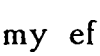
Preface

The work I have undertaken in this and the succeeding volumes grew from a more modest idea that came to me as I served on the committee for publishing Source Books in the History of the Sciences, namely to produce a Source Book in Ancient Egyptian Science consisting of enough extracts to illustrate some of the aspects of that science. However, when I considered the matter I realized that a few documentary extracts were insufficient to give a historian of science without any special knowledge of the Egyptian language and culture a well-rounded view of the growth and development of that science. Hence I decided to add substantial essays to introduce the documents. This resulted in a work independent of the Source Books series, a work whose first volume is published here.

It will be evident to the reader that the first section comprising Chapter One and Documents I.1-I.9 attempts to assay the importance for the development of Egyptian science--and its practitioners and institutions--of the invention and maturation of the art of writing in Egypt during the three thousand years or so after 3000 B.C. The first chapter supplies a general and connected account, and the documents present some detailed evidence to support that account. I have paid particular attention to the so-called Palermo Stone as my first document, since few if any efforts have been made to evaluate its content for the beginnings of Egyptian numerical, metrical, and calendaric techniques. Furthermore, no translator has included all the

fragments together and at the same time rendered all of the many numbers that appear in the text. Previous authors have generally passed over the difficult numerical passages. My careful attention to numbers has yielded evidence of a previously undetected, rudimentary place-value system. The relevance of the rest of the documents to those points I have made in the introductory essay should be clear without further elaboration here.

The second section has the same general format as the first. Chapter Two attempts to show in a coherent way the fundamental religious context of Egyptian cosmogonic and cosmological ideas. The various schemes of the world and its creation are detailed and organized according to the temple centers in which they developed. Again, ample documentary material has been given as supplementary support for the general account. I have purposely left the more technical astronomical considerations for the next volume, in which I shall examine in detail calendars, astronomy, and mathematics. A third volume will treat Egyptian medicine and biology and will close with a detailed presentation of Egyptian techniques for representing nature.

A few remarks are in order concerning the English translations of the documents. For most of the documents I have had the help of translations into modern languages made by competent scholars and I have often followed them closely. However, in many cases I have rendered the texts in my own way, mainly to bring some consistency to translation. A case in point is my effort to translate  and  almost always as "eternity" and "everlastingness", the first being the eternal past and the second the eternal future. Also,

I have at times had available to me a more complete Egyptian text than the earlier translators had. This is evident in the case of some of the translations of tomb inscriptions by Breasted. Revised texts by Sethe have allowed me to give a more complete interpretation. As I have already mentioned, my rendering of Document I.1, the so-called Palermo Stone, is more complete than any of the efforts in other modern languages, since it is based on all of the fragments and attempts to render all of the numbers. On the other hand, it will be clear to the reader familiar with the documents given in the second section, like the *Pyramid Texts* and the *Coffin Texts*, that these documents of mine are merely short excerpts from long originals, presented by me to illustrate sundry cosmogonical and cosmological concepts which I believe to be important. Certainly I make no pretense of giving definitive versions of even those passages that I have presented. More definitive versions would necessitate a careful rendering of the whole document to see if recent philological treatments of similar passages throughout the document throw further light on the passages in question. I am hoping that a student of the history of science coming to Egyptian culture for the first time will derive benefit from having these translations immediately available to him, incomplete though they might be.

A final word may be said about the title of this first volume: *Knowledge and Order*. It translates a pair of crucial Egyptian words: *rekh* () and *maat* (). It will be noticed as we examine the documents of the first section that the scribal craft embraced an ideal of the knowledgeable man, who by his writing abilities was able to measure, count, and

record. It is this ideal that is epitomized by *rekh*. Similarly, if we peruse the second section with its documents, it will be evident that the concept of cosmic rightness or order, one of the meanings of *maat*, lies at the heart of the ancient Egyptian efforts to describe the cosmos and its birth, together with the role of the gods and the king therein. By using these separate terms "knowledge" and "order" I do not mean to imply a more modern scientific method whereby systematic order in nature was intentionally and primarily sought by the careful gathering of knowledge. I merely mean that the concepts of "knowledge" and "order" arose as important aspects of the Egyptian intellectual achievement, and without their development Egyptian science, rudimentary as it was, would have taken some other form.

