A LOCUST'S LEG

Studies in honour of

S. H. TAQIZADEH

LONDON

PERCY LUND, HUMPHRIES & CO. LTD

1962

"YEARS" IN ROYAL CANONS

By O. NEUGEBAUER

In congratulating an octogenarian on his achievements, we have a fairly accurate idea what 80 years mean. Ancient and mediaeval astronomers—and modern historians—were often in a less fortunate position. It is certainly no mean achievement to be able to say how many days elapsed between a lunar eclipse that occurred in the month Skirophorion under the Athenian archon Phanostratos[1] and another eclipse seen in Alexandria in the seventeenth year of Hadrian, Payni 20/21.[2] The possibility of answering correctly such a question rests, in antiquity as well as in modern times, on the same two foundations: the existence of a time scale not tampered with by arbitrary changes, and lists which relate local calendars and historical events to this fixed time scale.

In antiquity the "Egyptian year" of 365 days each provides the time scale for chronological purposes. The modern counterpart is the reckoning with "julian days" (day 0 = —4712 Jan. 1), or, for historical purposes, the "julian year" of 366 days length if its number is divisible by 4, otherwise of 365 days.

The correlation of Egyptian years with historical events was established in antiquity by means of "royal canons" which relate conventionally adjusted regnal years of individual rulers to complete Egyptian years. It is a misnomer to call such chronological tables "Ptolemaic canon". Ptolemy's "Almagest" never contained such a canon (in spite of assertions to the contrary often made in modern literature), but we know that a *βασιλέων χρονογραφία* had been included in his "Handy Tables",[3] which are, however, no longer extant. Theon, in the latter half of the fourth century, refers to a

[1] Almagest IV,11 (p. 341,10 Heib.): —381 June 18 = julian day 1582066.
[2] Almagest IV,6 (p. 314,18): +133 May 8 = jul. d. 1769762.
[3] As a *προκανόνιον*, according to Ptolemaeus, Opera II, p. 160, 8 Heib.

κανὼν τῶν βασιλειῶν in his introduction[1] to his "Handy Tables", but the earliest extant version of a royal canon of this type seems to be the tables of the Emperor Heraclius[2] (610–41). It may be hoped that Ptolemy's version is (to the extent possible) identical, as is generally assumed, with the version known to us only from a time five centuries later.[3] On the other hand, there is no reason whatsoever to think that royal canons for astronomical purposes did not exist long before Ptolemy.

The only certain information that we have of Ptolemy's canon in his Handy Tables is the fact that they are related to a fixed era, namely, the years of Philip Arrhidaeus. This fact has undoubtedly contributed much to the spread of the use of continuous eras. The common acceptance of eras such as the era of Diocletian or, later, of the Byzantine world era would have made time reckoning a simple matter and royal canons superfluous.

In actual fact, however, a new ambiguity had been created by the introduction of a reckoning with julian years—either in their Alexandrian form with Egyptian months, beginning with Thoth 1 = Aug. 29 (or 30), or in the Roman form. Finally, with Islamic astronomy a new form of years appeared on the scene: the schematic lunar years of a 30-year cycle, accompanied by a revival of the intercalation-free Egyptian years in the form of the years of the era Yazdigerd. The net result for mediaeval chronographers was a situation as complex as the one from which the Alexandrian astronomers had extricated themselves.

Thanks to such outstanding works as Bīrūnī's "Chronology", solid chronological knowledge remained alive among professional Islamic astronomers. But the so-called revival of western astronomy, centering in Spain, proceeded on a much lower level, operating more with a collector's spirit than with the mind of critical scholarship.

---

[1] That is the short introduction, published by Halma, Commentaire de Théon I (Paris, 1822), p. 31,31.

[2] Cf. Usener, Fasti Heracliani, Monumenta Germaniae Historica, Auctores antiquissimi 13,3, pp. 386–410.

[3] A few papyrus fragments suffice to demonstrate the existence of variants. Cf. P. Ryl. 27 (col. III, 75ff.), P. Oxy. 35 (perhaps non-astronomical since no summation seems to be given), and a small fragment from a codex from Oxyrhynchus, to be published by Dr P. Sattler in the *Archiv für Papyrusforschung*. I owe the knowledge of this text to the kindness of Prof. E. G. Turner and Dr P. Sattler.

One illustration of this is the following discussion of a royal canon from the twelfth century.

In the Latin version of al-Khwārizmī's astronomical tables, extant in several copies from the twelfth and thirteenth centuries,[1] we find as the first table a list of "Tempora quae transierunt inter regna diversorum regum", giving intervals in years, months, and days.[2] This should furnish an easy check for the epoch dates of the eras listed, provided one knew what "year" and "month" means. In fact, however, one has to proceed in the opposite direction. Assuming that the epochs mentioned represent correctly the dates of known astronomical epochs, one must make the given numbers of years and months agree with the known intervals. For the "months" we make the plausible assumption that schematic months of 30 days each are meant. Then the meaning of "year" can be found for each interval by dividing the proper number of days by the number of years given in the canon. The result is very striking. For all years *before* "Alexander" (which is actually the Seleucid era in its Syrian norm, beginning —311 Tishri 1=Oct. 1=jul. day 1607739), the "years" are *Egyptian* years. Thus we find that the "diluvium" is actually the epoch date of the Kaliyuga, Chaitra 1= —3101 Febr. 17=jul. day 588465. The era Nabonassar begins, as expected, on Thoth 1= —746 Febr. 26= jul. d. 1448638, and the era Philip on Thoth 1= —323 Nov. 12= jul. d. 1603398.

After "Alexander", however, the "years" are reckoned as *julian* years, leading to the correct dates for the Spanish era (—37 Jan. 1), the Christian era (+1, Jan. 1), Diocletian 1 (Alex. Thoth 1=284 Aug. 29), and Hijra 1 (622 July 15=Muḥar. 1). The only exception is the interval between the era Hijra and the era Yazdigerd which is again to be reckoned in Egyptian, i.e. Persian, years.[3]

A similar case is found in al-Farghānī's Elements of Astronomy, translated into Latin by John of Spain in 1173, and by Gerard of

---

[1] Published by Suter in the Kgl. Danske Vidensk. Selsk., Skrifter 7 ser., Hist.-filos. Afd. III, 1 (1914). I am preparing a supplementary study for publication.

[2] Associated with Suter's text (p. 109) is a multiplication table for 28 which is in part repeated in Table 3. It has nothing to do with the present table and is absent from the similar table in the Corpus Christi College MS 283, fol. 114r.

[3] In the above computation I had to make the following emendations of day numbers: line 4 read 18 instead of 17; line 10 read 15 for 17; lines 12 and 13 read 2 for 0.

Cremona (before 1175).[1] In the latter's version we find in chapter 1, 18 the statement "Quod ergo est inter eram Nabuchodonosor et eram Iezdairt 1379 anni persici et 3 menses et illud quod est inter eram Alexandri Philippi et eram Iezdairt est 955 anni et 3 menses; et illud quod est inter eram Alexandri et eram Iezdairt est 942 anni et 259d". The first two statements are indeed correct for Persian years. The interval "from Alexander" (—311 Oct. 1) to Yazdigerd, however, has to be reckoned in julian years (ignoring for the total half a day).

This is only one, but a typical, example of the composite and often contradictory character of mediaeval tables. Without being aware of such internal inconsistencies, modern scholars can easily be misled to reconstruct chronological systems that never existed.

[1] Edited by Francis J. Carmody, Al Farghani, Differentie Scientie Astrorvm, Berkeley, 1943.