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PYRAMID RESEARCH
From the Archaic to the Second Intermediate Period
Lists, Catalogues and Objectives *

Nabil SWELIM

INTRODUCTION

Ancient Egyptian pyramids and pyramid-like monuments have held fascination for countless numbers of travellers who have flocked to see them from earliest times. One might assume that their fame should position pyramid research among the major branches of Egyptology. Unfortunately, this is not the case; pyramid research has never been selected for a special section or workshop in any of the IAE or other important congress meetings. Notwithstanding this oversight, pyramid research has been conducted since antiquity. The remarkable work of Perring, Lepsius and Petrie in the last century has been followed by many investigations, and excellent studies are currently underway. Yet we have not acquired a satisfactory volume of information and data on pyramids nor thoroughly explored the fields and subjects of pyramid research, and consequently, our knowledge about pyramids remains relatively inadequate. Meanwhile, pyramids are in a state of deterioration. The reasons for my judgement are the following: considerable numbers of monuments have not been sufficiently investigated, published and protected; our knowledge of some pyramid subjects is based on speculation; and many questions cannot be answered with certainty. In order to begin to ameliorate this situation, I have begun systematically organizing accumulated information and data under tentative categories. My objective is to take the first steps towards creating lists and catalogues of pyramid and pyramid-like monuments, and towards exhorting that restoring missing pyramid material should be an objective of pyramid research.

* This study is presented to Professor Jean Leclant, a friend and great scholar who is constantly enriching our knowledge by his unfailing Egyptological energy; his contribution to pyramid research is invaluable. Since I submitted this paper two pyramid discoveries were made at Saqqara and Giza; the first was the pyramid of a queen of Pepi I in the excavations of A. Labrousse, and the second was the pyramid very much destroyed, located 8 m. west of the south pyramid of a queen of Khufu, south east of the Great Pyramid of Khufu, and Z. Hawass decided to follow Reisner's numbering and refer to it as G1d. Consequentely the total number of funerary pyramids becomes 111, and the grand total becomes 139. I thank Ms. Pamela C. Reynolds for assistance in editing this paper.

Hommages à Jean Leclant, *BdE* 106/1, 1993, p. 337-349 + 1.

THE FIELDS AND SUBJECTS OF PYRAMID RESEARCH

The main substance of pyramid knowledge is information obtained from historical documents and data obtained from pyramid sites. Fields of study include: pyramid concepts, pyramid construction, pyramid history, pyramid developments and others which emerge from the information and data and eventually yield interpretations and theories on pyramids and pyramid-like monuments. These fields are further broken down into subjects within each field. For example, subjects of pyramid concepts include studies on: origins, functions and composition of each monument. Subjects of pyramid construction include studies on: planning, logistics, building and administration of the ancient builders. Subjects of pyramid history are accounts on the periods of: construction, cult maintenance, neglect and discovery of the monument. Subjects of pyramid developments include studies on: political, religious, economical and technological reasons. Most of these subjects are applicable to all monuments, large groups of monuments or monuments in relation to each other; a few of these subjects apply only to individual monuments.

THE PRESENT STATE OF KNOWLEDGE ON PYRAMIDS

Pyramid knowledge is the ultimate goal of pyramid research. Presently, we cannot claim to have a sufficient degree of knowledge about the fields of study and their subjects mentioned above. Consequently, the first step is to devise lists of the monuments, along with accompanying information and data, and to indicate the pyramid material we need to acquire. I have developed such preliminary lists which appear in this article. The need for the extension of these lists into pyramid catalogues and objectives of pyramid research is clear.

In order to promote knowledge about pyramids, more materials must be processed and fields and subjects developed. An important aside, however, concerns some problems that limit our ability to do so. First are issues that are beyond the control of most scholars. They include: restricted access to some pyramid sites; unpublished, deteriorating and lost pyramid materials; inadequate funding of pyramid investigations; and a shortage of pyramid scholars. Second, as one would expect, some difficulties are encountered in any attempt to formulate the lists, catalogues and objectives. For example, pyramid lists are subject to debatable chronology and the misplacement of unidentified monuments. The pyramid catalogues will not only suffer from inaccurate data, tainted material and speculative subjects but also from the missing material resulting from incomplete and unpublished excavations. The objectives will not only suffer from the problems mentioned above but also from many other factors, for example disharmony among scholars and scientists. Nevertheless, the need for compiling lists and catalogues far outweighs the problems that are encountered in constructing them.

