ZAMI HAWASS THE TREASURES OF THE PHILE AS UNIT OF THE PHILE PHILE AS A PHILE AND A PHILE PHILE AND A PHILE AND A PHILE AND A PHILE PHILE AND A PHILE AND A PHILE AND A PHILE PHILE AND A PHILE AND A PHILE AND A PHILE PHILE AND A PHILE AND A PHILE AND A PHILE PHILE AND A PHILE AND A PHILE AND A PHILE PHILE AND A PHILE AND A PHILE AND A PHILE AND A PHILE PHILE AND A PHILE AND A PHILE AND A PHILE AND A PHILE PHILE AND A PHILE PHILE AND A PHILE A

Edited by ZAHI HAWASS

Secretary General of the Supreme Council of Antiquities and Director of the Giza Pyramids Excavations

> PROJECT EDITORS Laura Accomazzo Valeria Manferto De Fabianis

> > GRAPHIC DESIGN Paola Piacco



THE TREASURES OF THE PYRANIDS



Contents

INTRODUCTION		Page	5	CHAPTER 8		
by H.E. Mrs. Suzanne Mubarak				THE ROYAL MORTUARY ENCLOSURES OF ABYDOS AND HI	ERAKONP	OLIS
THE PYRAMID	S	Page	12	by Matthew Adams and David O'Connor	Page	78
by Zahi Hawass		Tage	12	Chapter 9		
by Zani Hawass				The Step Pyramids		
CHRONOLOG	Y	Page	18	by Ali Radwan	Page	86
	CHAPTER 1			CHAPTER 10		
Why a Pyramid? Pyramid Religion				The Pyramids of the Fourth Dynasty		
by James P. Allen		Page	22	by Rainer Stadelmann	Page	112
	CHAPTER 2			CHAPTER 11		
THE ADMINISTRATION OF THE PYRAMID				The Queens' Pyramids of the Fourth Dynasty at Giza		
by Vassil Dobrev		Page	28	by Zahi Hawass	Page	138
	0			CHAPTER 12		
	CHAPTER 3			THE SATELLITE PYRAMID OF KHUFU		
Building an Old Kingdom Pyramid				by Zahi Hawass	Page	150
by Mark Lehner		Page	32	CHAPTER 13		
	CHAPTER 4			The Mystery of Hetepheres		
THE ARCHITECTURAL DEVELOPMENT OF THE EGYPTIAN ROYAL TOMB				by Zahi Hawass	Page	152
by Zahi Hawass		Page	46	CHAPTER 14		
	CHADTED 5			THE SECRET DOORS INSIDE THE GREAT PYRAMID		
CHAPTER 5			by Zahi Hawass	Page	156	
THE AKCHITECTURAL COMPONENTS OF THE PYRAMID COM			50	CHAPTER 15		
Dy Zam Hawass		Fage	50	The Pyramidion		
	CHAPTER 6			by Zahi Hawass	Page	160
The Predynastic F	PERIOD			CHAPTER 16		
by Renee Friedman CHAPTER 7		Page	54	The Royal Boats at Giza		
				by Zahi Hawass	Page	164
The Tombs of the First and Second Dynasties				CHAPTER 17		
AT ABYDOS AND SAC	QQARA			THE SPHINX		
by Günter Dreyer		Page	62	by Mark Lehner	Page	172



CHAPTER 18								
The Tombs of the High Officials at Giza								
by Peter Der Manuelian	Page	190						
Chapter 19								
The 'Unfinished' Pyramids of the Fourth Dynasty								
by Michel Valloggia	Pag.	224						
CHAPTER 20								
THE PYRAMIDS OF THE FIFTH DYNASTY								
by Miroslav Verner	Pag.	236						
CHAPTER 21								
The Surprising Abusir Blocks								
by Zahi Hawass and Miroslav Verner	Pag.	260						
CHAPTER 22								
THE PYRAMIDS OF THE SIXTH DYNASTY								
by Audran Labrousse	Pag.	264						
CHAPTER 23								
THE DECORATIVE PROGRAM OF THE OLD KINGDOM PYRAMID COMPLEXES								
by Zahi Hawass	Page	282						
CHAPTER 24								
The Tombs of the Fifth and Sixth Dynasties at Saooara								
by Karol Myśliwiec	Page	286						
CHAPTER 25								
THE PYRAMIDS OF THE MIDDLE KINGDOM								
by Dieter Arnold	Page	326						
CHAPTER 26								
THE TOMBS OF THE NOBLES IN THE MIDDLE KINGDOM								
by David P. Silverman	Page	348						
CHAPTER 27								
ROYAL AND PRIVATE STATUES OF THE OLD AND MIDDLE KINCDOMS								
by Hourig Sourouzian	Page	366						
INDEX AND BIBLIOGRAPHY	Page	392						
	and the second	All and a state of the state of						

