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★**Ancient Egyptian science. Vol. II.**

Calendars, clocks, and astronomy.

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This is the second of three planned volumes on ancient Egyptian science. Volume I [Amer. Phil. Soc., Philadelphia, PA, 1989; MR1060315 (92a:01014)] dealt with two essential aspects of the context of Egyptian learning in general, aspects from which the interest in nature and natural phenomena cannot be isolated: (i) the development of writing, and the character of scribal knowledge and culture; (ii) cosmogonic and cosmological (we might say theological) thought. The present volume deals with calendars, clocks, and astronomy. Volume III, finally, is meant to treat mathematics, medicine, and biology, and to offer a detailed presentation of the techniques for repesenting nature.

The present volume starts with 165 pages of general discussion of the topic, after which comes translation of 18 documents, each provided with an introduction and a rich array of notes, discussing everything relevant from uncertain readings to earlier interpretations (from Champollion onward). Presentation and critical examination of existing theories and opinions is also important in the general discussion. Often, page-long quotations from earlier publications support the analysis.

As far as calendars are concerned, the “civil calendar” of 365 days, its origin and its relation to the “Sothic year” (defined from the heliacal rising of Sirius) is of course dealt with in great depth; the author supports Neugebauer’s view that the connection to the heliacal rising of Sirius is a secondary artifice invented in the 28th century BC, and that the year of 365 days had been established much earlier (perhaps around 3000 BC) from averaging the variable Nile flooding. Much care is also dedicated to the presentation of the lunar calendars used for ritual purposes, in particular to Richard Parker’s assumption that the “old lunar calendar” was geared to the seasonal years via the Sothic year by means of intercalary months; it is persuasively argued that Parker’s account “is only barely possible and is quite speculative in detail and not convincing in its overall argument” (p. 21), even though a gearing to the seasonal year by means of intercalation may in itself be correct.

“Clocks” encompass both the use of decanal stars, where the shift from the early reliance upon risings to the later use of meridian transitions is well documented together with the “Ramseside” (actually somewhat earlier) use of near-meridian grids; outflow and inflow water clocks (the latter a device from Greco-Roman times); shadow clocks; and sundials. Very interesting is Document 15, the account given by the official Amenemhet of his discovery (in old books or by his own observation?) that the ratio of longest to shortest night is 14:12 and of his construction of a waterclock for Amenhotep I (c. 1530 BC). The original division of (complete) night and extended

day (i.e., including morning and evening dusk) into 12 hours each is well covered, as is the original connection of this division of the night to the decans and hence the 12 months of the year and (as far as the material allows any precision of the analysis) the later attempts to introduce hours of equal length. In the discussion of the shadow clock, E. M. Bruins's interpretation of the description of a shadow clock in the cenotaph of Seti I (c. 1300 BC) is discussed; according to this interpretation, the clock in question would compensate for the seasonal variation of the shadow. The theory is characterized as "clever and coherent" (p. 464) but unfortunately based solely on emendations of the text, in part in direct conflict with the grammar of the document.

"Astronomy" encompasses on one hand the "astronomical ceilings" of tombs and the zodiacs from the Greco-Roman period, on the other two cosmological texts explaining the visibilty and invisibility of the heavenly bodies—eaten by the goddess Nut, "a sow who eats her piglets" (p. 399), in order that they may be born once again.

Apart from these mythical texts, the volume is "largely [devoted] to technical detail" (p. 396) and hence quite terse (but still pleasant reading, due both to the author's style and to the ample discussion with earlier workers). Nonetheless, the author manages to document that the kind of knowledge which is dealt with in the volume was "integrally entwined with religion, myth, and magic", and "transmitted to us almost exclusively in religious documents" (p. 396). This observation is characteristic of the project as a whole, viz. to present not only the knowledge but also the intent of the ancient Egyptian scholars (p. 424), and allows a better insight than usual into the various "shortcomings" of Egyptian astronomy (unequal hours, persisting use of calendars centuries after they had been outdated, failing correlation between different time measurement systems in use during the same period, etc.): For religious purposes, truth may as often be accepted from definition as from empirical evidence or mathematical coherence (the reviewer was reminded of David King's report of the stance of certain Islamic religious scholars regarding the direction of prayer: "When the Prophet was in Medina, he prayed toward the south; what was good enough for the Prophet is good enough for me!"—even if I happen to live in Spain).

The translations have been made anew by the author, with specified regard to existing translations into modern languages. Part of the philological discussion (and in particular the cross-references to hieroglyphic versions in the plates) presupposes basic knowledge of Egyptian; French and German publications are quoted in the original in the notes. On the whole, however, the argument can be followed in English. Not only for the specialist but for any reader who wants to go beyond syntheses in the vein of (say) B. van der Waerden's *Science awakening. II* ["Nauka", Moscow, 1991; MR1155845 (92m:01009)] without having two centuries of Egyptological literature at his disposal (or who wants a guide to the relevant literature), this volume is most welcome. After the appearance of Volume I, the present reviewer expressed the opinion that "from its scope and its scholarly quality the series promises to become a worthy successor" to M. Clagett's monumental *Archimedes in the Middle Ages* [Vol. I, Univ. of Wisconsin Press, Madison, WI, 1964; MR0168443 (29 #5706); Vol. II, Amer. Philos. Soc., Philadelphia, PA, 1976; MR0523007 (80g:01005); Vol. III, Amer. Philos. Soc., Philadelphia, PA, 1978; MR0523009 (80g:01006); Vol. IV, Amer. Philos. Soc., Philadelphia, PA, 1980; MR0597892 (83h:01018); Vol. V, Amer. Philos. Soc., Philadelphia,

PA, 1984; MR0764216 (86k:01015)]. We have not been deceived.

Reviewed by *Jens Høyrup*