THE PYRAMID LISTS

The scope of pyramid research in the wider sense spans pyramids and pyramid-like monuments in general. Such ancient monuments are found in Egypt (pyramids), Mesopotamia (ziggurrats), Mexico and Central America (pyramid temples and tombs), India (stupa platforms), Rome (pyramids and tumuli), England (barrows) etc. and modern pyramids in Cairo, Paris, Richmond, Virginia, Chicago, Memphis, Tennessee etc. In Ancient Egypt pyramids and pyramid-like monuments are built from the Archaic to Ptolemaic Dynasties at the Delta, Nile Valley and Nubia. These could be divided into three divisions: **1) Royal, 2) Private** and **3) Nubian** monuments. The lists I present here are an elementary reckoning of a major part of the first division built before the end of the Thirteenth Dynasty; they total 137 monuments.[1]

The following five lists of funerary and religious pyramids; and funerary, religious and civil pyramid-like monuments, contain limited information because of the space constraints of this article. References to the monuments include: dynasties, common name, very limited or no description and occasional reference to the owner, location, uncertainties, subtotals and totals. Because of their complexity established numbering systems are avoided except for Lepsius numbers, which are kept to a necessary minimum. Some chronological disagreements and brief commentaries are found in footnotes 4-22.[2]

1. Funerary pyramids.

Funerary pyramids are layered, embankment-filled, solid, cross-walled and compound constructed creating forms of step, bent, benben and true pyramid shapes serving as: pyramid-tombs, pyramid-cenotaphs and ritual or subsidiary pyramids. Listed below are 109 pyramids of that nature:

THE STEP PYRAMID (LAYER PYR.) OF NETJERYKHET AT SAQQARA.
THE UNFINISHED LAYER PYRAMID OF SEKHEMKHET AT SAQQARA.
THE UNFINISHED PYRAMID OF NEBKARA AT ZAWYET AL-ARYAN NORTH.[3]

1. This article omits several monuments of the first division, the royal ones, because we know very little or nothing about some or because the monuments are not related to pyramids. With some exceptions these are the royal tombs of Dynasties VII-X and XIV-XVI. During the XVIIth and early XVIIIth Dynasties pyramid tombs and pyramid cenotaphs were built before the era of the Valley of the Kings, Dynasties XVIII-XX. Some royal tombs were found within the temple enclosure at Tanis; tombs in temples may be the case for Dynasties XXI-XXIV, XXVI, XXVIII-XXX. Alexander the Great and the Ptolemies were buried in Alexandria under *pyramides* or *extructus mons*, *i.e.* pyramid tumuli, according to *Lucan VIII*, 692-699.

2. The question mark in parentheses (?) indicates the uncertainty of the item it follows: the present existence of the pyramid, the classification mentioned or the owner to whom it has been attributed.

3. For an argument of the position of this pyramid in the Third Dynasty opposing its position in the Fourth Dynasty according to J.-Ph. Lauer, see N. Swelim, *Some Problems on the History of the Third Dynasty* (Alexandria, 1983) 125-179.

THE LAYER PYRAMID AT ZAWYET AL-ARYAN SOUTH.
THE BRICK PYRAMID AT ABU RAWASH, (LEPSIUS I).[4]
5 funerary pyramids during the Third Dynasty (5 subtotal).

THE LAYER PYRAMID OF SNOFRU AT SEILA, AL-FAYUM.[5]
THE PYRAMID OF SNOFRU (?) AT MEYDUM.
THE SUBSIDIARY PYRAMID OF SNOFRU (?) AT MEYDUM.
THE BENT PYRAMID OF SNOFRU AT DAHSHUR SOUTH.
THE SUBSIDIARY (?) PYRAMID OF SNOFRU AT DAHSHUR SOUTH.[6]
THE RED PYRAMID OF SNOFRU AT DAHSHUR NORTH.
THE GREAT PYRAMID OF KHUFU AT GIZA.
THE NORTH PYRAMID OF A QUEEN (?) OF KHUFU AT GIZA.
THE MIDDLE PYRAMID OF A QUEEN (?) OF KHUFU AT GIZA.
THE SOUTH PYRAMID OF A QUEEN (?) OF KHUFU AT GIZA.
THE ABANDONED PYRAMID PROJECT, REISNER'S "G1X" AT GIZA.
THE ABANDONED PYRAMID PROJECT, PETRIE'S TRIAL PASSAGES AT GIZA.
THE ABANDONED PYR. PROJECT (?) JUNKER'S NEBENPYRAMIDE AT GIZA.
THE PYRAMID OF DJEDEFRA AT ABU RAWASH.
THE SUBSIDIARY PYRAMID OF DJEDEFRA AT ABU RAWASH.
THE PYRAMID OF KHAFRA AT GIZA.
THE SUBSIDIARY (?) PYRAMID OF KHAFRA AT GIZA. [see 7]
THE PYRAMID OF MENKAURA AT GIZA.
THE EAST PYR. OF A QUEEN (?) SOUTH OF MENKAURA.
THE MIDDLE STEP PYR. OF A QUEEN SOUTH WEST OF MENKAURA.
THE WEST STEP PYR. OF A QUEEN WEST SOUTH WEST OF MENKAURA.
21 funerary pyramids during the Fourth Dynasty (+ 5 = 26 subtotal).