The Publisher would like to thank: H.E. Farouk Hosny - The Egyptian Minister of Culture, Nabil Osman - President of the Egyptian Information Center, Attiya Shakran - General Director of the Cairo Press Center, M. El-Damaty - Director of the Egyptian Museum, Cairo, Mena House Oberoi Hotel, Cairo, Gamal Shafik of the Cairo Press Center, The curators and assistants of the Egyptian Museum, Cairo, Rajiv Kaul, Guido Paradisi and Fabio Calamante - photographers' assistants.

The Editor would like to thank Mark Linz and Neil Hewison of the American University in Cairo Press. He also wants to thank Essam Shehab of the Giza Inspectorate, and Mohamed Ismail, Mohamed Megabed, Brook Myers, and Sahar Mabrouk from the Technical Office of the Supreme Council of Antiquities.

> 10-11 Scene showing the 'Meidum geese,' Egyptian Museum Cairo, Old Kingdom.

> > © 2003 White Star S.r.l. Via C. Sassone, 22/24 13100 Vercelli, Italy www.whitestar.it

All rights reserved. No part of this publication may be reproduced, stored in a retrieval system or transmitted in any form or by any means, electronic, mechanical, photocopying, recording or otherwise, without written permission from the publisher.

ISBN 88-8095-233-1

Reprints: 1 2 3 4 5 6 07 06 05 04 03

Printed in Italy by Officine Grafiche De Agostini Color separation by Fotomec, Turin Chapter 1

Why a Pyramid? Pyramid Religion

rom simple piles of children's blocks to monuments erected by civilizations around the world, the pyramid is one of the most common of all human architectural forms. Structurally, it is also one of the most stable. So it is not surprising that the ancient Egyptians should have chosen to create their most imposing architectural achievements in this shape. But the pyramids of ancient Egypt were more than huge piles of stone. They were also concrete expressions of specific beliefs about life in this world and the next. To understand why the Egyptians built pyramids in the first place, we have to look at the meaning and force of these beliefs.

Ancient Egypt was an agrarian society, and the Egyptians' view of the world was determined in part by agricultural life along the Nile. Each year, spring rains in the Ethiopian highlands fed the source of the Nile and eventually raised the level of the river in Egypt above its banks, flooding the land on either side from June to October. Ancient records from the earliest Egyptian dynasties show that this annual inundation could rise as much as 4.4 m above the river's normal level, turning much of the Egyptian countryside into vast lakes. As the flood receded, leaving behind fertile silt, new plants would spring to life on the highest mounds of earth that were the first to emerge from the waters of these lakes.

From this annual experience, the beginning of life was linked in the Egyptian mind to the vision of a mound of earth emerging from a vast expanse of water. The Egyptians extended this notion to their understanding of how the world itself had come into being. One of the earliest Egyptian creation accounts envisioned the first place in the world as a mound of earth emerging from the waters of a universal ocean and the first life form as a lily growing on the peak of this primeval mound. In Egyptian thought the lily was

by James P. Allen

a god, Nefertum, whose name means 'perfect and complete.' Nefertum was honored as a harbinger of the sun, which rose from the lily's petals to bring life to the newly created world. The mound itself was also worshipped as a god, called Tatjenen, meaning 'the emerging land."

Early temples sometimes incorporated a mound of earth as an icon of the original site of all life. This could be a hill of earth or sand, but it also took the more permanent shape of a small pyramid carved from a single block of stone. A miniature pyramid of this kind was called a bnbn ('benben'), a name that derives from the root bn, meaning 'swell up' or 'swell forth.' The benben was a concrete image of the first mound of land 'swelling up' from the waters of the pre-creation universe. As such, it was an icon not only of the primeval mound but also of the sun, which first rose from it; the Egyptian word for the rising of the sun is wbn, which comes from the same root as benben.

From the beginning, therefore, the pyramid shape represented the notion of new life, emerging both from a mound of earth and in the light and warmth of the sunrise. To the Egyptians, however, the benben was more than just an image. Like the primeval mound, it somehow incorporated the very power of life itself, the force that made it possible for new life to emerge after a period of dormancy.

