

SUDAN & NUBIA

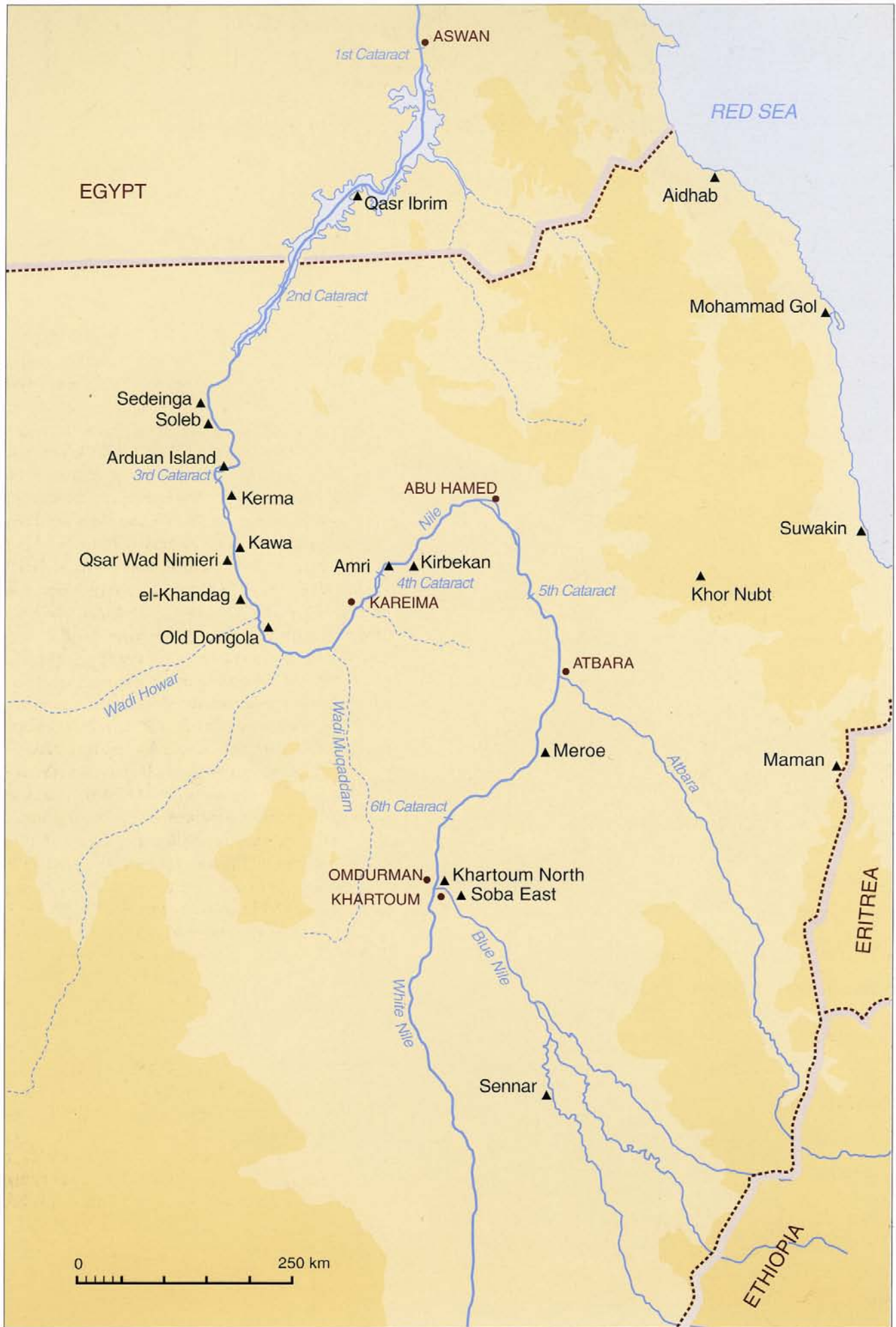
The Sudan Archaeological Research Society



Bulletin No. 4

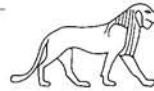
2000





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Front Cover: Meroe. Pyramid BEG N 18 (type XII) before restoration work on the chapel. In the background pyramid BEG N 9 (type VII). Photo taken by F. W. Hinkel in 1980 from the top of BEG N 19 (slide 5467).

Introduction

Vivian Davies

During the last winter the Society resumed its flagship project at Kawa, among other things uncovering more of the early Kushite town, including an extraordinary mud-brick building once decorated with wall-paintings showing royal and divine figures and containing the remains of large ceramic figures of the gods Bes and Beset (see Welsby below). We also responded to the international appeal for help from the National Corporation for Antiquities and Museums to document sites threatened by the planned Merowe Dam, carrying out a survey on the left bank of the Nile and on the islands between Amri and Kirkeban above the Fourth Cataract which identified well over a hundred sites of different types and periods (Welsby). Qasr Ibrim, for many years under excavation by the Egypt Exploration Society and still yielding information of first-rate importance (Rose), embodies an acute reminder of the destructive consequences of dams and of the loss to knowledge that such schemes entail.

The need for rescue-work in response to various threats (environmental as well as man-made) is a thread running through much of this issue, which also includes reports on the study and conservation of the monuments at Meroe (Hinkel), excavation necessitated by road-building at Soba East (Abdel Rahman Ali Mohamed), archaeological survey in the little-known Fifth Cataract region (Yousef El-Amin and Edwards), and continuing investigation of the Mahas region at the Third Cataract (Edwards and Ali Osman), the latter an interdisciplinary project which now valuably incorporates ecological, ethnographic and linguistic components (Muhammad Jalal Hashim and Bell). We are also very pleased to include two papers on aspects of Islamic archaeology in the Sudan (Intisar Soghayroun el-Zein and Salah Omer Elsadig), hitherto a chronically neglected subject but clearly one with great potential for further research.

It is an enormous pleasure to report that Professor William Y. Adams, one of the great names of modern Sudanese archaeology, has accepted our invitation to become Honorary President of SARS, in succession to the late Sir Laurence Kirwan. Professor Adams takes office in time to preside over our tenth anniversary in 2001, a year in which SARS celebrates a decade of progressive achievement and looks forward to the formidable but exciting challenges that lie ahead.

The Royal Pyramids of Meroe. Architecture, Construction and Reconstruction of a Sacred Landscape

Friedrich W. Hinkel

Foreword¹

Since earliest times, mankind has demanded that certain structures not only be useful and stable, but that these same structures also express specific ideological and aesthetic concepts. Accordingly, one fundamental aspect of architecture is the unity of 'planning and building' or of 'design and construction'. This type of building represents, in a realistic and symbolic way, the result of both creative planning and target-orientated human activity. It therefore becomes a document which outlasts its time, or - as was said a hundred years ago by the American architect, Morgan - until its final destruction, this type of structure is 'the printing press of all ages and gives a history of the state of society in which it was erected'.

We should remember that in the past architecture did not depend on an open market, but relied on the order given by the customer, i.e. by a person, or by the society.

Research into the underlying ideas and principles in a particular design as well as how it was affected by its builder, patron(s), material(s) and technical possibilities is of decisive importance in understanding the distinct nature of a given monument. The building materials, construction tools and technical means can usually be deduced from the structural remains. These provide information about building methods and about the state of the building trade. Greater difficulty is encountered in approaching the other aspect: the ideas within and behind the planning process. This more theoretical question needs, among other things, knowledge on our part of architectural practice during the relevant time, the consideration of possible contemporary influences on architecture, and experience in formulating appropriate and answerable questions about the structural remains.

Sacred and profane buildings of the Kingdom of Kush present excellent examples for such an investigation. First, traditional elements in their architecture are recognisable. Second, sources of contemporary foreign influences are limited and mostly identifiable. Last but not least, the ancient planning process and building technology are well enough understood to be both deduced from the structures and tested, since practical work and research at the pyramid fields of Meroe during the last decades have led to both a general

and detailed understanding of Meroitic architecture and its building trade.

The Southern Differences

We normally connect the term 'pyramid' with the enormous structures at Gizeh and Dahshur. These pyramids, built to ensure the afterlife of the Pharaohs of Egypt's earlier dynasties, seem to have nearly destroyed the economy of Egypt's Old Kingdom. They belong to the 'Seven Wonders of the World' and we are intrigued by questions not only about their size and form, but also about their construction and the types of organisation necessary to build them. We ask about their meaning and wonder about the need for such an enormous undertaking, and we admire the courage and the technical ability of those in charge. These last points - for me as a civil engineer and architect - are some of the most important ones.

In the millennia following the great pyramids, their intention, form and symbolism have served as the inspiration for numerous imitations. However, it is clear that their original monumentality was never again repeated although pyramids were built until the Roman Period in Egypt. For example, during the New Kingdom pyramids surmounted private tombs at Deir el-Medineh and later in Lower Nubia at Aniba. These were very much smaller than their prototypes at Gizeh, with steeply inclining sides.

We therefore cannot see Egyptian and Meroitic pyramids as closely related except for the small pyramids of the New Kingdom nobles at Deir el-Medineh which provide the closest Egyptian prototype in shape and size to those in the northern Sudan. It is possible that this resemblance reflects Egyptian/Nubian contacts from the Middle Kingdom onwards. The Egyptian occupation of Northern Nubia during the Middle Kingdom, their trading relations with the rulers of Kerma, and their colonisation southwards to the Fourth Nile cataract during the New Kingdom, later followed by the Nubian domination of Egypt during the so-called Ethiopian Dynasty no doubt greatly shaped and influenced the Middle Nile Valley culture in its approach to Egyptian religion, art and architecture.

The Sudanese pyramids cannot stand in competition to those at Gizeh, either in size or in age. However, the actual differences between these pyramids are not limited to size and age. Sudanese and Egyptian pyramids also differ considerably in shape and inclination. Whereas the Meroitic pyramids are steep and reach an inclination between 68° and 73°, and in one instance even 81°, those of the Egyptian Old Kingdom do not exceed 52°. The differences in inclination are due to different technical means of construction as well as to different approaches to the harmonic proportions of their design.

