Egypt, for more than two hundred years before: and the epoch or head of that Cycle at Babylon was fixed not to the *luna prima*, or new moon, but to

the *luna decima quinta*, or full moon, which B.C. 746 happened to coincide with the first day of their solar year. This, I say, is the true epoch of the lunar observations of the ancient astronomers of Babylon. They appear to have proposed to confine themselves exclusively to lunar eclipses. It is certain at least, that the date of a solar eclipse, observed and recorded at Babylon, is no where extant in all antiquity. And it is a curious coincidence, that a regular series of such observations having been thus begun at Babylon, in the first year of the first Apis Cycle there, B.C. 746, the earliest of these observations, of which we have any account at present, begins to appear in the very first year of the second Apis Cycle, B.C. 721.

Again; these Babylonian eclipses appear to have been all recorded from the first in terms of a particular æra, which chronologers call the æra of Nabonassar; the nature of which is at once understood, when it is explained to be a continuous reckoning of time by cycles or periods of 365 days and nights perpetually. There is no doubt that this was a proper Babylonian æra; first brought into being at Babylon at a certain time, and used there in particular ever after. The traditional account of this æra is, that it took its rise with the accession to the throne at Babylon of the oldest of the kings of Babylon, whose name and history are not mixed up with fable, viz., Nabonassar; and by his act or appointment itself; from which circumstance it derives its name. The epoch of this æra too is well ascertained. None of the æras of antiquity is more so. There can be no doubt, that in the reckoning of our own æra, B. C., the first year of this particular æra and B.C. 747, each being referred to one and the same day, are the same. Yet, why this celebrated Babylonian æra, the æra of Nabonassar, should actually have been dated from B.C. 747, whether Nabonassar himself really came to the throne at Babylon in that year, or not, involves a question which has never yet been fully explained: and which nothing but the history of the ancient Babylonian Calendar itself, from first to last, is competent to clear up and explain.

Again ; the dates of some of these eclipses too, though not those of them all, are further authenticated by the years of the reigning kings ; first, those of the kings of Babylon, and then, those of the kings of Persia, who succeeded to the kings of Babylon, and were kings of Babylon as much as any of the native Babylonians themselves. But the reckoning of these reigns is peculiar. The complex or series of these reigns altogether constitutes what is called the *Canon of Kings*, the *Astronomical Canon*, the *Canon of Ptolemy*, or the like ; a monument of antiquity, the value and importance of which are very well known to all chronologers, though the structure of this Canon even yet is not fully understood ; especially the technical rule by which it proceeds in its reckoning, from first to last. The origin of this Canon too is doubtful ; and whether it was the work of one person or of more. In my own opinion, it was compiled at three different times ; partly by Hipparchus ; partly by Ptolemy ; and partly by some one or other of the successors of Ptolemy at Alexandria : for it extends from the first year of Nabonassar to the end of the reign of Diocletian. These are questions, however, which are of no material importance at present. All that requires to be observed on this point is, that the Canon of Kings is merely another continuous æra, which is supposed to begin with the æra of Nabonassar, and to go on ever after without interruption, along with and parallel to it. The only difference between them all through is, that the Canon is referred to the æra of Nabonassar, and not the æra of Nabonassar to the Canon. The reigns in the Canon all through are but particular portions of the æra of Nabonassar. The Canon has no use, nor value, *per se* ; nor in fact any meaning or signification apart from the æra of Nabonassar. The ultimate standard of reference in all these cases is the æra of Nabonassar : and that is so well understood, that there never can be any ambiguity about it.

Again ; these Babylonian eclipses of the *Magna Compositio* are all dated in terms of the Egyptian Calendar ; though we have supposed that they were all observed and

recorded at Babylon. Yet this need not render them the less certain, nor cast any doubt on their authenticity; because I can undertake to say, that neither when these eclipses began to be recorded at Babylon, nor when the last of them was recorded, was there any difference between the Babylonian Calendar and the Egyptian, except one which was purely accidental and purely immaterial: viz., that the Egyptian Calendar had proper names for the months, and the Babylonian Calendar had not. The rule of all antiquity every where at first appears to have been, to distinguish the months of the civil calendar by number and order only. The Egyptian Calendar was no exception to this rule at first. The Egyptian Calendar itself had no proper names for its months, before the epoch of the Sothiacal period. The Babylonian Calendar was no exception to it *v. c.* 721, nor even *v. c.* 382. It is a great mistake to suppose that the names of the months in the lunar calendar of the Jews, which begin to appear in Scripture first after the return from captivity, and are still in use at the present day, were borrowed from the Babylonians; and not imposed by the Jews on their own calendar for themselves. In the *Magna Compositio*, we do not meet with the name of a single Babylonian month. The names of the months in their solar calendar are borrowed from the Egyptian; those of the months in their lunar, mentioned by Ptolemy at least, are the Macedonian:—which could not have been adopted at Babylon before the time of Alexander and his successors. It is to be presumed, then, that Hipparchus in the first place, and Ptolemy in the next, transferred the names of the Egyptian months to the Babylonian, merely for the sake of convenience. And no one can doubt that, if the two calendars were really the same in all other respects, they would clearly be at liberty to do this; and what is more, that it would be desirable to do it, and that it would serve as the means of reducing the dates of one of these calendars to the corresponding terms in the other, without any trouble, from the first.