Abstract

In spring 2013 the work of the German Archaeological Institute, Cairo completed the documentation of the architecture of the valley temple of the Bent Pyramid. The brick building to the north of the temple was investigated. It predates the stone-temple and extended further to the west than previously thought. Cleaning work and a magnetic survey revealed furthermore that the building originally stood within an enclosure wall.

Magnetic measurements undertaken by T. Herbich proved the existence of intensive workmen installations to the south of the Red Pyramid and to the north of the valley temple of the Bent Pyramid.

Introduction
In spring 2013 the team of the German Archaeological Institute (Cairo) continued its work at Dahshur from February 5th until March 28th 2013. Due to security reasons excavations could not be undertaken. The focus in the field lay on the documentation of the valley temple and on the investigation of a mudbrick building to the north of the temple. T. Herbich executed geophysical investigations, i.e. magnetic and resistivity surveys.

Field work in the temple along the causeway

This season the documentation of the temple along the causeway was completed. Work was focused on the southern forecourt of the temple. The court was clearly added to the temple proper as an afterthought, together with the stone causeway leading up to the pyramid. So far none of the control notes found on the building stones of the court reveal the date of its construction. Quite possibly the court was completed not significantly later than the temple itself, though in a second stage of work. The two stelae outside the southern wall of the court were constructed at the same time as the court wall.

The second focus of this season lay on the investigation of the brick building north of the temple. The building had been partially excavated in 1955 by A. Fakhry and cleaned again in 2005/06 by R. Stadelmann. In 2012 a trench between the stone temple and the brick building revealed that the brick building actually predates the temple. The temple foundation cuts the

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2 H. Ricke, in: A. Fakhry, *The Monuments of Sneferu at Dahshur I. The Bent Pyramid*, Cairo 1959, pp. 113 f., Fig. 60 and 62.

plastered floor which surrounds the brick building and the floor level of the temple lies higher than that of the brick building. The brick building thus must pre-date the construction of the temple in the year of the 15th counting of king Sneferu, and is possibly contemporaneous with the foundation of the Bent Pyramid in the year of the 8th counting of the king. This rather surprising discovery renewed our interest in the layout and function of the brick building. Previous interpretations of the building as a magazine of the temple or a house for the priests must now be reconsidered.

Fig. 1: Southeast corner of the brick building with row of holes
along the inner side, © GAI Cairo, J. Pinke.

This season the southeastern corner of the building and its nearby entrance were cleaned once more to study the construction of the building (Fig. 1). The outer wall is about 205 cm (4 cubits) thick in the south and 252 cm (5 cubits) thick in the east. The walls were constructed
of 28 cm long and 14 cm wide mud bricks and the walls and the floor were covered by a 1.5 cm thick white plaster. The plaster was renovated at least once before the construction of the temple. Holes in the floor first documented by H. Ricke must probably be interpreted as emplacements for pottery stands that had once lined the walls of the entrance rooms.

Cleaning work at the southwestern corner of the building revealed that the building extended further west than previously thought (Fig. 2). The width of the building measures 33.09 m, or about 63 cubits. The northern part of the building is not well preserved and an attempt to determine the location of its northwestern corner was not successful. The length of the building must be at least 27.5 m (52 cubits), but could actually have been more. The main entrance of the building lay at the southern end of the eastern façade, a location characteristic for royal buildings of the Early Dynastic Period. Like in the mastabas of the Old Kingdom, the entrance door was set into a 4.90 m wide and 38 cm deep niche. From the entrance door a 3 m wide passage leads to a columned hall. As is typical for domestic – and especially palatial – architecture, the axis of the entrance way changes twice, ensuring the
privacy of the interior space. The columned hall has an additional entrance from the south, establishing a second axis of the building. This second axis was adopted by the later temple and may in fact – for whatever reason – have conditioned the location and orientation of that temple. From the columned hall a second hall is accessible in the west as well as a courtyard in the north. The newly discovered room or rooms along the western outer wall of the building may have been entered from this courtyard. Whether additional rooms – or a porch – were located on the northern side of the court is unclear so far.