The siting also differs. Whilst the Egyptian pyramids occupy sites on the west bank of the Nile and are oriented to the east, the majority of pyramids in the Sudan - except those at Nuri - are found on the east bank and their orientation

¹ This article is based on a paper presented at the Annual General Meeting of SARS in September 1999. I would like to thank Dr. Janice Yellin for correcting my English.



varies between north east and south. The internal structure is another point of difference, especially when comparing the post-Napatan, i.e. the Meroitic (300 BC to AD 350), with those in Lower Egypt. The Meroitic ones consist of an internal filling of rubble and earth encased in one or two rows of mantle or casing blocks in contrast to the solid stone block structure of Egyptian pyramids. However, the greatest difference - although not visible - concerns their function and purpose, since the time of their construction in relation to the death and burial of the Meroitic owners differs decisively from Egyptian practice.

In the Sudan, the timing of pyramid construction followed older traditional burial customs. The substructure consisted of a varying number of burial chambers deeply cut into the ground or sandstone substrata with a staircase leading down to them. A grave mound of one kind or another was formed over the burial only after digging the substructure and after the burial took place. Therefore, in considering the pyramids of Kush, we have to distinguish between the substructure and the superstructure since, unlike Egypt, the superstructure was built after the owner's death and burial.

The superstructure was composed of the pyramid proper, an offering chapel, and often a temenos. The superstructure was normally constructed above the substructure. Given this fact alone, it becomes clear from the structural point of view that in many cases the underground structure and superstructure could not have been built contemporaneously (cf. Fig. 3). Provided that there was only one burial ceremony practised in Kush, we should assume that the pyramids, chapel and temenos walls were constructed after the actual burial took place and the staircase was refilled. The superstructure was erected by the successor and not the owner and was, therefore, built as an attempt to create a memorial or architectural sign over the grave of the predecessor (Hinkel 1984; 1997).

The Ancient Sudanese Pyramids

Pyramids first appear as part of Nubian royal burial practices in the 7th century BC. The best known of the Napatan kings who ruled as Egyptian pharaohs during Dynasty 25, Taharqo (690-664 BC), began the tradition of placing pyramids over the tombs of rulers and members of the royal family. His pyramid at Nuri is by far the largest such structure in the Sudan and may have reached a height of some 50m (Dunham 1955).

The number of pyramids that followed the prototype set by Taharqo's structure is quite impressive. There is evidence for more than 220 pyramid structures in the six major royal cemeteries alone (without counting other structures such as mastabas). The pyramid-shaped structures in those cemeteries first appear at the end of the 25th Dynasty and continue for approximately 1000 years, i.e. from about 700 BC to AD 350. Many other much smaller pyramids were built for non-royal, but wealthy Nubians, at sites such as Karanog-Aniba,

Jebel Adda, Faras, Dal, Emir Abdalla, Sedeinga, Kerma, Tebo, Abu Sufyan, Alim and around Meroe.

A quick survey of the royal pyramid fields should start at the earliest ones in the area around the holy mountain of Jebel Barkal, which was the site of ancient Napata, for many centuries the main religious and political centre of the Kingdom of Kush.

Two groups of about 25 pyramids, one dating from the beginning of the 3rd and the other from the 1st century BC, are found beside the mountain of Jebel Barkal (Dunham 1957). Across the river, the pyramid field of Nuri, began in the reign of Taharqo, contains 57 pyramids for kings and queens of the Napatan Period. Exceptionally, during this period, two pyramids were built at the older royal cemetery of El Kûrû where otherwise the predecessors of Taharqo were always buried in tumuli and mastaba graves.

Three hundred and fifty kilometres further south lies the site of the capital, Meroe. Its Royal City was enclosed by a thick wall and included palaces, audience halls, magazines and the so-called Roman Bath. In addition to a number of smaller temples found to date within the area of the former town, there is another Great Amun Temple joining the town wall in the east (Fig. 1).

A short distance to the east of the city, the so-called Sun Temple lies in the direction of three great royal cemeteries. In the so-called Western Necropolis, among its more than 800 graves, there are about 80 superstructures built in the shape of pyramids for members of the royal family. These date from the 2nd century BC to the 4th century AD (Dunham 1963). In the Southern Necropolis, out of 220 burials about 24 pyramids are recorded, including the pyramids of the first two kings (first half of 3rd century BC) to be buried at Meroe (Colour Plate X). At Meroe's Northern Necropolis, there are the remains of 38 pyramids (Dunham 1957). In this cemetery, the burial of Meroe's rulers continued for 600 years, from 250 BC to AD 350. Here a new burial custom appears to have started. In all the previous cemeteries, the main wives of the ruler were permitted burial in the same necropolis. This practice ended with the closing of the Southern Cemetery. In the new northern field, we find the pyramids for 27 kings, eight ruling queens and three princes only (Fig. 2). The princes seem to have been co-regents, which would explain why they were allowed to be buried here. However, the burials of the main wives were now relegated to the less important Western Necropolis. As at Nuri, an additional element for all these pyramids was a small chapel in the form of a one-room temple at the pyramid's east side complete with a pylon and sometimes a small portico or prostyle and temenos. The interior walls of the chapels were often decorated with funerary scenes in relief. Ancient graffiti written in Meroitic and later in Greek, Old Nubian and even Geez are found occasionally on the pyramid and chapel walls and tell us about early visitors who came to the site and carved their names, monograms, prayers and thanksgivings on the soft surface of the sandstone blocks (Plate 5).

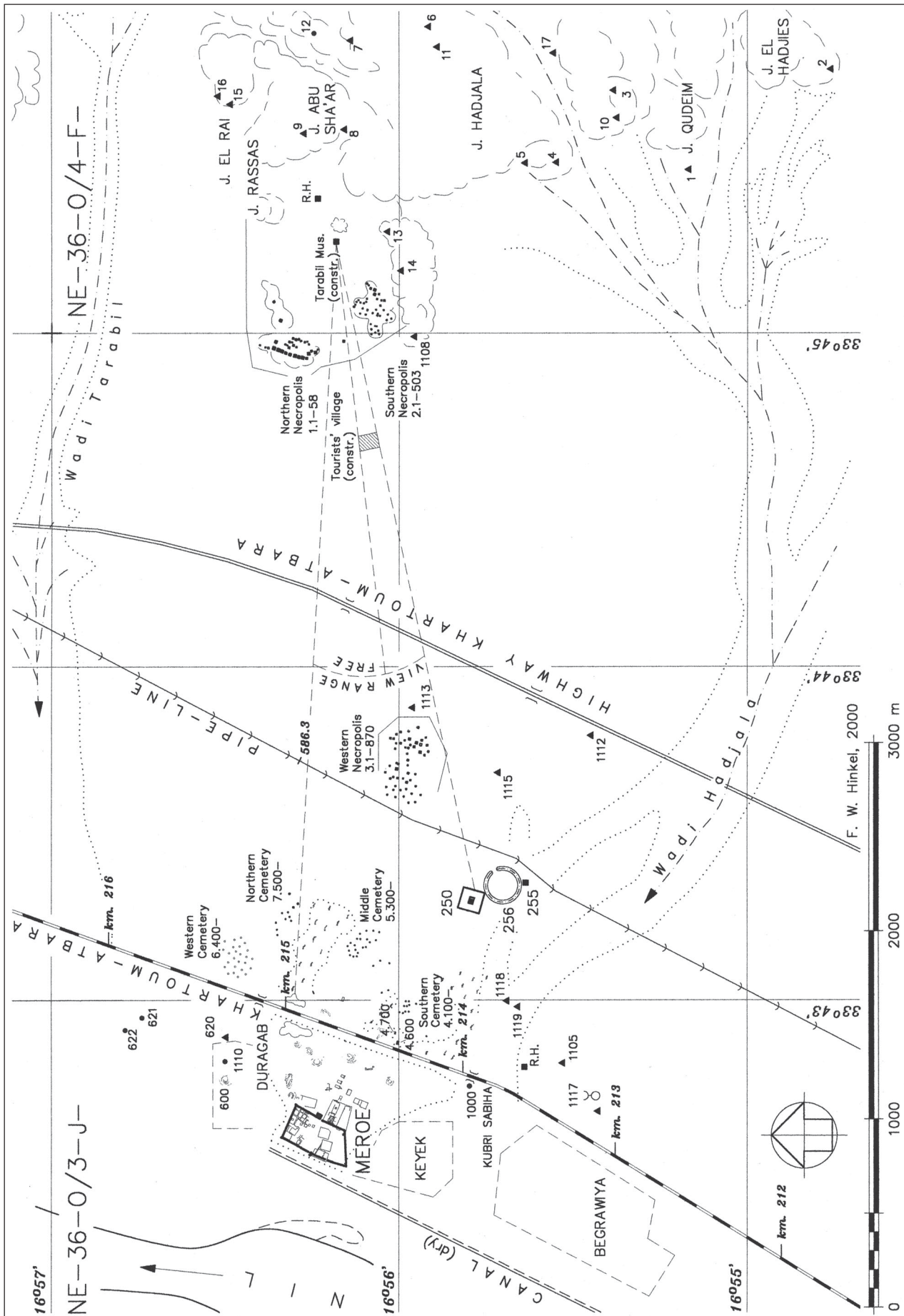
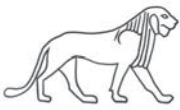


Figure 1. Map of the area of Meroe and the historical sites between the Nile and the Royal necropolises in the east.