THE PYRAMID OF USERKAF AT SAQQARA.
THE SUBSIDIARY (?) PYRAMID OF USERKAF AT SAQQARA. [see 7]

4. Rediscovered on December 16, 1985, and appeared in a preliminary study, SWELIM, *The Brick Pyramid at Abu Rawash, number I by Lepsius* (Alexandria, 1987).

5. Excavation report forthcoming. See my newsletter, *The Pyramid of Seila Locally Called "el Qalah"*, season 1987 (March 1987, unpublished); J. LECLANT and G. CLERC, *Orientalia* 57/3, 1988, p. 336, pl. XXXII, XXXIII, Figs. 40, 41.

6. Doubt that this pyramid is a subsidiary to the Bent pyramid is based on the fact that all the subsidiary pyramids in the time spanning between the subsidiary to Meydum and the subsidiary to Senusert I have bases that measure 1/5 of the base length of the principal pyramid. This pyramid and two others south of the pyramids of Khafra and Userkaf are likewise doubtful because their base lengths are greater than that relationship. SWELIM, "Funerary pyramid lists and dimensions of their superstructures," *The Greatness of Egypt* (Provo, Brigham Young University, forthcoming?) submitted July 1986.

7. An unfinished pyramid seen northwest of the pyramid of Sahura and southeast of the sun temple of Userkaf on an aerial photograph in H. RICKE, *Das Sonnenheiligtum des Königs Userkaf, BÄBA* 7, 1965 Taf. I.

THE PYRAMID OF A QUEEN OF USERKAF AT SAQQARA.
THE PYRAMID OF SAHURA AT ABU SIR.
THE SUBSIDIARY PYRAMID OF SAHURA AT ABU SIR.
THE PYRAMID OF NEFERIRKARA AT ABU SIR.
THE PYRAMID OF SHEPSESKARA (?) ON AERIAL PHOTO OF ABU SIR.[7]
THE UNFINISHED PYRAMID OF RANEFEREF AT ABU SIR.
THE PYRAMID OF NEUSERRA AT ABU SIR.
THE SUBSIDIARY PYRAMID OF NEUSERRA AT ABU SIR.
THE PYRAMID OF QUEEN KHENTKAUS AT ABU SIR.
THE SUBSIDIARY PYRAMID OF QUEEN KHENTKAUS AT ABU SIR.
THE NORTH SMALL PYRAMID AT ABU SIR.
THE SOUTH SMALL PYRAMID AT ABU SIR.
THE PYRAMID OF MENKAUHOR (?) AT DAHSHUR NORTH, (LEPSIUS L).[8]
THE PYRAMID OF DJEDKARA AT SAQQARA.
THE SUBSIDIARY PYRAMID OF DJEDKARA AT SAQQARA.
THE PYRAMID OF A QUEEN OF DJEDKARA AT SAQQARA.
THE SUBSIDIARY PYRAMID OF A QUEEN OF DJEDKARA AT SAQQARA.
THE PYRAMID OF UNAS AT SAQQARA.
THE SUBSIDIARY PYRAMID OF UNAS AT SAQQARA.

21 funerary pyramids during the Fifth Dynasty (+ 26 = 47 subtotal).

THE PYRAMID OF TETI AT SAQQARA.
THE SUBSIDIARY PYRAMID OF TETI AT SAQQARA.
THE PYRAMID OF QUEEN KHUIT AT SAQQARA.
THE SUBSIDIARY PYRAMID (?) OF QUEEN KHUIT AT SAQQARA.[9]
THE PYRAMID OF QUEEN IPUT I AT SAQQARA.
THE SUBSIDIARY PYRAMID (?) OF QUEEN IPUT I AT SAQQARA. [see 10]
THE PYRAMID OF A QUEEN MOTHER; OF USERKARA (?) [10]
THE PYRAMID OF USERKARA (?) UNDER THE VILLAGE AT SAQQARA.[11]
THE PYRAMID OF PEPI I AT SAQQARA.
THE SUBSIDIARY PYRAMID OF PEPI I AT SAQQARA.