With this viewpoint, it is not surprising that the Egyptians should also have associated mounds and " pyramids with their funerary monuments. In the ancient Egyptian mind, death was not an end to life but the beginning of a new form of existence. During life, each human being was thought to consist of three basic entities: body, ba, and ka. The body was the physical form, the material shell that a living being inhabited. The ba was somewhat like the modern notion of the soul: it was the unique essence of each

22 bottom right Head of Tutankhamun emerging as the sun from the lily on the primeval mound. Placed outside the sealed antechamber to his tomb, this image incorporated the king's reborn spirit as it left the tomb each morning.

22-23

The pyramid of King Sneferu at Meidum. This view, across the cultivated fields, evokes the ancient Egyptian concept of the pyramid as a mound of earth above the kind's body that was planted beneath it.





Pyramid Religion

individual, the person that inhabited the physical body during life. The ka was the energy of life itself, a force transmitted from the creator to each living person; death occurred when this force was separated from the ba and its body. After death, the ba was thought to reunite with its life force, its ka; the deceased were called 'those who have gone to their kas.' This union allowed the individual, the ba, to continue living, but in a spiritual rather than physical form. The Egyptians called this new form of life akb, meaning an 'effective' mode of existence. Since it no longer had a physical component, it was not subject to aging or death: unlike the temporary form of life on earth, the akb was essentially eternal.

Incorporated within the structure of the tomb, the mound or benben provided the power for this spiritual rebirth to take place. Early Egyptian tombs were mostly surmounted by the rectangular structure of mud brick known as a mastaba, but mounds of earth have also been found within these buildings above the burial chamber. The earliest pyramid tomb, that of the Third Dynasty king Djoser at Saqqara, began as a mastaba but was converted to a pyramid of six steps by the construction of five successively smaller mastabas on top of the original one. The resulting form seems to have been a variant realization of the primeval mound, envisioned as a series of steps rather than a hill with smooth sides; the same form has been found within earlier mastabas at Saggara. The true pyramids that first appeared in the Fourth Dynasty were derived from this shape by filling in the steps to create four smooth faces, but they are also representations of the more common pyramidal benben on a monumental scale. Some of the newly discovered tombs of officials from the same period, to the south of the three Great Pyramids of Giza, were surmounted by conical mounds; these undoubtedly served the same purpose as the royal pyramids and represent yet another architectural realization of the primeval mound.

Apart from their incorporation of the power of new life, not much is known about the role the earliest pyramids were thought to play in the king's afterlife. The great pyramids of the Third and Fourth Dynasties show successive changes and innovations in their architecture and plan, which suggests an evolution in Egyptian thinking about their function. In the Fifth Dynasty, however, the layout of the chambers within the royal pyramid became standardized. This new form reflects a vision of the afterlife that characterized Egyptian thought from then on.

The typical interior plan of these later Old Kingdom pyramids consists of three main



elements: 1.) an antechamber beneath the apex of the pyramid, connected to the outside by an entrance corridor that opens in the pyramid's north face, 2.) a burial chamber to the west of the antechamber; and 3.) a stone sarcophagus at the west end of the burial chamber. Some of these features were introduced in the Fourth Dynasty—a stone sarcophagus first in the pyramid of Khufu, and a separate antechamber beneath the pyramid's apex in that of

Menkaure-but the standard layout of all three elements did not appear until the end of the Fourth Dynasty, in the royal tomb built for King Shepseskaf, the successor of Menkaure. This was a mastaba rather than a pyramid, suggesting a break with the funerary traditions that had characterized royal burials since the time of Djoser, 150 years earlier.

Shepseskaf's tomb may have been designed to reflect the mastabas of Egypt's first kings at the site of Abydos in Upper Egypt. Abydos was a cult center of Osiris, the god most associated with the afterlife in Egyptian mythology. Like the primeval mound, Osiris represented the force of new life. His power was manifested in the transmission of life from one generation to the next and in the growth of new plants, the mysterious process that produced a living entity from an apparently dormant seed planted in the ground.

Osiris was also integral to the Egyptian understanding of the daily solar cycle. Each night the sun seemed to sink beneath the ground and die, yet in the morning it emerged again into the world, reborn to live once more during the day. To the Egyptians, this was possible only because during the night, the 'dead' sun had somehow received the power of new life. Two explanations of that process existed concurrently in Egyptian thought. In one, the sun reentered the womb of Nut, the goddess of the sky, at night, and was born from between her thighs again at dawn. In the other, the sun entered a netherworld, known as the Duat; there, in the middle of the night, it merged with the mummy of Osiris, lying in the depths of the Duat, and received from this union the ability to come to life once more. Together, these two explanations combined the role of mother and father in the production of new life.