This volume and its successors are the result of many trips to Egypt and much reading, and I hope they will be of some use to budding historians of science, and perhaps even to those who have fully blossomed. I know that the study of Egyptian science has given me great pleasure, for I have turned aside from my many years of detailed Archimedean studies to an earlier cultural area of perennial fascination. Fortunately my colleague Otto Neugebauer not only gave me his entire collection of Egyptian reprints but has shared with me his learning at all stages of this work. This will perhaps be more clearly evident in the technical volumes that follow. I am as well indebted to Robert Bianchi for reading my manuscript with a careful eye and for the many pleasant and (to me) profitable hours we had together in Egypt and to Erik Hornung for his keen analytical and textual studies that have proved so useful to me in composing Section Two and for his

cheerful letters. My research assistant Mark Darby read this work with his usual care and it has benefited from the close attention he has given it. Similarly my wife Sue, an editor by profession, has exercised her craft towards its improvement. Further, I owe much to her for photographing countless objects in the museums of Egypt, Europe, and America, and some of her many photographs have been included in the pages that follow. I must also thank my friend Dr. Alison Frantz for the skill and artistry with which she has copied and improved many older photographs that before her attention were scarcely readable.

The reader will notice that, for easy access, I have grouped all of the figures, i.e. the line drawings and photographs, at the end of the separately printed second tome, which also includes documents for the second section, a chronology, a bibliography and bibliographic abbreviations, and indexes. Permissions for and acknowledgments of the use of the illustrations are included in the legends accompanying them. Permission by the University of California Press to use the translations by Miriam Lichtheim of the Great Hymns to Osiris and Aten, the Bentresh Stela, and the Song from the Tomb of King Intef (i.e. The Song of the Harper) is gratefully acknowledged.

I initially composed this volume (on sundry different computers) with Nota Bene, a superior word-processing program, designing, by means of the font program Lettrix, some 500 hieroglyphs and a phonetic font needed to represent the glyphs. These fonts were designed for a dot matrix printer and are illustrated in my article "Computer-generated Hieroglyphs," *Proceedings of the American Philosophical Society*, Vol. 131 (June, 1987), pp. 197-223. Later I

acquired a laser printer and converted both my manuscript and its glyphs for use with that printer, employing the font program Fontrix and its complementary printing program Printrix (mentioned and briefly described in the above-noted article). I also found it necessary to compose a font which includes the accented letters that appear so frequently in the quotations, notes, and bibliography of my work. This was necessary because the Fontrix fonts do not include the higher ASCII characters representing the accented letters. Though no ambiguity is present, I regret the manner in which some of my accented capital letters dangle below the normal base line. On the whole, Printrix did a yeomanly job with the often complex and highly formatted text and only failed on occasion to impose proper spacing and justification, in some cases leading to loose lines. Also notice that the dots inserted to connect quoted passages after an omission are sometimes preceded and sometimes followed by spaces added to aid justification. But, as usual, three dots indicate that no period marking the end of a sentence is present in the omission, while four signify the presence of one or more periods. I believe that these few infelicities of Printrix's laser printing are a small price to pay for the enormous saving in publication costs.

The computer knowledge of my son Michael was always at hand, and I made frequent use of it, particulary in solving the problems of converting Nota Bene text to Printrix text. Incidentally, in making that conversion I directly converted footnotes to endnotes. But, needless to say, an endnote must continue to be thought of as a continuation of the text at the point where the note number has been inserted, and

accordingly any reference to "before" or "after" in a note relates to that point in the text where the note number occurs.

My secretary Ann Tobias has also participated in every step of preparing the initial manuscript and she it was who perfected many of the original glyphs. Needless to say, she has my warmest thanks, as does the staff of the Institute for Advanced Study and its library for supplying me with much of the equipment and books I needed. Indeed, the Institute has provided me with the ideal academic home for a quarter of a century. Finally, I must once again thank the American Philosophical Society for bringing another complex work of mine to light.

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Section One

Knowledge

Section One