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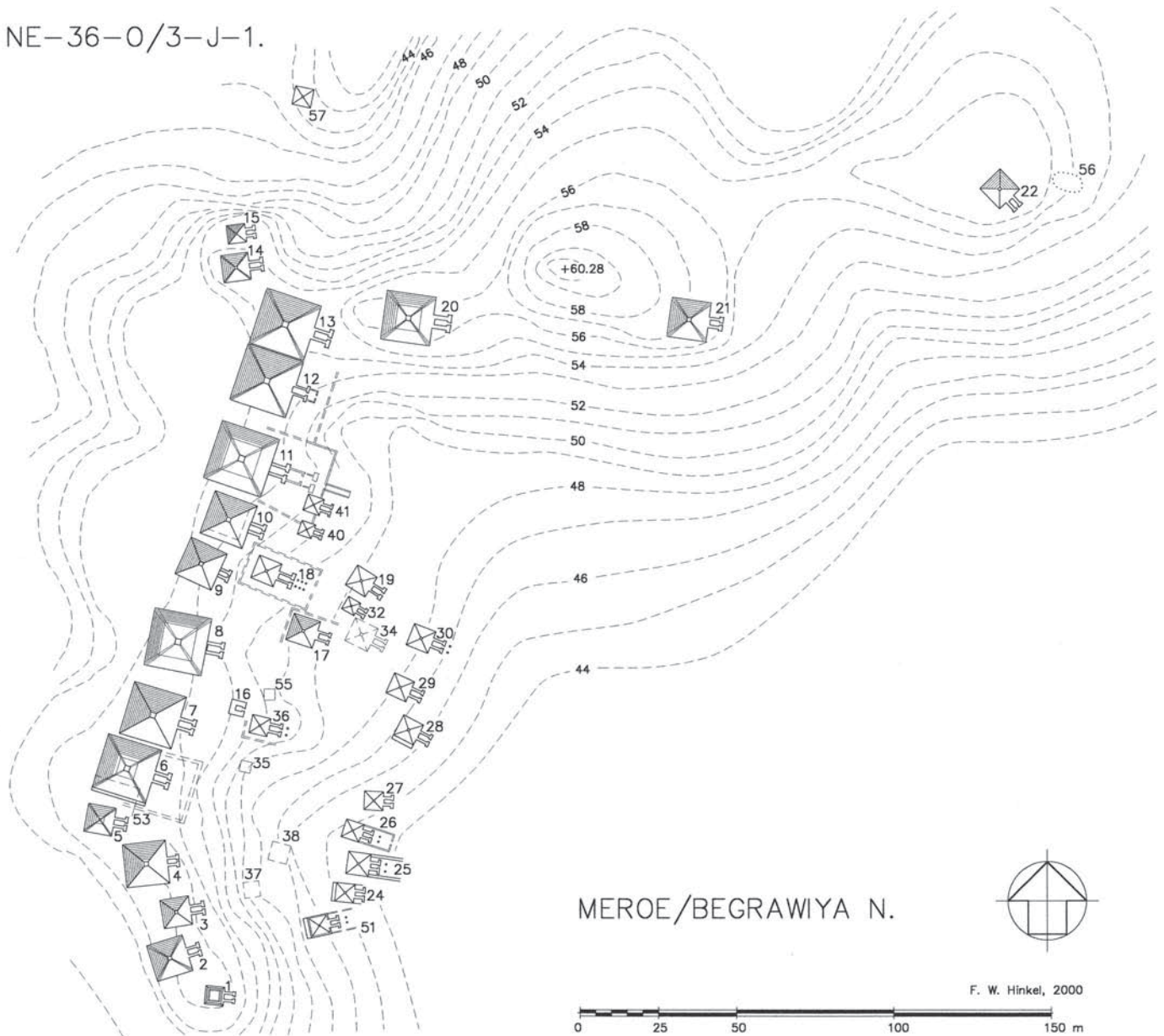


Figure 2. Map of the Northern Royal Necropolis.

In the hills east of the pyramids, there are the stone quarries from which the main building materials, sandstone and ferricrete sandstone, were extracted and worked (Hinkel 1982b, 28-33).

The early recording

Our knowledge of Meroe's necropolises is merely 200 years old. The first two European travellers in the area passed by without having heard of, or seen, the pyramids. On October 20th, 1772, the first modern traveller, J. Bruce of Kinnaird, rode over ruins which he thought could have belonged to the site of ancient Meroe during his return journey from Ethiopia (1790-92 XII, 135). However, because he was travelling near the river bank, he did not see the pyramids to the east. Forty years later, on April 17th and May 19th 1814, J. L. Burckhardt, a Swiss on his way to Shendi and then to the

Red Sea, travelled only a short distance from the pyramid fields but again failed to see them (1819, 275, 363).

It was left to F. Cailliaud, accompanying the army of Mohamed Ali, to reach the site of the pyramids on 25th April 1821 and to draw and describe them (Cailliaud 1823, pl. XXXI-XLVI; 1826-27 II, 150-175). He was accompanied by G. Seval, Th. Borg and P. C. Letorzec. A year later, at the end of March 1822, the pyramids were visited by L-M-A. Linant de Bellefonds, who also recorded valuable information in his diary and made drawings recording what he found at the site (Shinnie 1958, 139-149).

In 1823 E. Ruppell paid a visit to the site and left us with a panoramic rendering (1829, 114-116, pl. V) confirming what Cailliaud had already recorded: the destruction of the southern upper part of pyramid BEG N 6 belonging to the famous queen, Amanishakheto (c. 15-1 BC). This observa-

tion is very important in that it contradicts the story of G. Ferlini (1838, 13-15; also Hinkel 1985g), who claimed he found the treasure of the queen five years later in 1834 under the top of the pyramid. We will return to this piece of information later as part of our remarks on the treasure and its true location.

In the 1830s more well known travellers came to the pyramid fields and left notes about them in their diaries and books. In 1832 we know about visits by E. F. Callot (1854-55 VII, 38-52), by G. A. Hoskins in 1833 (1835, 66-85), by J. Lowell and Ch. Gleyre in 1835, and by Count H. L. H. von Pückler-Muskau in 1837 (1846-48 I, 9-13). During this period, the geologist Josef Russegger (1841-49 II, 1, 491) was one of the first visitors to doubt the pharaonic dating of the pyramids as suggested by Cailliaud and Hoskins. He was rightly convinced that he recognised Ptolemaic and Roman influences in them.

In 1844, the Prussian Expedition of C. R. Lepsius (1849-59 I, 133-138; V, 20-54; 1897-1913 IV, 293-331) stayed at the site and concentrated its recording work on the Northern and Southern Necropolises. The expedition collected information about the general architectural situation of the pyramids as well as the decoration of 49 wall scenes in the offering chapels. All these early documents are of special value for our knowledge of the structural, iconographic and epi-

graphic remains at that point in time.

After the middle of the 19th century, the number of known visitors increased. Among these visitors were three students from Trinity College, Cambridge, H. D. Barclay, M. Boulton and the famous F. Galton in 1846, the Melly family from Liverpool in 1851, the American, B. Taylor, and G. Drovetti, son of the French consul in Cairo, in 1852. Shortly after these visits, the first photographs were made by the Austrian R. Buchta in 1874. Until 1881, the names of well known civilian visitors are found carved on the surface of the structures, while names with the dates of 1898 and 1899 belong to British soldiers.

The Beginning of Research

During the first years of the last century, the three visits to the Meroe pyramids by E. A. W. Budge of the British Museum in 1899, 1903, and 1905 (Budge 1907) and the photographic survey of J. Breasted (1908, 5-14) of Chicago University and N. de G. Davies (Nov. 1906) are among the most important. It was left to Budge to find out - after many destructive trials - what casual remarks by Ferlini and Lepsius had already signalled, i.e. that the burial chambers were not constructed inside the pyramids but in the subterranean chambers beneath them (Fig. 3). As early as 1834, this understanding led Giuseppe Ferlini to the discovery of the

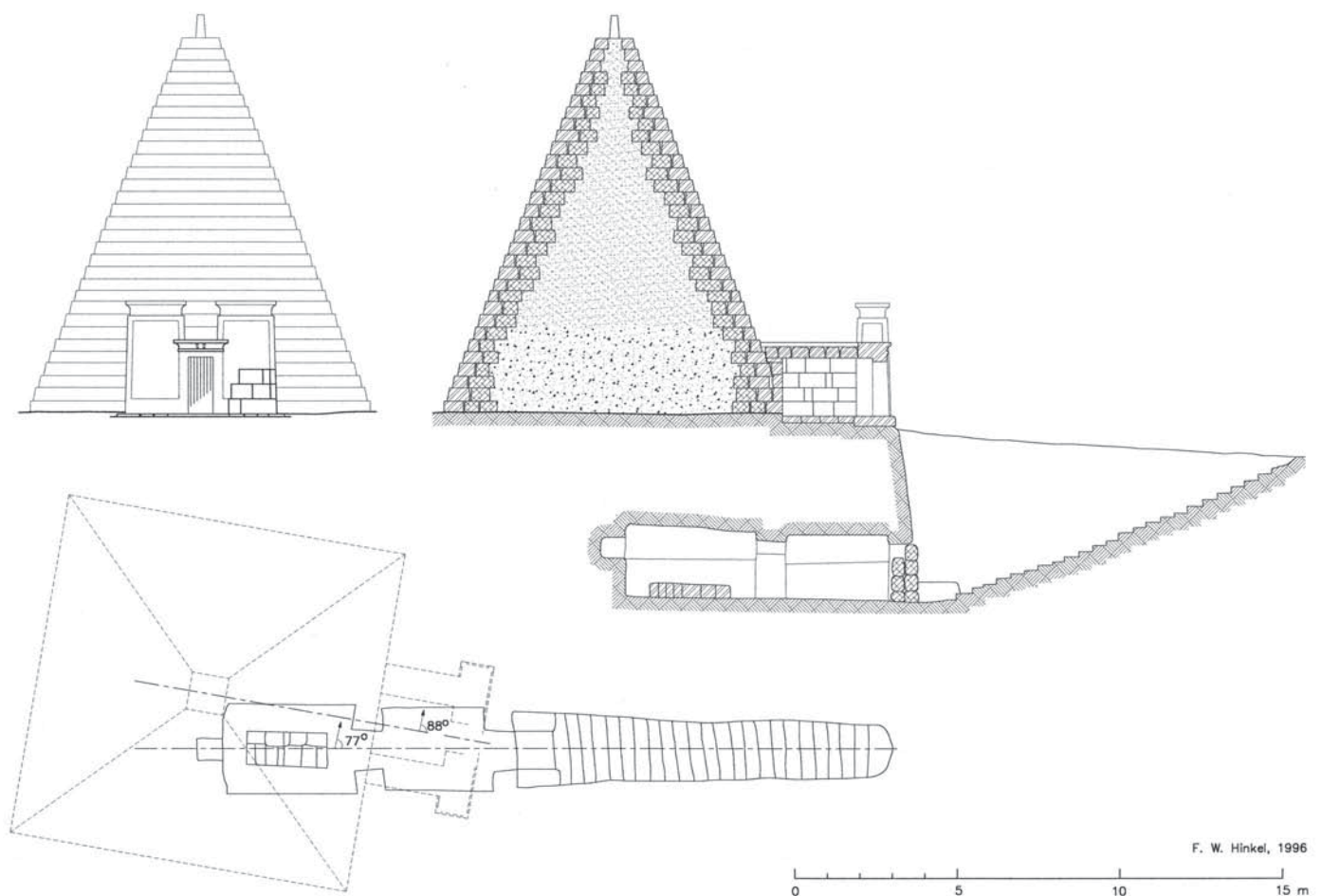
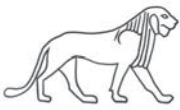


Figure 3. Pyramid BEG S 10: Plan of the substructure, section and elevation.



famous 'Gold of Meroe' treasure hidden in the burial chambers beneath the pyramid of Queen Amanishakheto (BEG N 6). However, perhaps to mislead future treasure hunters, his account describes the location of his discovery as being a room under the top of the pyramid itself. We have already mentioned the evidence from Cailliaud's and Ruppell's panoramic drawings of the pyramid field which show that the southern part of the top of this pyramid was missing some years before Ferlini's arrival. The sequence for the construction of the substructure and superstructure, the use of the *shaduf* in the construction of the pyramid proper, and a number of golden objects later found left in the burial chambers of BEG N 6 by G. Reisner which were similar to those found by Ferlini are further evidence against Ferlini's story (Hinkel 1985g; Markowitz and Lacovara 1996).