Both of these concepts are reflected in the standardized layout of interior chambers

24

The union of Re with Osiris in the Netberworld, assisted by Isis and Nephthys, from the tomb of Ramesses II's queen, Nefertari. The sun god is represented by the disk and ram's head, Osiris by the mummified body.

25 Osiris, the god of rebirth, represented both as a mummy and as king of the afterlife. From the mortuary temple of Ramesses III at Medinet Habu, now in the Egyptian Museum in Cairo





introduced by Shepseskaf and adopted in the pyramids of his successors during the Fifth and Sixth Dynasties. We know this because of the Pyramid Texts, a collection of funerary rituals and spells that were inscribed on the walls of these chambers and the sarcophagi in the pyramids of Unas, last king of the Fifth Dynasty, and his Sixth-Dynasty successors. These texts show that the king's afterlife was thought to parallel the daily solar cycle.

Each night, as the sun entered the body of Nut and the Duat, the king's spirit would come back to the interior of his tomb. The stone sarcophagus in the west end of the burial chamber was an analogue of Nut's womb. Within it, the king's mummy was both a fetus and an analogue of the mummy of Osiris lying in the Duat. The Pyramid Texts refer to the burial chamber itself as the Duat, and the spells inscribed on the walls of this room refer to the king not only by name but also as Osiris: for example, 'Osiris Unas.' As the sun united with Osiris's mummy in the Duat, the king's spirit was thought to join with his own mummy in the Duat of his tomb and, like the sun, receive through this union the power of new life.

The texts inscribed in the burial chamber are those of two rites performed at the funeral. They begin with a ritual of offerings, always inscribed on the north wall of the burial chamber. This may have accompanied the actual presentation of offerings at the funeral, but it was also meant to be repeated each day in the pyramid's mortuary temple; inscribed within the burial chamber, it would continue to provide the king's ba with the necessities of daily life. The offering ritual was followed by a second rite, whose words are always inscribed on the south wall of the burial chamber. This was a resurrection ritual, intended to release the king's ba from its attachment to the body so that it could rejoin its ka and enjoy life again. It begins by assuring the king that "you have not gone away dead: you have gone away alive," encourages him to "go and follow your sun . . . and be beside the god, and leave your house to your son of your begetting," and ends by reassuring him that "you shall not perish, you shall not end: your identity will remain among the people even as it comes to be among the gods."

As the sun left the womb of Nut and the Duat, the king's revitalized spirit proceeded from the pyramid's burial chamber to the antechamber. In Egyptian thought this room corresponded to the Akhet, a liminal zone between the Duat and the day sky (in practical terms, the Akhet was the Egyptian

explanation for why the sun's light appears in the morning before the sun itself has risen above the horizon). The name Akhet means 'place of becoming effective' and refers to the process through which the ba-of the sun and the deceased alike-took on an 'effective' form of new life, as an akb: the Pyramid Texts tell the sun that he and the dead king "shall rise (wbn) from the Akhet, from the place in which the two of you have become akh." The texts on the walls of the burial chamber represent rituals performed by the living on behalf of the deceased king, but those inscribed in the antechamber were mostly intended to be recited by the king himself. They gave him the proper words and instructions he needed to overcome the hazards of his journey between the Duat and the world of the living: spells to surmount physical obstacles, to control and vanguish inimical forces, to persuade the celestial ferryman to accept him as a passenger, and to encourage the gods to accept him in their company. At this point the king was no longer identified with Osiris, and the texts of the

antechamber refer to him only by his royal name.

Finally, as Nut gave birth to the morning sun, the king's *akb* left his tomb. In the earliest pyramids it was apparently thought to do so through the long corridor connecting the antechamber to the outside on the north of the pyramid, an analogue of the birth canal. From the Fourth Dynasty onward, however, the pyramid complex included a mortuary temple on the east of the pyramid, with a false door through which the *akb* could also emerge more appropriately in the direction of the rising sun. In either case, the reborn king was then free to enjoy life during the day, journeying across the sky with the sun and visiting the world of the living.