The layout and execution of the building seems to fit domestic architecture of the period as it is known from Abydos, Buto, Giza, Elephantine and other sites. Missing is an elongated reception hall with a niche at its southern end, but such a hall may be located in the western rooms of the building that still await closer study. The size of the building and especially the thickness of the walls leave no doubt of the importance of its owner, in all likelihood the king. Cleaning work at the southwestern corner of the building revealed that the building originally stood within an enclosure wall. So far parts of the western and southern walls of the enclosure could be traced. The western outer face was cut by the foundation of the brick enclosure wall of the stone temple, while the southern wall was heavily damaged by a ramp that was built to access the foundation level of the pillars of the temple courtyard. The thickness of the wall can be estimated to have been about 4.3 m (8-9 cubits), far more than any of the later enclosure walls.

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A geophysical survey in the area north of the temple conducted by T. Herbich confirmed the existence of this thick enclosure wall (Fig. 3). Its orientation deviates significantly from that of the later enclosure wall and the stone temple. It also deviates slightly from that of the brick building, however. In the magnetic image the western wall can be traced for about 80 m, the eastern wall for 65 m. The width of the complex measures about 56 m (possibly 100 cubits). The length cannot be determined, as the northern extension of the complex is not clear in the image. The complex may have been about 105 m (200 cubits) long. A gate is clearly visible in the west wall of the enclosure. Further gates may be suggested to have existed opposite the two entrances of the brick building, in the middle of the south wall and near the southern end of the east wall.

The brick building was not the only structure inside the enclosure. Already in the plan of H. Ricke the remains of a building are noted, that originally stood east of the brick building and was later built over by the enclosure wall of the temple. The wall of a building of similar nature was found during cleaning work at the southwestern corner. The magnetic image suggests that the northern part of the enclosure was also not completely empty. A segment of a massive brick structure is visible about 30 m north of the brick building. A series of holes...
along the inner side of the enclosure wall and especially within its northwestern corner could be interpreted as pits for wooden supports, for offering stands or most likely for tree pits. The layout of the enclosure is reminiscent of the so called “fortresses of the gods” at Abydos, more commonly known as “funerary enclosures” or “forts”\(^6\). The size of the enclosure at Dahshur is in fact quite similar to enclosures A, B, E and G at Abydos\(^7\). Only the Shunet el-Zebib, the enclosure of Khasekhemwy, is slightly larger, with a width of 77 m and a length of 137 m. The existence of a domestic building in the southern half of the enclosures is typical for those found at Abydos, including the slight deviation in the orientation of the building\(^8\). In comparison to the examples known from Abydos the brick building at Dahshur is significantly larger, however. The secondary door in the south and the columned hall are not found at Abydos but in a building of the same category found in the Djoser complex\(^9\). All these buildings served as rest houses for the king during the celebration of festivals that were conducted inside and presumably also outside the enclosures.

The further study of the brick building and especially the excavation of the area north of it will be a focus of field work in the coming season. To understand the function and meaning of the building it will be essential to determine what other structures existed within the enclosure, especially since the evidence at the enclosures at Abydos has so far not provided conclusive results. Another interesting question will be whether the enclosure wall at Dahshur was supplied with niches like those at Abydos or whether the apparent aversion of Fourth Dynasty kings to such facades was also applied to structures such as this one.

**Geophysical surveys**

Magnetic surveys were undertaken to the north and north-east of the valley temple of the Bent Pyramid and in the south-western part of the Red Pyramid in the area of a workmen village of the Old Kingdom. T. Herbich was able to locate an enclosure wall to the north of the valley temple as well as – further to the north of the temple – an extensive settlement with a regular

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\(^7\) Enclosure A at Abydos (Djer) measures 55 x 100 m, Enclosure B (Wadj) 45 x 90 m, Enclosure G (Qa’a) 70 x 100 m and Enclosure E (Peribsen) 50 x 100 m.


lay out with parallel streets and rectangular and square house units organized along the streets\textsuperscript{10}. Magnetic measurements to the south of the Red Pyramid showed traces of another workmen village of the Old Kingdom\textsuperscript{11} with great similarities to the barracks in the Gallery Complex at the Heit el-Ghurab site at Giza\textsuperscript{12}. The results will be discussed in detail in a separate article.