The pyramid cemeteries lay outside the limit of the license of the Liverpool University expedition during 1909-14 under J. Garstang, which covered the Meroe town site and a perimeter of one kilometre only. Nonetheless, we know that A.H. Sayce (1923, 366), in connection with this Meroe expedition, completed some test excavations in the Western Necropolis, which was then most probably recorded as Cemetery No. 800.

It was left to the expedition of Harvard University and Boston Museum of Fine Arts under G. Reisner (1922; 1923; 1923a) to execute systematic excavation work in the three pyramid fields of Meroe during 1921 and 1922. The burial chambers were opened and the discovery of thousands of objects in them led to the most important result of Reisner's work - the construction of the first relative chronology of Meroitic rulers. However, we have to deplore the unrecorded destruction of many offering chapels and the displacement of pyramid and chapel blocks throughout the site, which caused an irreparable loss of information about the reliefs and architecture, subjects which were obviously of little interest to that expedition. The clearing of the site during 1903 and 1921-22 amounts to an extraordinary estimated volume of debris and stones at 10.000 cbm.

Stocktaking

A survey of the present situation will quickly reveal the clear and extensive damage to structures and their decoration. The upper part of all pyramids is missing either through having collapsed a long time ago or through wilful destruction. The reason for the natural destruction might lie in the very weak structural design of the pyramids since they were encased with only one or two rows of mantle blocks to contain the loose filling in their centre (Plate 1). Besides natural destruction, action by men was also responsible for damage to, and the reduction of, these structures (Hinkel 1986; 1988; 1992c). In the past, the pyramid fields may have supplied building material to the population living along the riverbank. We also know that the sites became a treasure hunting ground whereby whole pyramids were destroyed in

attempts to reach the burial chambers. Even very recently, visitors would cut out the best parts of the reliefs or inscriptions into manageable sizes from larger blocks. Even whole relief blocks were removed from the walls and taken away. However, re-used relief and architectural blocks show that even in Meroitic time the building materials of collapsed structures may have been reused in the construction of later pyramids and chapels - an important fact which will lead to investigations of now vanished structures.

The comparison of air photos from 1966 with ones from 1978 show alarming changes during those 12 years. Sand dunes have started to cover the ground and vegetation in the wadis as well as on the surface of the ferricrete sandstone crust in the northern pyramid field (Colour Plate XI). During the last 20 to 30 years, one can observe many traces of erosion on exposed surfaces due to the action of strong wind and moving sand. Such a phenomenon might be connected with the generally observed trend of desertification in the northern Sudan. There are a number of offering chapels which are not yet protected and are especially endangered by the increased wind erosion of the last decades. An example of this irreparable damage can be seen on the walls of chapel BEG N 6, of Queen Amanishakheto, where 90% of the wall reliefs were destroyed during 1989 and 1995 when protection work was stopped by the then director of the Antiquities Service, Ahmed M. Ali Hakem (Plate 2).

The Task

From 1976 to 1987 and again - thanks to the present Director General, Sayed Hassan Hussein Idris - from 1996 onwards, the Sudan Antiquities Service was and is engaged in the protection of the monuments in the pyramid fields. The goals of work can be listed as follows:

1. Securing the sites and, by fencing and guarding the sites, stopping the removal of stones or any other damaging activity, such as climbing the structures, scribbling on the stone surface, camping in the pyramid fields and the use of chapels as toilets.

2. Restoring offering chapels and relief walls in an anastylosis and providing them with roofs and doors. The goal is to gather as many of the fallen and removed blocks as possible and to incorporate them in the restoration work. This work has so far involved about 1200 architectural and relief blocks as well as copies of reliefs in foreign museums. We are very thankful to the British Museum and to the former and current Keepers of the Egyptian Collection, Messrs James and Davies, and to its Trustees, as well as to the authorities of the Egyptian Museum in Berlin, for their generous help in this matter.

3. Any anastylosis in this connection had to indicate the newly added structures and could be justified - along with other conditions - only if there is never left

'any doubt, at least to the discerning eye, as to what is authentic and what is to be taken as a justifiable ex-



Plate 1. Pyramid BEG N 3: Internal filling encased with only one row of mantle stones. (Ph. No. R 537/3)

pedient essential for the realisation of the anastylosis'. An anastylosis is further 'acceptable as part of the landscape. A monument may fit perfectly into the landscape when seen from a distance of 200 meters, but in the interest of accuracy, when viewed from 50 meters it should be clearly apparent that it is largely a modern reproduction of lost elements.'

(Plenderleith 1968, 130)

4. The work should follow the UNESCO guidelines for the construction of a site museum. Currently, a small 'Wadi Tarabil Museum' is under construction.

5. The work should be accompanied by research into the building history of the sites, and into the architecture, design, construction and sequences in the growth of the cemeteries.

6. All observations have to be recorded with a view to a final documentation. This goal is now in progress and the results will be published in co-operation with Dr. Janice W. Yellin (Boston) in four volumes related to the three Meroitic cemeteries of Meroe - South, North, and West - as well as Barkal under the title *Necropolises of Kush* as supplements of

The Archaeological Map of the Sudan.

7. The overall idea should be to harmonise and treat the area between Meroe Town and her Necropolises as a historical landscape. Unfortunately, this goal has already been spoiled by the state authorities' decision to build a 'Tourist Village' in the middle of this area, close to the royal necropolises despite the existence of a more sensitively located site earmarked for a tourist Rest House near to the 'Wadi Tarabil Museum'. This other site would have been in the visual 'background' on the edge of the historical site (Fig. 11).

The Architectural Appearance

As the result of this work at Meroe, we have arrived at a number of fundamental conclusions concerning the monuments and their architecture.

Types

Variations in the design of the pyramids are visible. Steps created by retreating stone courses, moulded corner decorations or smooth surfaces indicate changes in architectural concepts and modes of fashion (Hinkel 1984). Types VII,



Plate 2. The chapel of pyramid BEG N 6: Southern chapel wall showing the the recent destruction of the surface and reliefs by wind erosion. (slide 9725)

the earliest, dates up to about 185 BC. Type X, with a number of variations, was dominant between 185 BC and AD 100. Type XII spans the period between 100 BC and the end of Meroe (Fig. 4).

Capstones

At least seven specially shaped capstones were found and give

evidence for the truncated shape of Meroitic pyramids. Holes were made through the capstone that may have been for connecting the capstone with the interior of the pyramid and perhaps to crown the structure with a sign or emblem (sun disc?) (Hinkel 1982c, 127-140).

Plaster and Colours

Many of the blocks showed traces of the typical Meroitic lime plaster composed of feldspar, calcite and quartz. However, this has often been mislabelled as stucco (plaster on gypsum base), although not one example of stucco has ever been found on Meroitic architecture. The lime plaster was normally applied in two layers. The first one was a rough mixture with a finer finishing on top. It formed an unbroken smooth surface on sacred as well as profane architecture, covering the sometimes roughly-made masonry or brick work on temple walls and pyramids. This type of finished surface provided the ground for a final layer of paint based on mineral colours like red or brownish hematite and yellow ochre. Unfortunately, only a few examples of coloured plaster survive (Hinkel 1982c, 141-145; 1989a; Hinkel *et al.* 1985). We found evidence for these practices, which could create quite a colourful pyramid and chapel, on several of the structures. The remains of painted decoration on the surface of pyramid BEG N 51, which show traces of large, five-pointed stars outlined in black or brown on a red background, deserve special mention (Colour Plate XII).

Design and Metrology

A unique design by an architectural colleague of 2000 years ago was found in 1979 in the northern cemetery (Hinkel 1981a, 107-112; 1982a; 1987; 1994b; 1997). This was a line drawing engraved on the wall of chapel BEG N 8 which was made in preparation for the construction of another pyramid. The 168cm high drawing showed half of the structure to the left of the axis of symmetry of 48 horizontal lines representing 48 stone courses that led up to a clearly drawn platform. The base is divided into vertical lines engraved at a distance of 5.25cm apart, which equals a tenth of the cubit, the Egyptian ell. We can deduce from this that the drawing was constructed at a scale of 1:10 (Figs 5 and 6).

The proportional ratio between height to base equals 8 to

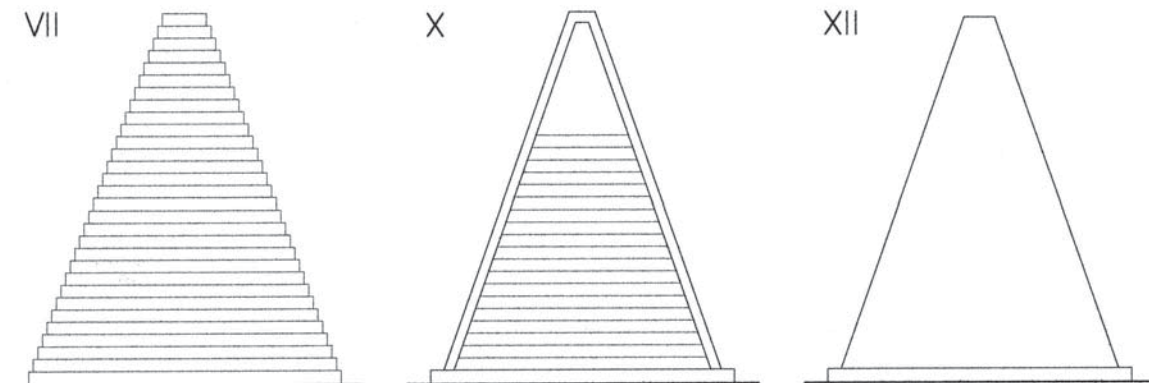


Figure 4. Three main variations in the architecture of Meroitic pyramid design.