At least from the time of Shepseskaf onward, therefore, the afterlife was envisioned as a daily cycle of spiritual rebirth. Since Shepseskaf himself was buried beneath a *mastaba* rather than a pyramid, the function of the tomb's interior chambers—as Duat and Akhet—was apparently more important to this cycle than the shape of its superstructure. The kings of the Fifth and Sixth Dynasties, however, reverted to



Chapter 1

the pyramid form while retaining Shepseskaf's layout of the interior chambers. In doing so, they combined Osiris's subterranean power of new life with the lifegiving force of the primeval hill above the earth. The result was an evocative metaphor of rebirth: beneath the pyramid, the king's mummy lay like a seed planted in a mound of earth, waiting each night to transmit Osiris's power of new life to his spirit. Pyramids were not merely monumental tombs erected to perpetuate the memory of Egypt's kings: they were also—and more fundamentally resurrection machines, designed to produce and ensure eternal life.

We have less information about the way in which the king's subjects envisioned their own afterlives in the Old Kingdom, but there is no reason to believe that it was any different. During this period, non-royal tombs were not inscribed with Pyramid Texts, but they do contain lists of the same offerings presented in the royal offering ritual. Some of them were also decorated with scenes of funerary rites corresponding to the king's resurrection ritual, and their owners claim to be a "capable *akb*" and to know spells and "everything by which an *akb* becomes *akb*." Though these tombs were usually *mastabas* with a single burial chamber, they also contained sarcophagi, and the newly discovered mounds above some of them at Giza clearly served the same purpose as the royal pyramids.

All of these features point to a common vision of the afterlife for kings and commoners alike. After the Old Kingdom, non-royal tombs, sarcophagi, and coffins were also inscribed with Pyramid Texts—in some cases, direct copies of the corpus first inscribed in the pyramid of Unas—and with new spells of the same kind, known as the Coffin Texts. These eventually became the Book of the Dead and other funerary texts used in both royal and non-royal burials from the New Kingdom onward. Some nonroyal tombs in the New Kingdom were also surmounted by small pyramids. Like the great pyramids themselves, these monuments and their texts bear witness to the hope for eternal life that all Egyptians shared.



26-27

The night sky represented as the goddess Nut, from the tomb of Ramesses VI. The upper figure shows the sun proceeding through Nut's body toward rebirth at dawn, the lower figure shows the stars on the surface of her body.



27 right Detail of the night sky from the tomb of Ramesses VI, showing Nut's body receiving the sun as it disappears from the day-time sky at dusk.

BIBLIOGRAPHY

THE PYRAMIDS Text by Zahi Hawass

Zahi Hawass is a world-renowned Egyptian archaeologists. Now he is the General Secretary of the Supreme Council of Antiquities and the Director of the Excavations at the Giza Pyramids, Saggara, and Bahariya Oasis. He has been excavating around the pyramids for the last twenty years and has made several major discoveries, including the Tombs of the Pyramid Builders and the Valley of the Golden Mummies in Bahariya Oasis. He is the author of many books and articles on the Pyramids, such as The Pyramids of Ancient Egypt and other books related to Egyptology. He has lectured all over the world. Hawass has brought Egypt into the homes and hearts of people worldwide through numerous television appearances. Zahi Hawass received the First Class Award for Arts and Sciences from President Mubarak in 1988 for the Sphinx conservation. In October 2000, he was one of thirty international figures to receive the Golden Plate Award from the American Academy of Achievement in honor of his accomplishments in archaeology. In 2001, National Geographic announced him as an Explorer in Residence and in 2003 his name was written on a CD for the Mars exploration and Rover Mission.

Photo credits:

- Marcello Bertinetti/Archivio White Star
 Giulio Veggi/Archivio White Star
 Marcello Bertinetti/Archivio White Star
 Araldo De Luca/Archivio White Star
- 16-17 Kenneth Garrett
- 19 Araldo De Luca/Archivio White Star 20-21 Araldo De Luca/Archivio White Star

WHY A PYRAMID? PYRAMID RELIGION Text by James Allen

James Allen received his degree in Egyptology from the University of Chicago, with a dissertation on the grammar of the Pyramid Texts. He has served as epigrapher with the University's expedition in Luxor, Egypt, and as Cairo Director of the American Research Center in Egypt. Since 1986 he has held a research appointment at Yale University, and has taught there as well as at the University of Pennsylvania. He is currently Curator of Egyptian Art at the Metropolitan Museum of Art and Vice-President of the International Association of Egyptologists. Dr. Allen's specialties include ancient Egyptian language, texts, and religion, and he has written extensively on these subjects as well as the history of the Middle Kingdom and Amarna Period. He is the author of Genesis in Egypt: the Philosophy of Ancient Egyptian Creation Accounts and, most recently, Middle Egyptian: an Introduction to the Language and Culture of Hieroglyphs.