Geophysical investigations were also carried out near the modern cemetery, located at the mouth of the wadi which runs from the southern edge of the Red Pyramid to the edge of the Nile valley. The investigations were undertaken in order to get information about the existence or non-existence of archaeological remains in the areas adjacent to a modern cemetery situated in the entrance of the wadi to the Bent Pyramid. The investigations were undertaken because the modern cemetery was illegally enlarged by villagers to the west, north and south in January 2013\textsuperscript{13}.

Two geophysical methods were applied: magnetic method and electrical resistivity method\textsuperscript{14}. The magnetic method was used in the area to the north of the modern cemetery, in a

\textsuperscript{10} Remains of this settlement were already discovered during a survey conducted in 1997, compare R. Stadelmann, N. Alexanian, “Die Friedhöfe des Alten und Mittleren Reiches in Dahschur”, MDAIK 54 (1998) 309.


\textsuperscript{13} Compare for example Nevine el-Aref, Al-Ahram weekly (17 – 23 January 2013) 7.

\textsuperscript{14} The magnetic survey was carried out using a fluxgate gradiometer Geoscan Research FM256, an instrument with a proven effectiveness in tracing Nile mud architecture. Measurements were made in a grid 0.50 x 0.25 m (at 0.25 m along traverses 0.50 m apart), in a zigzag mode. Postprocessing was performed using Geoplot 3.0 software, maps were printed using the Surfer 8.0 software. The results are presented as greytone maps showing gradient of the vertical vector of the intensity of the Earth magnetic field (herein after magnetic map, Fig. 3). The vertical range of the instrument is from 1 to about 4 meters, depending on the magnetic properties of structures and the properties of their surroundings. Measurements have shown that in Dahshur prospecting can reach the depth of 4 m, due to high magnetic properties of bricks (thanks to their high silt content), well contrasted to non-magnetic gravel and sand deposited on non-magnetic shale.

The electrical resistivity study was carried out using aADA05equipment by Elmes. The vertical electrical sounding (VES) method was applied. The method, also known as an expanding probe system, consists of taking measurements with increased distance between current electrodes. Increasing the distance between electrodes causes the increase of depth of prospection. The result of the measurement determines the stratigraphy, with layers differentiated according to their electrical properties. A series of soundings carried out along the line allows observation of setting of the layers along a cross-section. The registration accuracy of the layers in the cross-section depends on the density of sounding points, the depth of prospection depending on the spacing between the current electrodes. The results are presented in the form of an apparent resistivity pseudo cross-section, which is a qualitative interpretation of the results (Figs 5A and 6A) and in the form of a resistivity cross-
flat desert plateau between the base of a slope and a road. Electrical resistivity survey was carried out across the wadi, on the western side of the cemetery. The aim of the study dictated the choice of the method. In both cases, the purpose of the research was to find out whether any remains of architecture are preserved in the areas. The magnetic method was used in the study at the northern side of the cemetery, where the remains of architecture were expected to be at a shallow depth (less than 2 m below the surface). The resistivity survey on the other hand, was used to determine the existence of architectural remains at a depth of at least several meters, below layers of sand deposited in the wadi as a result of erosion processes.

To the north of the modern cemetery measurements covered an area of 9,400 m². There were no structures that could be considered a reflection of architectural remains on the magnetic maps.

Electrical resistivity measurements were carried out along two lines 50 m apart, across the wadi (Fig. 4). Soundings were taken every 5 m on the line. The length of each line is 110 m; a total of 44 soundings were carried out.

