

PREFACE

Preface

This volume is the second of the three volumes on Ancient Egyptian Science which I hope to complete. I have not included everything which I projected for Volume Two in the Preface to Volume One. The chapter and documents regarding mathematics are missing. It would have greatly increased the length of the volume to have included them here and accordingly I decided to shift them to Volume Three. That shift makes no difference in the progression of subjects originally planned for the whole work, for I believe that the lack of theoretical discussions of mathematics by the ancient Egyptians in their rudimentary science made it imperative first to outline the principal uses of mathematics by the dwellers on the Nile before discussing its structure and content. One possible benefit of including mathematics in Volume Three is that it can be more closely related to my discussion of Egyptian techniques of representing nature and within that topic to appraisals of the ancient Egyptian lack of a direct angular or arcal measure to quantify stellar displacements and thus produce more accurate celestial diagrams, of the absence of an effective method of geometric projection, and finally of their lack of any extended use of perspective (which, however, surely did not hamper their considerable artistic skill).

The organization of the current volume is self-evident. Again I have given a lengthy introductory chapter which attempts to synthesize the three main subjects included in the volume: calendars, clocks, and astronomical monuments. It summarizes the principal

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conclusions which we can draw from the eighteen documents and the Postscript that constitute the bulk of the volume. The order of those documents follows that of the three subjects mentioned. There is, however, no hard and fast isolation of the topics one from another. Because of this there is much skipping around from date to date in the corpus of documents, but within each area of treatment there is fair chronology evident as befits a historical work covering three millennia of activity.

In the case of every individual document the effort is made to supply a meaningful date or dates. It is true that sometimes the carrier of the document, say a temple ceiling, has a date of construction or execution that is often much later than the document itself, as, for example, is the case of Document III.12 where the decanal transit tables (marked in my document by the letter "U") found in the ceiling of the Cenotaph of Seti I (ca. 1306-1290 B.C.) date from at least as early as the reign of Sesostri III in the 12th dynasty (ca. 19th century B.C.). Similarly, the earliest copies of the Ramesside Star Clock (Document III.14) are found in the Tomb of Ramesses VI (ca. 1151-43 B.C. in the 20th dynasty), but the carefully reasoned date implied by the document itself is some time between about 1500 and 1470 B.C. in the 18th dynasty.

I have given more than 150 pages of illustrations. For the most part they include the hieroglyphic (or rarely, hieratic or demotic) texts, some from a single legible copy, others from an edited text based on several copies. These illustrations will allow the reader who controls the Egyptian language to have ready access to the texts that lie behind my translation. But, as in the first volume, it is my hope that the

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translations themselves will give readers without detailed knowledge of the original language, i.e., most students of the history of science, a good sense of what the documents intend. In regard to the illustrations, I should note that occasionally a magnifying glass may be needed by the reader studying them. But even in the cases where considerable text appears on a single illustration, the reproductions are remarkably clear as a result of the careful photocopies prepared by my secretary, Ann Tobias, who often improved the contrast and clarity of the originals from which the illustrations were made.

I have given very full notes to illustrate the historical steps taken by earlier scholars to advance our knowledge of the subjects treated in this and the succeeding volume of my work. This was done not only to give the reader a good sense of the development of scholarship over the last two centuries, but also to give honor and credit where they are due. Since the appearance of Volume One, two towering figures in the study of Ancient Egyptian Astronomy have died: Otto Neugebauer, whose help and friendship I have acknowledged in the Preface to Volume One, and Richard Parker, a premier student of the Egyptian calendars and Neugebauer's coauthor of the penetrating and informative *Egyptian Astronomical Texts* in three volumes. Their respective talents complemented each other exceedingly well: Neugebauer's superb analytical powers and Parker's philological skill and extensive knowledge of the texts. The reader will be well aware of my debt to them. Among earlier authors, Renouf, Lepsius, Brugsch, Meyer, Sethe, and Borchardt stand out, but the reader will also find mentioned the works of many other later scholars (e.g., Hornung and Barta)

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and younger ones (e.g., Krauss) who have clarified and solved many of the puzzling problems concerning the topics of this volume. Unfortunately, it was only after I completed this volume that I obtained a copy of Christian Leitz's *Studien zur ägyptischen Astronomie* (Wiesbaden, 1989), and so I was unable in this volume to give it the careful study which it deserves (but see Chapter Three, note 49). I must also note with gratitude that James ("Jay") O. Mills of the Nekhen Excavations team has allowed me to publish as a Postscript most of his unpublished paper on a petroglyph with possible astronomical significance. This petroglyph was discovered by Mr. Mills and Ahmed Irawy Radwan during a survey operation in 1986. As in the case of Volume One, special thanks are tendered to Dr. Robert Bianchi for his helpful reading of this volume in its first version.

Closer to home, I must again thank my wife, Sue, to whom the whole work is dedicated, for her expert editorial help and, above all, for her constant encouragement. I have already thanked my secretary, Ann Tobias, for the magic she has worked with the illustrations. But she also undertook the formidable task of reading and rereading the manuscript numerous times, much to its improvement. I also repeat here my thanks to my home institution, The Institute for Advanced Study, for all of its intellectual and material assistance; and especially am I in debt to the Library staff, who uncovered copies of even the rarest articles and books. And finally I want to express my appreciation to the American Philosophical Society for continuing to publish this large work. In that organization thanks must especially go to Herman Goldstine, its Executive Director, to Carole Le Faivre,

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its Associate Editor, and to Susan Babbitt, who skillfully copy-edited this volume. All have contributed to its appearance, its accuracy, and its publication.

Once again I have provided the Society with camera-ready copy, using Printrix to print the copy and Fontrix to create special fonts (see the Preface to Volume One). But since the publication of the first volume, I have prepared additional, smaller fonts to represent the consonantal, phonetic transcription of hieroglyphs and to indicate a large collection of accented letters and letters with various diacritical marks in order to print accurately the notes and bibliography. My hieroglyphic fonts are those of the first volume designed by me and greatly improved and extended by Ann Tobias, though many more glyphs have been fashioned for this volume.

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