Bibliography:

- Allen, J. "Reading a Pyramid," in Hommages à Jean Leclant (Bibliotheque d'Étude 106; Cairo: Institut Français d'Archéologie Orientale, 1994), vol. 1, pp. 5-28.
- Barta, W. "Die Beudeutung der Pyramidentexte für den verstorbenen König," Münchner Ägyptologische Studien 39 (Munich, 1981).
- d'Auria, S. H., et al., Mummies & Magic: the Funerary Arts of Ancient Egypt. Boston, 1988, pp. 27-59.
- Quirke, S. Ancient Egyptian Religion, London, 1992. Ritner, R. K. "The Cult of the Dead," in D. P. Silverman (ed.), Ancient Egypt, London, 1997, pp. 132-147.

Photo credits:

22 Araldo De Luca/Archivio White Star 22-23 Giulio Veggi/Archivio White Star 24, 25, 26, 27 Araldo De Luca/Archivio White Star

THE ADMINISTRATION OF THE PYRAMID Text by Vassil Dobrev

Vassil Dobrev, a French archaeologist, was born in 1961 in Varna (Bulgaria). In 1992, he received is PhD in Egyptology from the University of Paris-Sorbonne for his dissertation "Researches on the Kings of the Fourth Egyptian Dynasty." From 1995 until 1998, he was Scientific Member of the French Archaeological Institute in Cairo (IFAO). Since 1987, he has worked on the excavations of the pyramids and temples of Pepy I and his Queens at South Saqqara. Since 2000, he has been responsible for the IFAO Mapping Project of South Saqqara and Director of the IFAO Mission at Tabbet al-Guesh (South Saqqara). The author of several scientific studies, and he is specialized in the inscriptions of the pyramid builders and pyramid history.

Bibliography:

- Dobrev, V. "Les marques de la pyramide de Pépy I". Notes complémentaires," *BIFAO* 98 (1998), pp. 151-170.
- Eyre, C. J. "Work and the Organisation of Work in the Old Kingdom," in M. A. Powell (ed.), Labor in the Ancient Near East, New Haven, 1987, pp. 5-47 (American Oriental Series, vol. 68).
- Posener-Kriéger, P., Les Archives du temple funéraire de Néferirkarê-Kakaï (Les papyrus d'Abousir). Traduction et Commentaire, 2 vol. IFAO, Le Caire, 1976 (BdÉ 65).
- Reisner, G. A. Mycerinus: The Temples of the Third Pyramid, Cambridge, Massachusetts, 1931, pp. 273-275, appendix E, pl. XI-XII.
 Roth, A. M., "Egyptian Phyles in the Old Kingdom.
- The Evolution of a System of Social Organization," SAOC 48 (Chicago, 1991).

Photo credits:

28 Giulio Veggi/Archivio White Star 29 Vasko Dobrev 30 Marcello Bertinetti/Archivio White Star

BUILDING AN OLD KINGDOM PYRAMID Text by Mark Lehner

Mark Lehner is one of the leading experts on Giza's Great Sphinx and Pyramids. He is president of the nonprofit research organization AERA, Inc., that sponsors the Giza Plateau Mapping Project. The project conducts excavations of Old Kingdom settlements near the Sphinx and Pyramids with a team of archaeologists, geochronologists, paleobotanists, and faunal specialists. Lehner has appeared on television in National Geographic's Explorer program. and on NOVA's Secrets of Lost Empires series on ancient technology including This Old Pyramid and Obelisk. He is author of The Complete Pyramids published in 1997. In addition to books and articles in print, Lehner's book on the Great Sphinx is in preparation with the University of Chicago Press. From 1990 until 1995 Lehner was Assistant Professor of Egyptian Archaeology at the University of Chicago. He is now a Research Associate at the Oriental Institute of the University of Chicago and at the Harvard Semitic Museum. Lehner was born, raised, and began his college education in North Dakota. He went to Cairo in 1973 as a Year Abroad Student at the American University in Cairo where he received his B.A. in Anthropology. He lived in Egypt in for thirteen years, working for American, Egyptian, British, French, and German archaeological projects. From 1979 until 1983 he was the Field Director and then Director of the Sphinx Project sponsored by the American Research Center in Egypt. In 1984 he began the Giza Plateau Mapping Project (GPMP), sponsored by ARCE and Yale University where Lehner received his Ph.D in Egyptology in 1990. In 1988 the GPMP began to excavate in search of the settlement and infrastructure that supported the pyramid work force. The team has discovered a workers' city that includes work shops, storage buildings, bakeries and a large royal administrative center from the time of the pyramids (ca 2,500 B.C.).