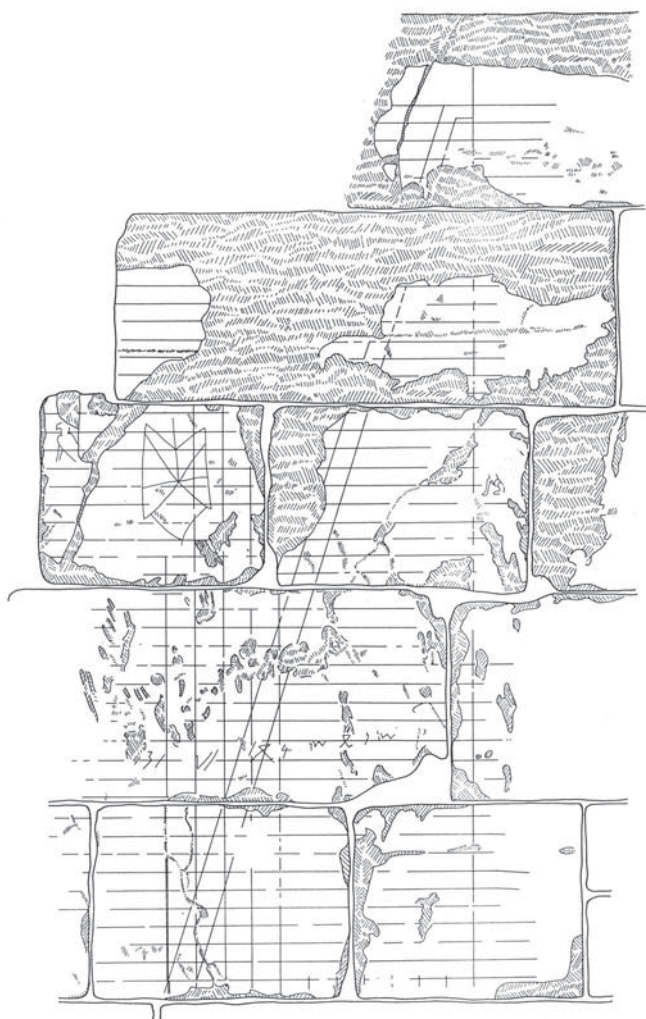


Figure 5. Line drawing of a design to construct a truncated pyramid found on the chapel wall of BEG N 8.

$5 (= 2.5 + 2.5)$. This ratio represents the harmonic proportion of 8:5, a proportion very close to the Golden Section, which can be reached when dividing a line unevenly in such a way that the ratio between the whole length and the longer part equals the ratio between the longer and the shorter part (Hinkel 1981a, 112-113).

Further examination of this pyramid drawing revealed that the height of the upper platform was $9/10$ of the ideal pyramid height. The drawing also confirmed what the existence of the pyramid capstones suggested, i.e. that the Meroitic pyramids are of truncated shape (Hinkel 1981a, 114-116).

By comparing these details with surviving pyramids we were able to identify pyramid BEG N 2 in the northern cemetery as the structure being planned in the drawing. This identification provides us with a rough date of about 40 BC for the drawing (Hinkel 1981a, 117-118).

Research on the metrological data from Egyptian and Meroitic monuments reveal that all of them follow simple proportions in their ground plan and elevations. As noted above, many of them are designed using 8:5 proportions (Hinkel 1991a). In Egyptian architecture, for example, the

plan of the Buhen Temple in Nubia built under Queen Hatshepsut is based on two rectangles in 8:5 proportions. Even the intercolumnation relative to the diameter of the column of the peristyle offers an 8:5 ratio. The extension of this temple under Thutmosis III represents a similar rectangle in 8:5 and generally follows this harmonic rule as applied by Hatshepsut's builders. In the Kingdom of Kush, the pylons of the Apedemak Temples at Musawwarat and Naqa offer similar examples of the use of harmonic proportions in Meroitic sacred architecture. They too reflect, through their ground plans, the use of 8:5 proportions. Later examples of this same harmonic proportion are found in Greek and Roman architecture, as well as in buildings in Renaissance and neo-classical styles of architecture.

Building Construction Techniques

Stone Lifting

Beside architectural design insights, there were also three important discoveries connected with the techniques of building construction. In the centre of four pyramids, poles of cedar wood (*cedrus libani*) were found left in a shaft built of stones and filled with sand. They are certainly remains of a *shaduf*, a lifting device which has been used for millennia in the Near East. The oldest evidence of the use of a *shaduf* is recorded on an Akkadian cylinder seal belonging to the time

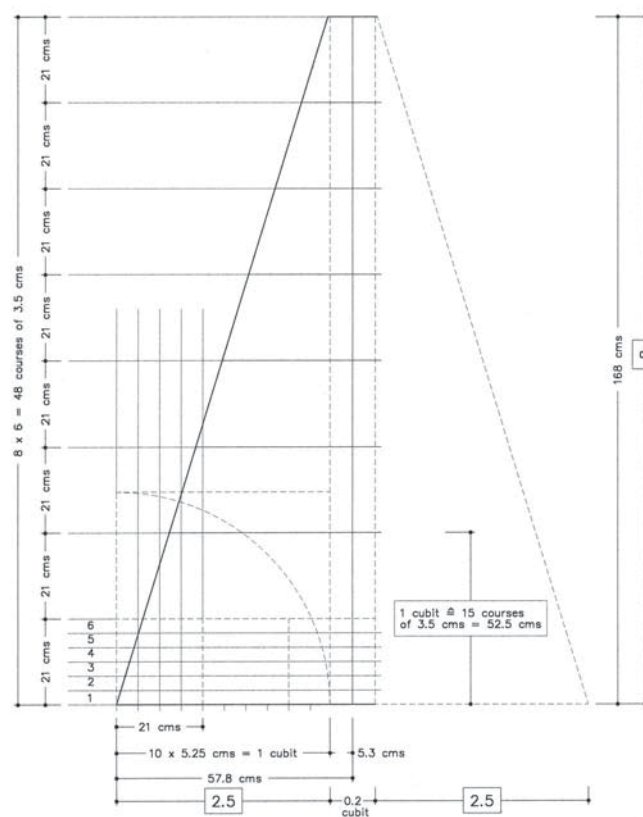
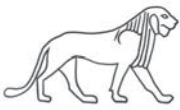


Figure 6. Interpretation of the pyramid drawing, explaining measurements, the use of the cubit (52.5cm), its scale (1:10) and the predetermined proportion (8:5), i.e. the inclination.



of Sargon I, about 2300 BC.

Tombs of the 19th Dynasty in Thebes in Egypt show the use of the *shaduf*, e.g. Tomb 217 of Ipu and Tomb 49 of Nefer-hotep, demonstrating that the *shaduf* was in use in the Nile Valley from about the middle of the second millennium BC. Even as recently as the 1960s it was still found to be a useful lifting device in Nubia.

At the beginning of our work at the pyramid groups, it was necessary to understand clearly if stones could be lifted by means of the *shaduf* in the construction of the pyramids in addition to its well documented use for the lifting of water (Hinkel 1982b, 36-51; 1984b). Through actual testing, it became clear that while the *shaduf* could be used for lifting stones, its use did not allow the construction of a true pyramid but only of a truncated one. Therefore the truncated shape of the Meroitic pyramids as indicated by: a) the shape of pyramids Barkal 2 and 3; b) the function and shape of the pyramid capstones and c) the pyramid drawing found carved on chapel BEG N 8, was further confirmed by the technical limitations imposed by the use of a *shaduf* to lift blocks. The use of the *shaduf* also explained the steep inclination of these structures (Fig. 7). The final proof for the likely use of the wooden *shaduf* in lifting pyramid blocks was confirmed by a static calculation studying the static forces effecting the structural elements of it under different loads.

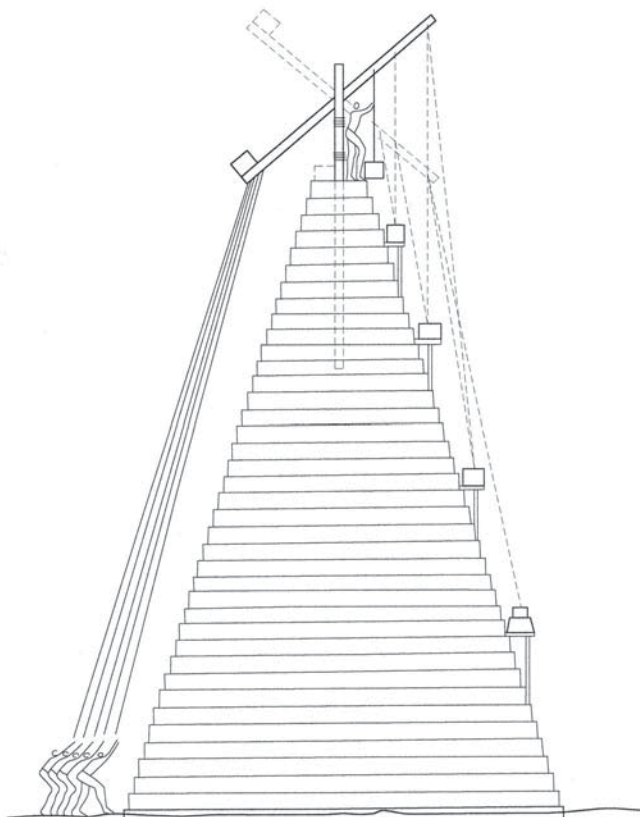


Figure 7. Drawing to study the function, the possibilities and the limitations of a *shaduf* in constructing a truncated pyramid.