Fig. 4: Location of the vertical electrical sounding lines on a Google Earth satellite picture.
Fig. 5: Results of VES survey, line 1. A – apparent resistivity pseudo cross-section. $A_0$, m – half distance between current probes, in metres, in logarithmic scale; B – resistivity cross-section. $H$, m – depth below the surface, in metres, © GAI Cairo, T. Herbich.

Fig. 5: Results of VES survey, line 2. A – apparent resistivity pseudo cross-section. $A_0$, m – half distance between current probes, in metres, in logarithmic scale; B – resistivity cross-section. $H$, m – depth below the surface, in metres, © GAI Cairo, T. Herbich.
Apparent resistivity pseudo-sections (Fig. 5A, 6A) clearly illustrate a fault at the southern edge of the wadi. Low-resistivity formations correspond to the shale, visible on the surface (the edge of the shale is visible on the satellite image, as a dark line parallel to the wadi edge, Fig. 4). The fault has been registered between 75 and 80 VES points. A fault at the northern side of the wadi is less clearly visible and has a different character, as the resistivity of the rock that forms the fault is higher than the resistivity of sand that fills the wadi. This proves that the rock forming the fault is not shale. Pseudo cross-sections show that the sediments filling the space between the faults are not homogeneous. On the surface, layer sediments of a high resistivity are clearly visible (for example, on Line 1, area north of VES point 20, area between 65 and 75, at 40). Resistivity cross-sections illustrate a geological setting: the surface layer (down to a depth of about 2 m) is characterized by a high resistivity (from 30 to 90 ohm-m), below to a depth of about 6 -8 m there is a layer characterized by low resistivity (2-3 ohm-m), under which lies a layer of even lower values (about 1 ohm-m) (Figs. 5B, 6B). The setting is visible better in the case of cross-section along Line 2 (Fig. 6B). The layer down to a depth of 6 -8 m (the level of the Old Kingdom) corresponds to salinated sand that fills the wadi. The aim of this study was to check the presence or absence of any disturbances in this layer. Disturbances can be seen online 1 at VES points 5, 20-25, 40, 65 and 70. In line 2, such disturbances can be seen at VES points 10, 25, 65. The disturbances include changes at the level of the floor of the high resistivity surface layer and the floor of the layer of sand.

As a result one can summarize that the measurements showed certain anomalies in a depth of about 6 – 8 m (the level of the Old Kingdom) where installations of the harbour of the Bent Pyramid, e.g. a canal, are to be expected. At this stage of research, it is impossible to determine the character of these disturbances, however; this could be achieved only by applying a method of horizontal mapping at the same depth where these disturbances have been registered (carrying out, e.g., deep resistivity profiling).

*Reliefs, Small Finds and Pottery – work in the magazine*

R. Neef undertook archaeobotanical studies on some wooden objects and identified the wood of small finds as fragments of coffins, sticks, staffs and model objects of the Middle Kingdom shaft 5P12-1 and from the Old Kingdom tomb complex of Ipi at Dahshur South (DAS 8-12) from the Old Kingdom.
Further research has been done by A. Winkels concerning the plaster and mortar samples of the lower causeway of the Bent Pyramid of King Sneferu\textsuperscript{15}. These were sampled \textit{in situ} from the Bent Pyramid, the lower causeway and harbour basin and the valley temple during the excavation campaign in spring 2012. The purpose of the analysis was the differentiation, comparison and categorization of the mortar materials used for the construction of the complexes and the plastering of their architectural surfaces. Besides the determination of the materials’ chemical-mineralogical composition and characteristic similarities or differences of the mortars and plasters another focus lies on the documentation of technological features that reveal the applied technology.

The work on the pottery from the Middle Kingdom shafts 5P12-2, 7P16-1 and 7O2-1 was continued by J. Pinke.

The relief fragments from the valley temple of the Bent Pyramid which were discovered in the New Kingdom transport way in 2012 were documented by S. Müller and U. Pauly and restored by E. Peintner.

\textsuperscript{15} The investigations were conducted as part of a research and PhD project of A. Winkels dealing with the analysis of mortars and plasters in ancient Egyptian wall paintings and architecture with conservation- and natural scientific methods.