8. R. STADELMANN, *Die Ägyptischen Pyramiden*, Darmstadt, 1985, p. 179, Abb. 23. It has been thought by other scholars that the pyramid under the village at Saqqara belongs to Menkauhor; see footnote 12.

9. Information on the existence of the two subsidiary pyramids of the queens of Teti: Khuit and Iput I, was given to me by J.-Ph. Lauer, whom I thank.

10. Reused parts of this pyramid were found in the pyramid complex of Pepi I; information by A. Labrousse, whom I thank. The attribution that I am giving here, however, is tentative.

11. It was generally believed that this was the pyramid of Menkauhor before Stadelmann suggested the pyramid Lepsius L for this king see footnote 8. STADELMANN, *LÄ* IV, 1982, col. 1219, dates this pyramid to the Third Dynasty; I do not believe that the architecture could support that early dating. Consequently I have suggested Userkara, but the pyramid could be from the First Intermediate Period as well.

THE EAST PYRAMID OF QUEEN NOUBOUNET OF PEPI I AT SAQQARA. see 26
THE MIDDLE PYRAMID OF A QUEEN OF PEPI I AT SAQQARA. see 26
THE OCCIDENTAL PYRAMID OF A QUEEN OF PEPI I AT SAQQARA. see 26
THE SOUTH PYRAMID OF QUEEN MERITITES II OF PEPI I AT SAQQARA.[12]
THE PYRAMID OF MERENRA AT SAQQARA.
THE SUBSIDIARY PYRAMID OF MERENRA AT SAQQARA.
THE PYRAMID OF PEPI II AT SAQQARA.
THE SUBSIDIARY PYRAMID OF PEPI II AT SAQQARA.
THE PYRAMID OF QUEEN OUDJEBTEN AT SAQQARA.
THE SUBSIDIARY PYRAMID OF QUEEN OUDJEBTEN AT SAQQARA.
THE PYRAMID OF QUEEN NEITH AT SAQQARA.
THE SUBSIDIARY PYRAMID OF QUEEN NEITH AT SAQQARA.
THE PYRAMID OF QUEEN IPUT II AT SAQQARA.
THE SUBSIDIARY PYRAMID OF QUEEN IPUT II AT SAQQARA.

24 funerary pyramids during the Sixth Dynasty (+ 47 = 71 subtotal).

THE PYRAMID(?) OF ITY MENTIONED IN WADI HAMMAMAT.[13]
THE PYRAMID(?) OF NEFERKARA MENTIONED AT SAQQARA.[14]
THE PYRAMID OF KAKARA IBI AT SAQQARA.

3 funerary pyramids during the Eighth Dynasty (?) (+ 71 = 74 subtotal).

THE PYRAMID (?) OF MERYKARA MENTIONED AT SAQQARA.[15]

1 funerary pyramid during the Tenth Dynasty (?) (+ 74 = 75 subtotal).

THE PYRAMID OF AMENEMHAT I AT LISHT.
THE PYRAMID OF SENUSERT I AT LISHT.
THE SUBSIDIARY PYRAMID OF SENUSERT I AT LISHT.
THE PYRAMID OF QUEEN NEFERU, SOUTH NUMBER 1 AT LISHT.
THE PYRAMID OF PRINCESS ITAKAYET, SOUTH NUMBER 2 AT LISHT.
THE PYRAMID SOUTH NUMBER 3 AT LISHT.
THE PYRAMID WEST NUMBER 4 AT LISHT.
THE PYRAMID WEST NUMBER 5 AT LISHT.
THE PYRAMID NORTH NUMBER 6 AT LISHT.
THE PYRAMID NORTH NUMBER 7 AT LISHT.
THE PYRAMID EAST NUMBER 8 AT LISHT.
THE PYRAMID EAST NUMBER 9 AT LISHT.

12. A. Labrousse kindly showed me this very recent discovery when I visited the site on May 9, 1991. The name of the queen was found on a gateway in the enclosure wall of her pyramid.

13. *LD II*, pl. 115, no. 41.

14. G. Jéquier, *Les Pyramides des reines Neit et Apouit*, p. 53.

15. J.E. Quibell, *Excavations at Saqqara 1905-1906*, pl. 13-15.

THE WHITE PYRAMID OF AMENEMHAT II AT DAHSHUR.
THE BRICK PYRAMID OF SENUSERT II AT EL LAHUN.
THE BRICK PYRAMID OF QUEEN NEFERU AT EL LAHUN.
THE BRICK PYRAMID OF SENUSERT III AT DAHSHUR.
THE BLACK, BRICK PYRAMID OF AMENEMHAT III AT DAHSHUR.
THE BRICK PYRAMID OF AMENEMHAT III AT HAWARA.
THE BRICK PYRAMID(?) OF PRINCESS NEFERUPTAH AT HAWARA.