Surveying during construction

The crucial point in ancient pyramid construction was certainly not the question of transporting the blocks to its final location but the reliable execution of the survey in keeping and controlling the predetermined inclination during construction work. The question of how surveying was conducted during the construction of the pyramids was answered by recording all the ancient artificially engraved lines on the surfaces of the pyramid mantle blocks. It was found that the design of the pyramids and their structural realisation depended on the perception of symmetry. The central, vertical axis of symmetry became the basic element and small lines engraved down the middle of pyramid faces were the pendant to the centre line on the ancient drawing found on the chapel wall of BEG N 8. Measuring from this central engraved line on all four pyramid faces with the same length (x) to the right and to the left of that axial line on each stone layer would guarantee that the same inclination was kept on all four sides (Fig. 8, Plate 3). The angle of the pyramid thus depended on the reduction of distances in each new stone layer and may have been, for example, one hand wide (y) for the height of each stone course. This simple method presented an easy guide for keeping the predetermined angle on all four sides during the building process.

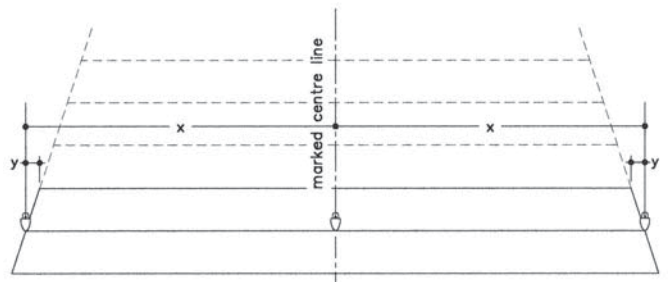


Figure 8. Sketch to explain the ancient method of keeping the predetermined inclination of a pyramid with a plummet and the vertical axis of symmetry.

Masonry Work

The practical work on the site supplied information about methods and tools used in extracting the stones in the quarries, preparing the blocks and setting them in courses during construction. Building stones were roughly shaped and squared in the quarries. The surface was prepared with bossage and margin dressing. The margin dressing allowed the line between the corner stones of each side to be kept. The roughly hewn corners and joints of the blocks were sawed together after setting them in their course. This method resulted in extremely thin vertical and horizontal joints. A specially prepared stone (*kneser*) finished each course, mostly in the centre. Finishing work on the masonry included the chiselling away of the bossage and the pecking and roughing of the surface for plastering.



Plate 3. Centre line of a pyramid engraved on the projecting foundation block and on the first stone course as a line. From the second course onwards the centre line continues as an engraved mark on the edge of the stone. (slide 9761)

The Results

From the very first day spent in 1975 planning the steps necessary to start restoration, and during the reconstruction work the following year at Begrawiya, the then director of the Sudan Antiquities Service, Negm ed-Din, was very concerned about rescuing the endangered pyramid BEG N 19 (Plate 4). Its whole west wall was missing and the remaining three sides of the structure bordered an empty shell held together by the weight of the remaining mantle blocks. There was no way to save the pyramid other than through the careful dismantling of the remaining 900 blocks (with the help of a simple derrick constructed on site) and its re-erection on new foundations. For this, reinforced concrete foundations had to be prepared in order to span the burial chambers and unknown holes in the ground. This reconstruction work provided an opportunity to use ancient methods, like the *shaduf*, and to test their efficiency. In the end, the whole operation came to a very satisfying conclusion. It proved that with manpower, ropes, lever, ramp and the *shaduf*, as an auxiliary tool, the Meroitic pyramids could be constructed without undue difficulties within the limits of the resources and technical means available.

Between 1976 and 1988, fourteen chapels were completely restored and protected by using original roof blocks - when found - or prefabricated roof slabs. Glass bricks were

incorporated in the new roof slabs and along the top of the side walls to provide daylight in the chapels and on their reliefs. Recorded, identifiable architectural blocks were the basis for the restoration work on chapel walls and pylons. Missing blocks in the anastylosis had to be replaced by brick work. Work was conducted on early chapels as well as constructions of later date and in different stages of completion.

Since there was no time for a thorough evaluation and registration before this urgent work began in 1976, restoration work was conducted in tandem with the documentation of the situation at the site. It was, therefore, found useful to start somewhat unconventionally where protection or restoration could be done easily in order to gain more time to prepare for the more difficult tasks. During the first seasons, we sometimes found additional relief blocks under Reisner's excavation debris or under the sand, so it became the practice never to finish a chapel within one season. This tactic would allow an easier incorporation of any such additional 'discoveries' during the ensuing one or two years. As a result of this practical tactic, when this work was unexpectedly and suddenly halted in 1989 by the successor of Negm ed Din M. Sherif and Osama Abdel Rahman el Nur, the situation in the northern pyramid field was abruptly left with chapels in various states of restoration - completed ones besides those half finished, just started or still awaiting restoration.

The recording work during this first phase of rescue and reconstruction was comprised of photographs and measured drawings. In order to record the state of preservation of the pyramids, these drawings depicting the surface of pyramids or at least the lower 5 to 6m of them show the measurements of each stone. The drawings allowed for the study of the original process of construction and, as a by-product, recorded lines engraved on each stone (quarry and/or masons' mark), many secondary sketches and unknown

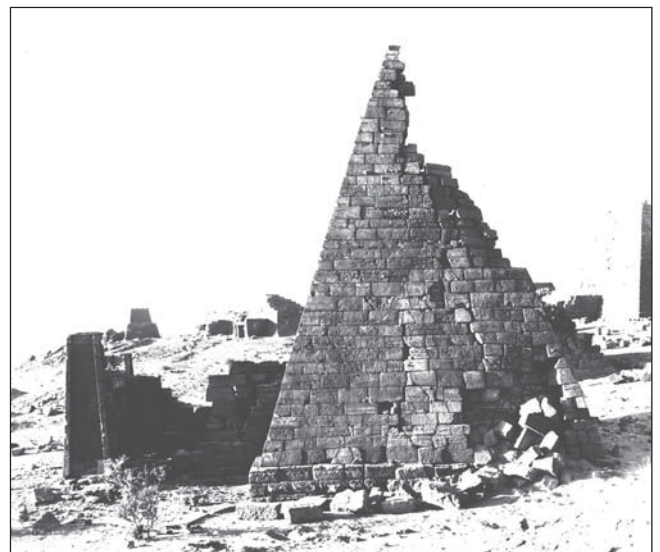


Plate 4. Pyramid BEG N 19: State of the north side in 1976 before its restoration on new foundations.



inscriptions of Meroitic and later times, as well as graffiti with early travellers' names (Plate 5). Surviving structures belonging to chapels, porticoes or temenos walls were completely measured and drawn. Existing remains of chapel wall reliefs, as well as loose architectural or relief blocks, were numbered, photographed with a scale and stored in safe places for future restoration work.

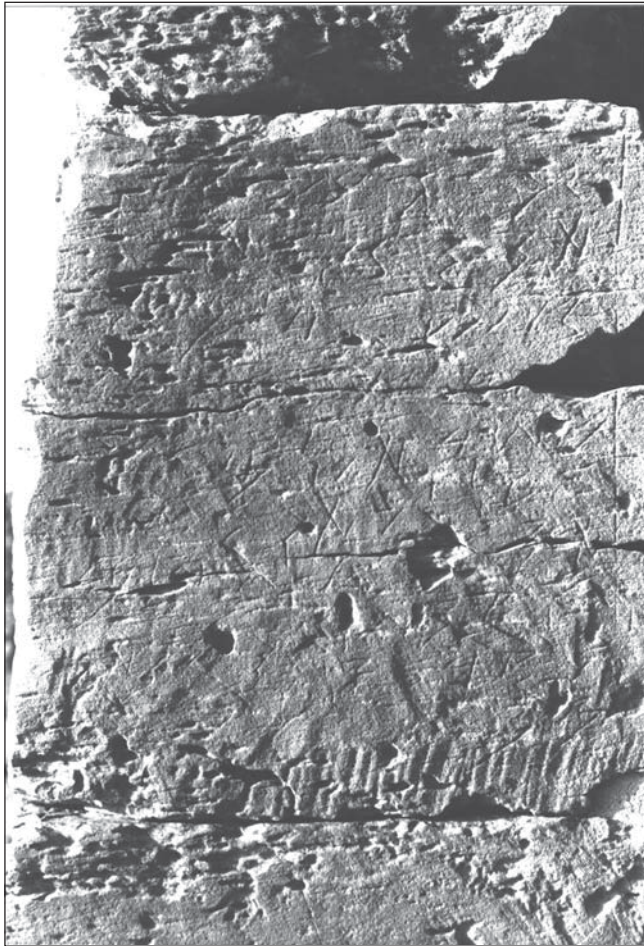


Plate 5. One of a number of Meroitic cursive inscriptions recorded on pyramid and chapel walls. (Ph. 365/63)

Forty-nine wall scenes were completely or partially drawn by the Lepsius expedition to the three pyramid fields at Begrawiya. Depictions of about seventeen additional chapel wall reliefs were provided by the photographs and sketches of S. E. Chapman and D. Dunham (1952). Since 1976, our systematic work on the chapel walls has increased our knowledge of relief scenes to more than 175 walls in different states of preservation and completeness. These have been recorded by scale photographs and by measured drawings. This number of known chapel relief scenes may increase even more after further study of many reused blocks and the large number of still unidentified loose blocks.

On special occasions, the time and number of workers needed for moving heavy blocks (up to 2 tons in weight) using ancient methods were recorded. To some extent, these

records allowed conclusions about the efficiency and manpower usage in ancient times and provided a basis for estimating the number of working days necessary for the construction of a pyramid in dependence to height and volume.

Since the resumption of work in 1996, the focus of restoration and protection work has changed to the Western and Southern Necropolises. In the first season, the remains of the chapel walls of BEG W 14 and W 18 were restored.

Meanwhile, the precariousness of the pyramid structure of BEG W 18 of Prince Taktidamani (about 1st century AD) which threatened imminent collapse demanded a quick response (Fig. 9, Colour Plate XIII). Help in rescuing this pyramid was generously offered by Mrs. S. Carney who, after having received my estimate, decided to take financial responsibility for underwriting its rescue. Considering its structural situation, I had to suggest its complete dismantling and reconstruction on new foundations. In November 1997, the dismantling work started with the installation of suspended scaffolding and the removal of the stone courses one by one as well as the removal of its internal filling of rubble. Each of its 650 blocks were numbered and measured again. Overhanging stone courses were secured by underpinning before their removal. The dismantled blocks were laid in their original order in rows opposite their side of the pyramid. After four weeks, at the end of December 1997, the remains of the pyramid were dismantled to the first stone course. At the end of October 1998, work on BEG W 18 was resumed. The remaining stone course of the plinth was then dismantled and trenches for the foundation were excavated. The string course beams of mild steel round bars were laid into the trenches which then were filled with concrete. Then the blocks of the plinth were brought back to their proper place on the new foundation and secured by brick work from behind (Plate 6). Internal brick work formed a stabilising cross. The resetting of blocks up to the height of about 4m was organised using a quickly built earthen ramp. Meanwhile the pole of the *shaduf* was erected in the centre of the pyramid and beginning with the 17th course, the lifting of blocks was handled by the *shaduf* (Colour Plate XIV).