Bibliography:

- GENERAL Arnold, D., Building in Egypt. Pharaonic Stone Masonry, New York and Oxford. 1991.
- Badawy, A., "The periodic system of building a pyramid," JEA 63 (1977), pp. 52-8
- Dunham, D., "Building an Egyptian Pyramid,"
- Archaeology 9, no. 3 (1956), pp. 159-65
- Garde-Hansen, P., On the Building of the Cheops Pyramid, Cascais, 1974.
- Hodges, P. and E. B. J. Keable, *How the Pyramids Were* Built, Shaftesbury, Dorset, England, 1989.
- Isler, Martin, Sticks, Stones, and Shadows: Building the Egyptian Pyramids, Norman 2001.
- Lauer, J.-P., "Comment furent construites les pyramides," *Historia* 86 (1954), pp. 57-66.
- Mencken, A., Designing and Building the Great Pyramid, Baltimore, 1963. Petrie, W. M. F., "The Building of a Pyramid," in
- Ancient Egypt (1930), pp. 33-9.
- Smith, Craig, "Program Management B.C.," Civil Engineering (June 1999), pp. 34-41.

SUPPLY AND TRANSPORT

- Bietak, M., "Zur Marine des Alten Reiches," in Pyramid Studies and Other Essays Presented to I.E.S. Edwards (London, 1988), pp. 35-40.
- Bradbury, L., "Kpn-boats, Punt trade, and a lost emporium," JARCE 33 (1996), pp. 37-60.
- Fischer, H. G., "Two tantalizing biographical fragments of historical interest, 1. a speedy return from Elephatine," *JEA* 61 (1975), pp. 33-5.
- Goyon, G., "Les navires de transport de la chausée
- monumentale d'Ounas," BIFAO 69 (1971), pp. 11-41.
- Goyon, G., "Les portes des pyramides et le grande canal de Memphis," *RdÉ* 23 (1971), pp. 137-53.
- Haldane, C., "A new method of ancient Egyptian hull construction, preliminary report," *Mariner's Mirror* 74 (1988), pp. 141-52.
- Haldane, C., "The Lisht timbers: a report on their significance," in D. Arnold (ed.), *The Pyyramid Complex of Senwosret I*, New York, 1992, pp. 102-12.
- Landström, B., Ships of the Pharaobs, Garden City, 1970.
- Schenkel, W., "Kanal," LÄ III, (1980), pp. 310-12. Sølver, C. V., "Egyptian obelisk ships," *Mariner's Mirror* 33 (1947), pp. 39-43.

ORGANIZING THE LANDSCAPE

- Aigner, T., "Facies and origin of nummulitic buildups: an example from the Giza Pyramids Plateau (Middle Eocene, Egypt)," N. Jb. Geol. Paläont. Abb. 166 (1983), pp. 347-68.
- Aigner, T., "Zur Geologie und Geoarchäologie des Pyramidenplateaus von Giza, Ägypten," *Natur und Museum* 112 (1983), pp. 377-88.
- Lehner, M., "The Development of the Giza Necropolis: The Khufu Project," MDAIK 41 (1985).

QUARRIES

- Engelbach, R., The Aswan Obelisk, Cairo, 1922. Engelbach, R., The Problem of the Obelisks: From a Study of the Unfinished Obelisk at Aswan, London, 1923.
- Harrell, J. A., "An inventory of ancient Egyptian quarries," NARCE 146, (spring 1989), pp. 1-7.
- Harrell, J. A. and T. M. Bown, "An Old Kingdom basalt quarry at Widan el-Faras and the quarry road to Lake Moeris," *JARCE* 32 (1995), pp. 71-92.
- Harrell, J. A. and V. M. Brown, Topographical and Petrological Survey of Ancient Egyptian Quarries, Toledo, 1995.
- Klemm, D. and R. Klemm, "Herkunftsbestimmung altägptischen Steinmaterials," SAK 7 (1979), pp. 103-40.
- Klemm, D. and R. Klemm, Steine der Pharaonen, Munich, 1981.
- Röder, J., "Steinbruchgeschichte des Rosengranits von Assuan," Archäologischer Anzeiger 3 (1965), pp. -461-551.

THE NOVA PYRAMID

395

Lehner, M., "The Pyramid," in Secrets of Lost Empires, New York, 1996, pp. 46-93.