19 funerary pyramids during the Twelfth Dynasty (+ 75 = 94 subtotal).

THE STONE PYRAMID OF NORTH MAZGHUNA.
THE BRICK PYRAMID OF SOUTH MAZGHUNA.
THE BRICK PYRAMID OF AMENEMHAT (?) (LEPSIUS LIV).[16]
THE BRICK PYRAMID OF KHINDJER AT SAQQARA.
THE BRICK PYRAMID OF THE QUEEN OF KHINDJER AT SAQQARA.
THE UNFINISHED BRICK PYRAMID AT SAQQARA (LEPSIUS XLVI).
THE DEMOLISHED BRICK PYRAMID (LEPSIUS XLIV) AT SAQQARA.
THE BRICK PYRAMID OF AMINIKIMAU AT DAHSHUR.
THE BRICK PYRAMID (?) NORTH OF AMINIKIMAU AT DAHSHUR.[17]
THE BRICK PYRAMID (?) NORTH WEST OF AMINIKIMAU AT DAHSHUR. [see 18]
THE BRICK(?) PYRAMID OF MERNEFERRA AY AT KHATAANA(?)[18]
THE SECOND BRICK (?) PYRAMID AT KHATAANA(?). [see 19]
THE THIRD BRICK (?) PYRAMID. [see 19]
THE UNIDENTIFIED BRICK PYRAMID (LEPSIUS LIX), EAST OF DAHSHUR(?).
THE UNIDENTIFIED SUBSIDIARY BRICK PYRAMID(?),(SUBSID. LEP. LIX).

15 funerary pyramids during the Thirteenth Dynasty (+ 94 = 109 total funerary pyramids).

2. Religious pyramids.

Seven of the religious pyramids mentioned below are layered, squared-base constructions which differ from funerary pyramids by their lack of a substructure or funerary aspect; the eighth no longer exists.

16. The name of this king was found at the site of this monument. I thank Ahmed Moussa for giving me this information. It is difficult at this stage to draw any conclusions further than to date this pyramid to the Thirteenth Dynasty by the architecture.

17. This and the following pyramid northwest of Aminikimau are suggested by D. Arnold, *MDAIK* 31, p. 172.

18. This pyramid and the two which follow are confirmed by pyramidions in the Cairo Museum: for the first two, *ASAE* LII, 471-479; the third is half a pyramidion which was reused as an anchor. It is on display east of the Atrium, above 23, temporary number is 5/1/15/12, thanks to May Trad. The preserved side is uninscribed; the hole of the anchor rope is worked through the upper part. Two partly preserved sides show the seated gods Anubis and Horakhty; a hand and part of an arm can be seen in front of the latter. The fourth side is the break, see plates I, II in, A. Nibbi, "A half pyramidion as an Egyptian anchor shape", *GM* 56, 1982.

THE LAYER PYRAMID OF HEBENU, ZAWYET AL-MAYITEEN, MINYA.
THE LAYER PYRAMID "EL SINKI" NAG AHMED KHALIFA, ABYDOS.
THE LAYER PYRAMID (?) UNDER THE CHAPEL OF AY, ABYDOS.[19]
THE LAYER PYRAMID OF NUBT, AL-ZAWAYDA, NAQADA.
THE LAYER PYRAMID "EL KULA" NAG AL-MIAMARIYA, EDFU NORTH.
THE LAYER SAND STONE PYRAMID, AL-GHENIMIYA, EDFU SOUTH.
THE LAYER GRANITE PYRAMID OF ELEPHANTINE, ASWAN.
THE PYRAMID (?) OF ATHRIBIS; OF DESCRIPTION DE L'ÉGYPTE.

8 religious pyramids during the Third Dynasty (?) (+ 109 = 117 total pyramids).

3. Funerary pyramid-like monuments.[20]

Funerary pyramid-like monuments share a structural or formative aspect with funerary pyramids.

EL DEIR, THE SQUARE BRICK MASSIF, ABU RAWASH (?).[21]
THE SARCOPHAGUS SHAPE(?) TOMB OF KHENTKAUS, AT GIZA.
MASTABET FAROUN, THE TOMB OF SHEPSESKAF AT SAQQARA.
THE MONUMENT "DARA" OF KING KHUI (?) AT ARAB AL-AMAIEM, BENI QURRA.
THE MASSIF OF MENTHUHOTĖP AT AL-DEIR AL-BAHARI.