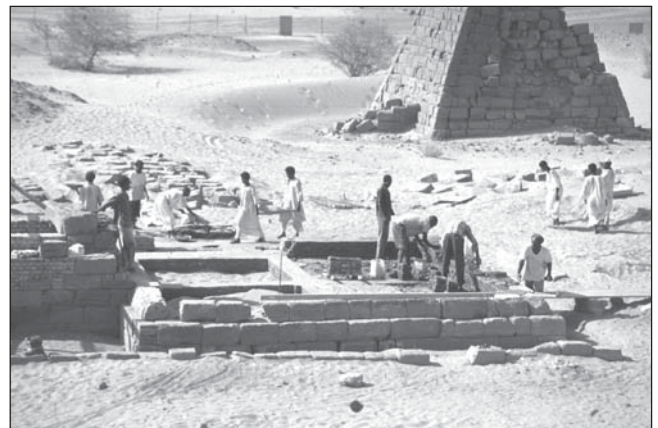


Plate 6. Pyramid BEG W 18: Beginning of the reconstruction on the new foundation. (slide 10624)

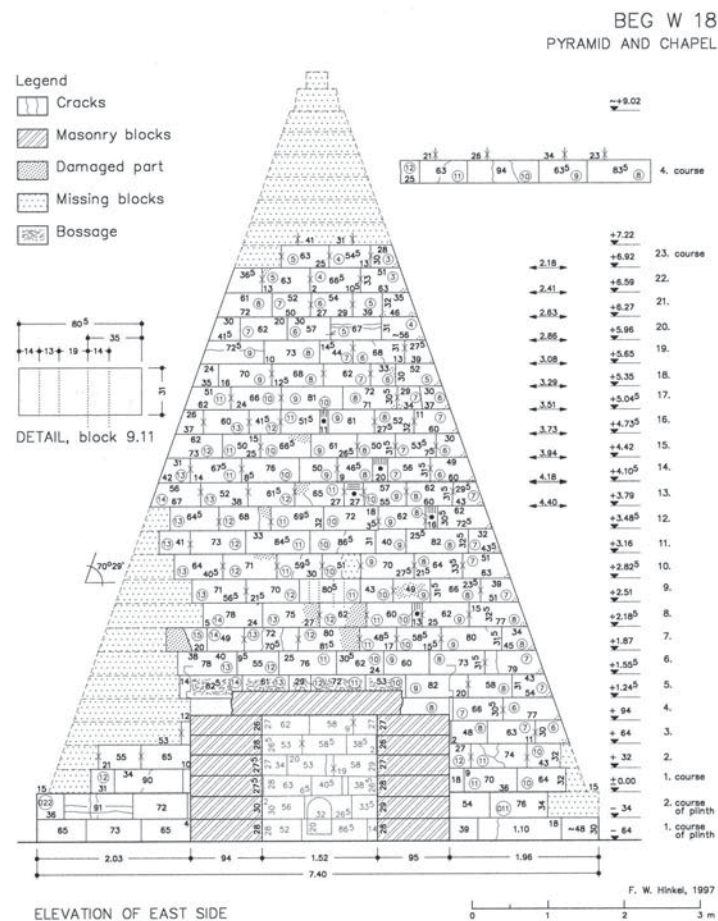


Figure 9. Example of the generally applied recording scheme for the ancient masonry surface; here of the east side of pyramid BEG W 18, used later on for the reconstruction work.

With the replacement of the original stones of the 23rd course, all the dismantled blocks had been restored to their original location. The rest of the pyramid was finished in brickwork. Its top also included a capstone modelled after the seven samples I had found in previous years in the north and west cemeteries. In February 1999, plaster work started. All modern work in connection with the anastylosis was indicated by lime plaster. The completion of the offering chapel with its roof, flooring, pylon and mahogany door continued parallel to the work on the pyramid (Colour Plate XV). The *stela* of Prince Taktidamani from the west wall niche of the chapel was taken in 1844 by Lepsius to Berlin (Berlin 2253, REM 0049). Thanks to the director of the Egyptian Museum at Berlin, a copy was provided which was placed into the niche by Mrs. Carney during her visit at the beginning of March 1999.

Another recent contribution to rescue work came from the German Television Company ZDF (Second Channel), which wanted to film protection work on another pyramid during a visit to the Sudan in 1999. The small queen's pyramid of BEG W 8 was selected. Pyramid BEG W 8 is a double structure, consisting of an internal core pyramid built of ferricrete rubble laid in courses then covered by one row of mantle stones in masonry. It seems that the size of the well-

built core had already been extended during the time when the inner core was being constructed or immediately thereafter. This explanation is based on the way the chapel wall was attached to the mantle blocks. The outer pyramid was dismantled and new foundations were made ready for the documentation of its reconstruction by the film team of the TV-series 'Schliemann's Erben'. During the dismantling work a number of relief blocks of the chapel walls and architecture blocks from the pylon were found and were earmarked for the anastylosis. The showing of the TV-film has attracted further sponsors and has led to the creation and distribution of a 'catalogue' listing further possible projects for contributions.

In 1996, work at the southern cemetery started in the eastern part in connection with the pyramids of the 3rd century BC. The Antiquities Service became very interested in opening a burial chamber for visitors. According to the excavation diary of Reisner, it seemed that the substructure of pyramid BEG S 2 would be in good enough condition for this purpose. We, therefore, excavated the staircase and followed the stairs to the burial chambers. The condition of the two burial chambers, however, was not very safe. Many cracks in the roof and side walls indicated unstable conditions and I decided to close the burial chambers and to refill the stair-



case. In future, we will have to search for a better suited one.

Another structure in need of protection work in the southern necropolis was the offering chapel of pyramid BEG S 10, so the south and west wall have been reconstructed from a number of loose blocks and on new foundations. The north wall is still in a decomposed state and will - if money becomes available - be restored during the next winter season on a new foundation.

The restoration and protection of a second offering chapel BEG S 5 (King Amanislo, 260-250 BC) will be funded by a yet another benefactor (Fig. 10). However, the generous offer of Mrs. M. Lyle came during our engagement in the western cemetery. At the time of her kind response, blocks of pyramid W 18 were already dismantled and lying on the ground awaiting reconstruction. Because of transportation difficulties, parallel work in two different cemeteries was not



Plate 7. Chapel of pyramid BEG S 5: Beginning of work on the foundation and roofing. (slide 10924)

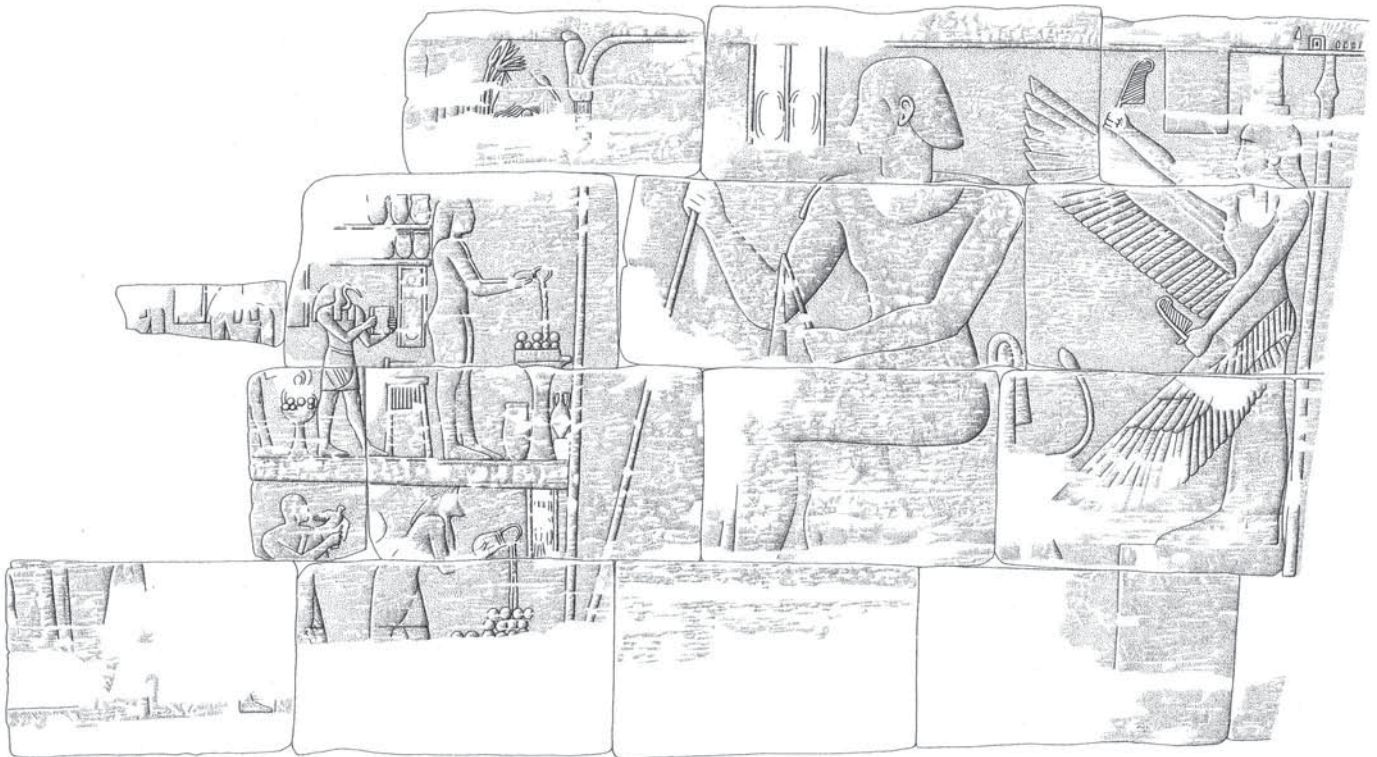


Figure 10. Chapel of pyramid BEG S 5: Drawing of the south wall relief with King Amanislo together with the Goddess Isis under a baldachin receiving offerings. (Drawing I. Fechner)

advisable, so the preservation work on offering chapel S 5 will have to wait for another season. Last year, during a brief period of spare time, foundations for the pylon could be prepared and the preparation for new roof slabs was also started (Plate 7).