TOOLS, TECHNIQUES, AND OPERATIONS

- Hinkel, F. W., "Hölzernes Fördergerüst an der Cheopspyramide?" *Das Altertum* 2, no. 28 (1982), pp. 113-18.
- Lane, M., "The pull-saw in Egypt," Ancient Egypt and the East, (June 1935) pp. 55-8.
- Lucas, A. and J. R. Harris, Ancient Egyptian Materials and Industries, London, 1962
- Moores, R. G., "Evidence for the use of a stone-cutting drag saw by the Fourth Dynasty Egyptians," *JARCE* 28 (1991), pp. 139-48.
- Petrie, W. M. F., Tools and Weapons, Egyptian Research Account 22, London, 1917.
- Ryan, D. P., "Old rope," *KMT* 4, no. 2 (1993), pp. 72-9 Teeter, E., "Techniques and terminology of rope-mak-
- ing in ancient Egypt," JEA 73 (1987), pp. 71-7 Zuber, A., "Techniques du travail des pierres dures dans l'Ancienne Egypte," Techniques et Civilizations 29.5, no. 5 (1956), pp. 161-78.
- Zuber, A., "Techniques du travail des pierres durés dans l'Ancienne Egypte," *Techniques et Civilizations* 30. 5, no. 6 (1956), pp. 196-215.

SURVEY AND ALIGNMENT

- Borchardt, L., 'Ein altägyptisches astronomisches Instrument,' ZÄS 37 (1899) pp. 10-7
- Borchardt, L., Längen und Richtungen der vier Grundkanten der grossen Pyramide bie Gise (Berlin, 1926)
- Cole, J. H., The Determination of the Exact Size and Orientation of the Great Pyramid of Giza (Survey of Eygypt Paper No. 39) (Cairo, 1925)
- Dorner, J., 'Die Absteckung und astronomische Orientierung ägyptischer Pyramiden' (Innsbruck, 1981).
- Dorner, J., 'Studien über die Bauvermessung und astronomische Orientierung,' AfO 32 (1985) pp. 165-66
- Goyon, G., 'Quelques observations effectuée autour de la pyramide de Khéops,' BIFAO 47 (1969) pp. 71-86
- Isler, M., 'An ancient method of finding and extending direction,' JARCE 26 (1989) pp. 191-206 Isler, M., The merkhet,' VA 7 (1991) pp. 53-67
- Isler, M., The gnomen in Egyptian antiquity, JARCE 28 (1991) pp. 155-86
- Lauer, J.-P., 'À propos de l'orientation des grandes pyramides,' Bulletin de l'Institut d'Égypte (1960) pp. 7-15
- Lehner, M., 'Some observations on the layout of thepyramids of Khufu and Khafre,' JARCE 20 (1983) pp. 7-25
- Lehner, M., The Giza Plateau Mapping Project season 1984-85,' NARCE 131, no. (Fall 1985) pp. 23-56
- Lehner, M., The Giza Plateau Mapping Project,' NARCE 135 (Fall 1986) pp. 29-54
- Lepsius, R., *Die alt-ägyptische Elle* (Berlin, 1865) Neugebauer, O., 'On the orientation of pyramids,'

Centaurus 24 (1980) pp. 1-3 Petrie, W. M. F., Ancient Weights and Measures (London,

- 1926) Pochan, A., 'Observations relatives au revetement
- des deux grandes pyramides de Giza,' Bulletin de l'Institut d'Égypte 16 (1934) pp. 214-20
- Zába, Z., L'orientation Astronomique dans l'ancienne Égypte, et la précession de l'axe du monde (Prague, 1933)

RAMPS, LEVERS, LIFTING THEORIES

- Arnold, D., "Uberlegungenzum Problem des Pyramidenbaues," MDAIK 37 (1981), pp. 15-28. Cunningham, J., "Techniques of pyramid building in
- Egypt," Nature 332, no. 3 (1988). Dunham, D., "Building an Egyptian pyramid,"
- Archaeology 9, no. 3 (1956), pp. 159-65. Fitchen, J., "Building Cheops' pyramid," Journal of the
- Society of Architectural Historians 37 (1978), pp. 3-12. Isler, M., "Ancient Egyptian methods of raising
- weights," JARCE 13 (1976), pp. 31-41. Isler, M., "On pyramid building," JARCE 22 (1985),
- pp. 129-42. Isler, M., "On pyramid building II," JARCE 24
- (1987), pp. 95-112. Lowdermilk, R., "Re-inventing the machine Herodotus said built the Great Pyramid," KMT 2, no. 4 (1991), pp. 45-53.