5 funerary pyramid-like monuments during Dynasties III, IV, IV, VIII (?) and XI, respectively (+ 117 = 122 subtotal).

4. Religious pyramid-like monuments.

Religious pyramid-like monuments share structural or formative aspects with layered and true pyramids.

FOUR TUMULI AT NAQADA.
THE BENBEN IN THE SUN TEMPLE OF USERKAF AT ABU SIR.
THE BENBEN IN THE SUN TEMPLE OF NEUSERRA AT ABU GHURAB.
FOUR FIFTH DYNASTY BENBENS KNOWN FROM TEXTS.[22]

10 religious pyramid-like monuments during Dynasties II (the tumuli) and V (the benbens); (+ 122 = 132 sub total).

19. SWELIM, *History of the Third Dynasty*, p. 100, footnote 2; C.T. CURRELLY, in *Abydos* III, pl. XV.

20. Several mastabas have some likeness to pyramids in the concept of their architectural composition; for example: at Saqqara nos. 2302 and 2307 have mud tumuli imbedded; they are usually described as mud-filled cores, in plain brick facades; at Giza "T" has a recessed brick mastaba imbedded in a plain brick facing and there is a layer stone one at some distance east of it; at Bet Khallaf "K 1" has a gravel tumulus embedded in its plain(?) brick facing; and "K 2" has a stepped brick core imbedded in its plain(?) brick facing; at Zawyet al-Aryan "Z 500" is a stone embankment rubble-filled structure; at Meydum no. 16 combines the features of having a mud tumulus with a plain brick white-washed facing imbedded in a recessed brick facade and no. 17 is composed of rubble-filled stone embankments constructed of limestone chipping superimposed creating a stepped core imbedded in a brick recessed casing.

21. The funerary aspect has not been proved; see an argument, however, in SWELIM, *History of the Third Dynasty*, p. 36-91 and *The Brick Pyramid at Abu Rawash*, 91-95.

22. In the sun temples of kings Sahura, Neferirkara, Raneferef and Menkauhor; the names

5. Civil pyramid-like monuments.

Other selected pyramid-like monuments share civil and structural engineering aspects with layer and true pyramids.

THE REVETMENT OF THE ARCHAIC TEMPLE AT HIERACONPOLIS.
THE DAM OF WADI GARAWI, WADI MILISAT, HELWAN.
HEET AL-GHURAB SOUTH OF THE SPHINX AT GIZA.
TWO PEDESTALS OF AMENEMHAT III, BIYAHIMU, AL-FAYUM.

5 other pyramid-like monuments during Dynasties I, IV, IV (?) and XII respectively (+ 132 = 137 total).

117 PYRAMIDS and **20 PYRAMID-LIKE MONUMENTS**, giving a total of **137 MONUMENTS** known to us from the Archaic to the Second Intermediate Period (as of spring, 1991).

THE PYRAMID CATALOGUES

We can assess the volume of pyramid material by recording information and data in pyramid catalogues.[23] Such catalogues are currently being compiled by the author; it would help if special pyramid research software were available. The following section will briefly discuss the necessity, requirements and limitations of such catalogues.

NECESSITY OF PYRAMID CATALOGUES

Catalogues are necessary because they will eventually clarify the volume and depth of scholarship about pyramids. A glance at the information and data on any given monument in a catalogue would directly reveal how much is known and, indirectly, how much is still missing. It would contain interpretations and theories so their reliability could be checked. Thus, the catalogue would assess our perception, bring missing material to our attention and serve as a comprehensive reference and tool for further research on that pyramid.

of these sun temples are found in J. von BECKERATH, *Handbuch der ägyptischen Königsnamen*, 1984, p. 54-56, 181-183.

23. When erroneous information, incorrect data, opposing interpretations, speculations, theories and preconceived ideas penetrate our literature it becomes tainted. Whenever the source of information and data is in question, it should be carefully revised. Interpretations and theories should be ascribed. Expressing this very clearly is a quotation from a letter dated Oct. 10, 1988 from S. Seidelmayer of University of Bonn: "It is extremely impressive to become aware of how much and how fundamental insights can be gained ....by going back to the primary data and by examining the monuments .... free of preconceived ideas! Things are neither so exhausted nor so definitively settled as our libraries make them look like."