Next to the western cemetery lies the area of MER 250, the so-called Sun Temple. At the time of my work documenting the surviving structure 15 years ago, the ground plan of its priests' house was chosen to become the model for a small site museum to the east of the northern and southern pyramid groups. This museum satisfied the general

demand by UNESCO for a place of information near important historical sites. Interestingly, no significant changes had to be made in the ground plan of the priests' house in my preliminary design, which used it as a basis for this small museum. The central room in the design was an atrium with eight columns surrounded with the *alae*, i.e. rooms mainly reserved for the exhibition. A site was selected in 1986 and foundation work started. This site allowed the visual connection between the museum and the main three royal necropolises, as well as a view towards the so-called Sun Temple and the place where Meroe town is hidden under acacia

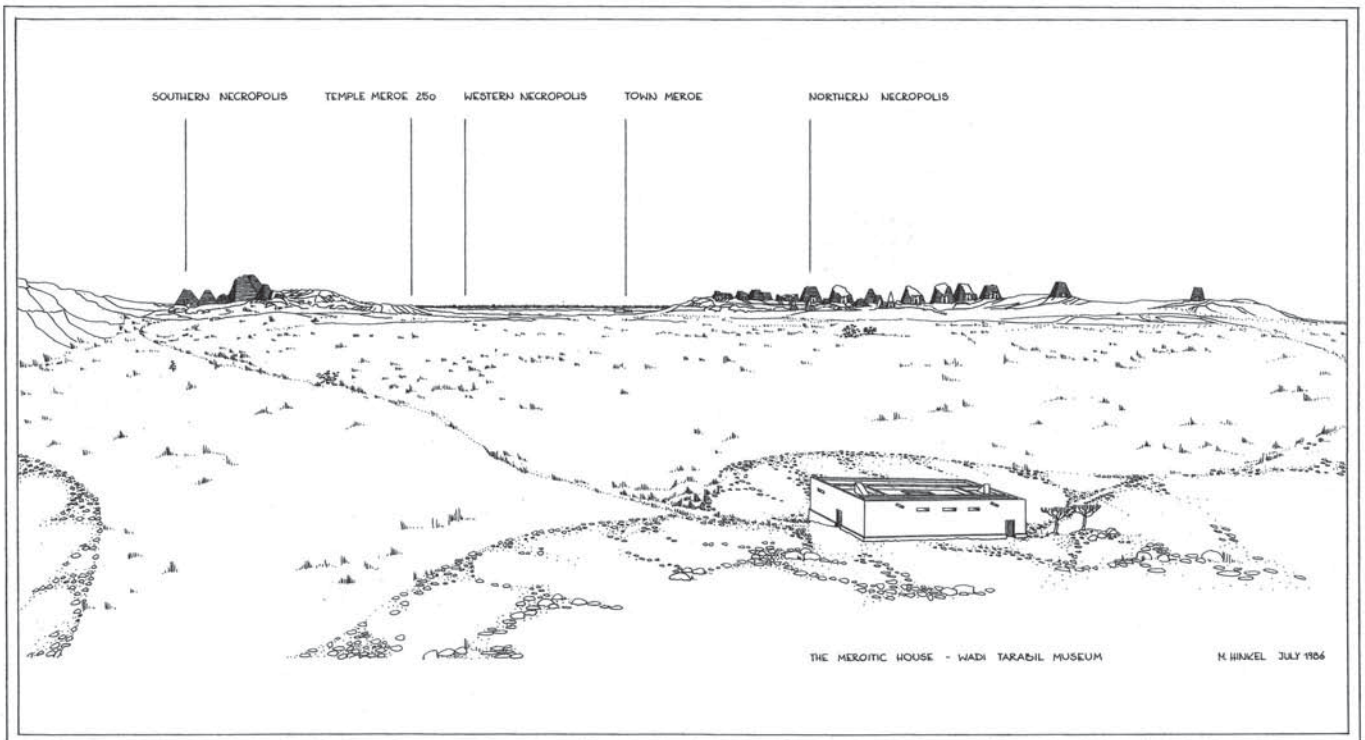


Figure 11. Drawing showing selected site for the Wadi Tarabil Museum from where the Southern, Northern and Western necropolises as well as the so-called Sun Temple in the plain were supposed to be seen. (Drawing M. Hinkel)

trees on the Nile (Hinkel and Hinkel 1990) (Fig. 11). This once stunning view is now partly blocked by the construction of the afore-mentioned government 'Tourist Village'. The foundations for the Wadi Tarabil Museum were already started in 1986 and work has resumed during the last two years. The walls have already reached 3.40m - the height of the proposed exhibition rooms.

During the last four years the extremely endangered remains of the High Altar (MER 246) in front of the Temenos Wall of MER 250 have been protected by a wall capping. A complete restoration would be advisable since it would include an original room under the upper platform that could be used as an reception area for visitors. Explanation boards, drawings and photographs on the walls could give the tourists background information about the structures which they urgently need as they begin their visit at the site. This project has already found a sponsor in Khartoum whereas work to reconstruct the splendid baldachin nearby is still in need of such support. This baldachin is historically significant. Besides its actual remains, we have an image of it carved in the relief on the west wall of the so-called Sun Temple. This lively scene may record the return of the Meroitic army after a raid to Aswan in 24 BC. A queen, perhaps Amanirenas of Pyramid BEG N 21, is shown in front of the baldachin (in reality the ruler would have been sitting inside and under the roof, but this was obviously difficult to show in the relief). A male figure standing behind her might be Akinidad, her son and the general who led the raid. When restored, the High Altar and baldachin would provide a landmark, visible from

quite a distance, standing in the centre of a sacred landscape reaching from the Nile and the town site to the pyramid fields and stone quarries in the east - a landscape formed over more than 1000 years of Kushite history.

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Plate X. Meroe. The Southern Necropolis seen from the air. (slide 6085).



Plate XI. Meroe. The Northern and Southern necropolises from the air in 1978. (slide 5109).

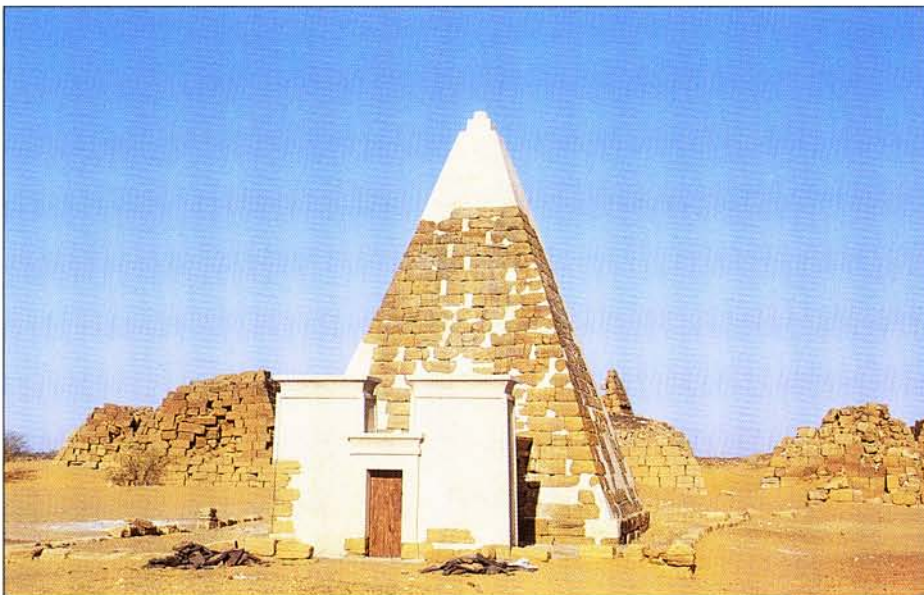
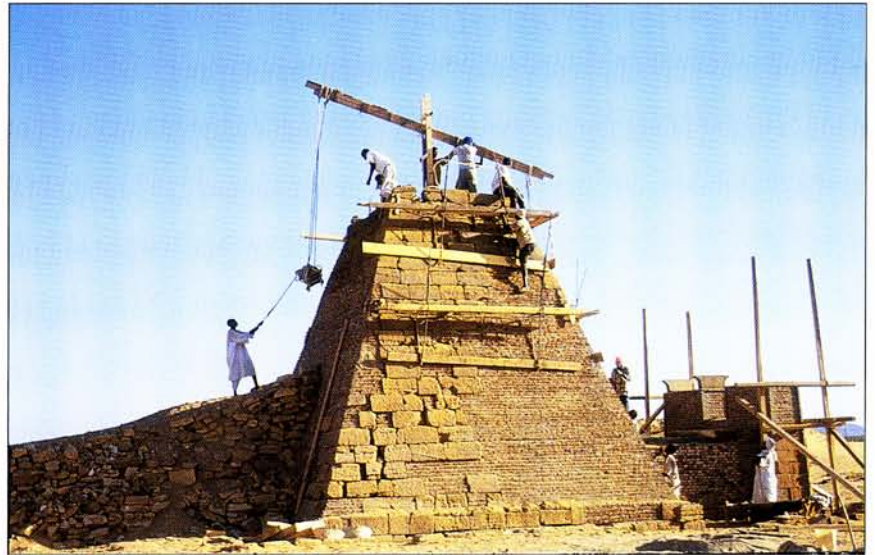


Plate XII. Proposed finished appearance of a Meroitic pyramid with the use of different colours and decoration according to evidence found on remaining structures. (slide 6354).



*Plate XIII. Meroe. Pyramid BEG W 18:
Structural situation in December 1997
after the beginning of the restoration of
the offering chapel.
(Ph. 430/32).*

*Plate XIV. Meroe. Pyramid BEG W 18: Lifting
a block of the 22nd course by means of the
shaduf. (slide 10725).*



*Plate XV. Meroe. Pyramid BEG W 18:
Reconstructed pyramid and chapel, March
1999. (slide 10943).*