REQUIREMENTS OF PYRAMID CATALOGUES

Pyramid catalogues should offer all the information and data we possess on every monument in the five lists mentioned above indicating interpretations, speculations and theories. I suggest that pyramid material in the catalogues should be presented for each pyramid under some heading that would include the following: introduction, identity, complex, appearance, architecture, funerary objects, written matter, art works and archaeological finds. A treatment of the subjects of these headings is needed to serve the specifics of the pyramid material. It should provide useful definitions which describe, classify and govern the correct rearrangement of the material in the catalogues.[24]

The introduction could include: a bibliography, investigations performed and a general commentary. The pyramid identity could include: the location, reference maps, date, owner, functions, names and numbers. The pyramid complex—if such were the case—could include: other pyramids in the complex; temenos, enclosure and boundary walls; pavements, boat pits, temples and a causeway. The pyramid appearance could include: shape, form, dimensions and volume, initial and present state, elevations, photographs. The architecture concerning the superstructure could include: plans and sections, foundation, leveling, orientation, composition (core, nucleus, outer facing and pyramidion), masonry and mortar. The architecture concerning the substructure—if the monument had one—could include: plans, sections, entrance, corridors, portcullis, shafts, chambers, roofing systems, masonry and stresses. Funerary equipment—if the monument is a funerary one—could include: sarcophagus, canopic box, serdab, niche, stelae, cult chapel and temples. The written matter could include: inscriptions, texts, archives, quarry marks and graffiti. The art works could include: statues, reliefs and wall paintings. The archaeological finds could include: temple plans, elevations, stratigraphic drawings, stone vessels, pottery, tools and skeletal remains.

LIMITATIONS OF THE PYRAMID CATALOGUES

Realistically, the pyramid catalogues cannot cover all the above mentioned requirements; there are additional requirements that will appear in the course of handling the material. The better investigated monuments offer more factual material.

24. From my current research on the classification on pyramid components the following example is borrowed concerning pyramid shapes. They are either stepped, bent, benben or true; and each shape comes in various forms. Stepped shapes could be of mild, normal and upright forms — according to the side angle, $\leq 69°$, $70°$ to $79°$ and $\geq 80°$, respectively. Upper parts of bent pyramids and benbens and true pyramid shapes could be of blunt, regular and sharp (apex) forms — according to the side angle, $\leq 49°$, $50°$ to $55°$ and $\geq 56°$ respectively.

The quantity of material is unbalanced; for example, there is much more on a royal pyramid tomb than on the subsidiary pyramid. There is very little material on insufficiently investigated monuments (such as those at Abu Rawash, Zawyet al-Aryan, Mazghuna and many others scattered on the more famous sites). There is scanty or no material available on monuments we know of from documents, reused elements, museum objects, surveyed sites and aerial photographs.

THE OBJECTIVES OF PYRAMID RESEARCH

The objectives of pyramid research should be higher levels of understanding pyramid material and deeper perception of pyramid knowledge by processing information and data and developing fields of research. In the absence of material, speculations find their way into the literature. Though essential in some cases, the fewer the speculations, the more reliable the conclusions. In contrast, with the presence of information and data, ineffectual investigations create less reliable conclusions. Consequently maximal accumulation of information and data and thorough investigation are required. It has already been mentioned that restricted access to some sites; unpublished, deteriorating and lost material; inadequate funding; and shortage of pyramid scholars are problems. For the time being we have to content ourselves with what is available today; be that as it may, it remains an immense quantity.

Pyramid research is conducted at libraries and sites. The tools used in both cases are conventional, which have been implemented in the past, and technological, which are becoming indispensable today. Conventional methods are basic while technological achieve goals with greater efficiency, ease and speed. Presently pyramid scholars are moving closer towards scientific technology. At libraries, word processing, data base and spread sheet programs are being used for creating, researching and updating reports, references and records. At the sites some precedents have already been set. Success in discovering new monuments by the Mission Archeologique Française de Saqqara at the pyramids of the Queens of Pepi I; the Charles University of Prague expedition at the Pyramids of Abu Sir; the Polish expedition west of the Step Pyramid at Saqqara and others has been conducted by application of geophysical, geomagnetic and electrical resistance sounding.[25] Some

25. LECLANT, "À la quête des pyramides des reines de Pépi I^er^," *BSFE* 113, oct. 1988, p. 20-31; P. DELETIE, Y. LEMOINE and J. MONTLUCON, "La recherche des pyramides de reines de Pépi I," *Les Dossiers d'Archéologie* 146-147, mars-avril 1990, p. 88, see update in footnote 13; M. VERNER, "Excavations at Abusir, Season 1978/1979, Preliminary Report," *ZÄS* 107, 1980, p. 169; M. VERNER, V. HASEK, "Die Anwendung geophysicher Methoden bei der archäologischen Forschung in Abusir," *ZÄS* 108, 1981, p. 68-84; VERNER, "Excavations at Abusir, Season 1980/1981, Preliminary Report," *ZÄS* 109, 1982, p. 165; K. MYSLIWIEC, in *Abstracts of Papers fifth international congress of Egyptology, October 29 to November 3*, Cairo, 1988, p. 201.

applications of other nondestructive electromagnetic microwaves, ultrasonic waves and microgravity measurements have taken place at the Great Pyramid of Khufu.[26] The superstructure of the pyramid of Khafra had been examined for cavities by monitoring cosmic rays and by application of other sensing techniques.[27] Scientists have dated pyramid material by examining pollen and carbon deposits in mortar of pyramids.[28]

As the case is in all scientific aspects of our era, we are experiencing great revolutionary changes in the tools of pyramid research. It is necessary to use these tools wisely or otherwise they may lead us astray. The first international symposium on the application of modern technology to archaeological exploration at the Giza necropolis in Cairo during December 1987 has shown that scientists working independently pursue goals which are not in our interest; sometimes scientists working on the same subject reach different results. Unfortunately, scientific and pseudo-scientific theories based on unreasonable grounds have thus been advanced. Scientific tehchnology has successfully detected monuments buried in the desert, yet detection of chambers and corridors unknown to us in pyramids seems questionable. As concerns dating we cannot be sure of either our academic, radiocarbon or pollen results until they confirm one another. Scientific technology and conventional archaeology lack unifomity in terms, procedures and goals; as a matter of fact Egyptological terms require some coordination.

26. S. Yashimura, S. Tonouchi, T. Nakagawa and K. Seki, "Non-destructive pyramid investigation (1) and (2)" *Studies in Egyptian Culture, nos. 6-7*, Tokyo, Waseda University, 1987 and 1988; H. Bui, J. Lakshmanan, J. Montlucon and Sh. Nakhla, "First results of the structural analysis of the Cheops pyramid by microgravity," *Proceedings of the first international symposium on the application of modern technology to archaeological explorations at the Giza necropolis Cairo, December 14-17, 1987*, EAO, 1988, p. 66-90.

27. F. Bdewi, L. Alvarez, *Science* (Feb. 1970); Ain Shams University - Stanford Research Institute (SRI), *Electromagnetic sounder experiments at the pyramids of Giza* (Menlo Park, May 1975), p. 7-29; *Application of modern sensing techniques to Egyptology* (Menlo Park, Sept. 1977), 13, p. 33-64; A. Fakhry, "X-Raying the pyramids," in *The Pyramids*, Chicago, 1974, p. 259-262.

28. F. Darmon, "La palynologie archéologique dans le cadre de l'étude de la pyramide de Khéops," *Proceedings of the first international symposium on the application of modern technology to archaeological explorations at the Giza necropolis, Cairo, December 14-17, 1987*, EAO, 1988, p. 125-136; M. Regourd, J. Kerisel, P. Deletie, P. Haguenauer, "Microstructure of mortars from three Egyptian pyramids," *op. cit.*, p. 106-116. At this symposium H.Haas discussed these problems, and his report states that "The final conclusion therefore is that the radiocarbon dates suggest that events in the Old Kingdom, up to the 6th Dynasty, are older by at least three centuries than established by traditional historical reconstructions," H. Haas, J. Devine, R. Wenke, M. Lehner, W. Wolfli and G. Bonani, "Radiocarbon chronology and the historical calendar in Egypt," *BAR International series* 379, 1987, p. 597, I thank him for mailing material and comments on the reliability of radiocarbon dating results; see, however, R.D. Long, "Ancient Egyptian chronology, radiocarbon dating and calibration," *ZÄS* 103, 1976, p. 103 ff.; *Radiocarbon* 19/3, 1977, p. 355-363; *Antiquity* 61, 1987, p. 119-135.

Today the aims of a better understanding of information and data and a deepening of our perception of fields of research and their subjects are far from being actualized. Without probing deeply into some of the delicate matters mentioned in this article and admitting that this is not the place to discuss them, I should like to make the case that pyramid research should be placed under auspices capable of dealing with problems beyond the control of scholars.

Pyramid scholars should have their own symposium; in IAE congress meetings, their own section; generally they should be encouraged to work more closely together. I suggest that they discuss terms, measuring units and patterns of pyramid research and standardize them within the frame of the languages used in Egyptology and the technological sciences involved. In order to assess our aquired pyramid material and our perception of fields of research and their subjects, I believe that the more complete the lists and the more accurate the catalogues the more precise the assessment. On the basis of this assessment, research can proceed towards acquiring the necessary missing material, restoring deteriorating monuments and processing the information and data to develop the fields and subjects of pyramid research. I invite discussion from interested scholars as to their opinions and suggestions regarding the ideas expressed in this article.