Teresa Dziedzic

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Teresa Dziedzic
Wrocław University of Technology

Abstract: The article reconsiders the architectural and egyptological evidence for the appearance of the Solar Altar in the Solar Cult Complex of the Temple of Hatshepsut at Deir el-Bahari, summarized within the framework of the author's extended architectural study of this complex carried out since 2002. The results have provided grounds for a tentative reconstruction of the Solar Altar assuming the presence of an offering table and two obelisks or just an offering table on the altar platform.

Keywords: Deir el-Bahari, Hatshepsut, Complex of the Sun Cult, Solar Altar, theoretical reconstruction

The research and restoration work on the Solar Altar in the Temple of Hatshepsut in Deir el-Bahari has been part of a broader program carried out since the 1960s by a team from the PCMA UW on Queen Hatshepsut's funerary temple complex. For the past two years the author has concentrated on an examination of the evidence, which has led to a theoretical reconstruction of the Sun Altar within the framework of a wider study of the temple's Solar Cult Complex. The present article reconsiders the architectural and egyptological data in support of the proposed reconstruction of the Sun Altar, which is dated to the New Kingdom and is the biggest monument of its kind known from Ancient Egypt.

THE SOLAR CULT AND ITS SYMBOLIC ELEMENTS

Knowledge of ancient Egyptian solar sanctuaries to date is limited for lack of sufficient archaeological sources. Studies of diverse sources have given some idea of the appearance of the two sanctuaries, that of Rehorachte and that of Atum, at Heliopolis, Egypt's oldest and biggest sacred complex dedicated to the sun god, which however has not been excavated. The sanctuaries were situated within an enclosure 1000 m long and 900 m wide, surrounded by a brick wall which was 3 m thick. An

avenue of sphinxes ran from the west gate most probably toward the temple of Atum which faced west. One of the limestone sphinxes was 7 m long. Assuming that the plan presented in an inventory tablet from the Museo Egizio in Turin refers to the Rehorachte temple in Heliopolis, it would have been a complex with three pylons and three courtyards, with a pillar hall or four obelisks in front of the temple, the famous *ben-ben* building (Arnold 2003: 105). It seems to have been a freestanding structure, comparable to that in the temple in Amarna. Strabo's description speaks of an open courtyard with the cult stone, the *ben-ben*, which caught the first sun rays on its gilded peak, every dawn repeating for eternity the creation of the world. The stone stood on a high artificial mound believed to be the primeval hill which had risen from the "truth" (Arnold 1992: 205). Strabo wrote of seeing the toppled and fire-blackened obelisks, as well as houses of the priests who "excelled in their knowledge of the heavenly bodies, albeit secretive and slow to impart it" (Strabo, *Geographica* 17:29)."The city is now entirely deserted; it contains the ancient temple constructed in the Egyptian manner, which affords many evidences of the madness and sacrilege of Cambyses, who partly by fire and partly by iron sought to outrage the temples, mutilating them and burning them on every side, just as he did with the obelisks. Two of these, which were not completely spoiled, were brought to Rome, but others are either still there or at Thebes, the present Diospolis — some still standing, thoroughly eaten by the fire, and others lying on the ground" (Strabo, *Geographica* 17:27). The *ben-ben* was considered a prototype of obelisks considered as the primeval sacred stone (Kemp 2009: 165–166) or as a means of concentrating the sun's rays connected with solar symbolism. The pyramidion, like the primeval mound, could have been considered as a monument of the primeval beginning and by the same a symbolic guarantee of the recurring act of creation (Arnold 1992: 61).

There were at least 16 obelisks in the solar temple in Heliopolis at its peak. The oldest known obelisk, from the reign of king Teti of the Sixth Dynasty, was 3 m high. Sesostris I raised a new temple of Re-Horachte in Heliopolis on the occasion of his *sed* feast and founded a pair of obelisks made of Aswan granite, each 20.41 m high, in the adjacent temple of Atum. Thutmosis III set up in front of the temple his own pair of obelisks on the occasion of his *sed* feast, each 21 m high. An ancient architectural model suggests that Seti I raised a limestone pylon with statues and obelisks at the Re-Horachte temple. One of these obelisks was not raised until the reign of Ramesses II. Ramesses II and Psammetych II also founded their own obelisks in Heliopolis (Arnold 1992: 204–206).

Monumental solar temples, eight in all, belonging to the first group of solar sanctuaries known from ancient Egypt, were raised by every pharaoh of the Fifth Dynasty, starting with Userkaf. They were located in the neighborhood of the kings' funerary enclosures. By this time the king, once believed as an embodiment of the sun-god, had lost in importance, becoming 'only' the Son of Re in the reign of Chufu's heir Djedefre and was positioned slightly lower in the hierarchy of gods (Arnold 1992: 35). Userkaf's temple in Abusir is presumed to be modeled on the sanctuary in Heliopolis, from which town his dynasty hailed (Grimal 2004: 84).

Of the eight solar sanctuaries that are known, only two — Abu Gurob and Abu Simbel — have been excavated, but there is much to say that the complexes were very similar (Arnold 1992: 35–39). Mud brick was used as the principal building material at first, progressively replaced with stone. The complexes were connected with pyramids, but were formally temples, not tombs. They were linked with the lower temples, as at Abu Gurob. In this sanctuary a huge obelisk was raised at the back of the temenos, as a counterpart to the pyramid in mortuary complexes. The obelisk was faced in granite and stood on a huge podium. At its foot on the eastern side there was an alabaster altar made up of four pieces in such a way that the ritual could be celebrated to four sides of the heavens. To the south of the obelisk podium there were two chapels, the one in front decorated with representations of the *sed* festival (Arnold 1992: 198; sse also Hornung 1990) and a series of representations thematically related to the role played by the Sun in different seasons. A ramp wound its way from this chapel, through the base of the obelisk, to the top of the podium. The main solar cult celebrations are presumed to have taken place here, possibly during sunrise, including hymns recited to the Sun and offerings made on the altar below (there were no sacred images to adore in the case of the solar cult). A brick-made solar bark 30 m long was discovered in the valley to the south of the sanctuary. It had a wooden deck with annexes and was partly gilded.

The last king of the Fifth Dynasty to raise such a sanctuary was Djedkare-Isesi. The tradition was revived, as said above, by pharaohs of the Eighteenth Dynasty, who linked it directly to the royal cult. A series of solar cult sanctuaries was built then in West Thebes and Karnak (for an analysis of New Kingdom solar sanctuaries, see Karkowski 2003: 88–118). Queen Hatshepsut raised her "House of a Million Years", that is, her mortuary temple with a solar complex in Deir el-Bahari and a sanctuary to the Rising Sun with two obelisks in the eastern temenos of Tuthmosis I in Karnak (later replaced with Tuthmosis III's Jubilee Hall) (Grimal 2004: 313, 314). It is a known fact that Hatshepsut drew much of the inspiration for her building projects from Middle Kingdom foundations, especially those of Sesotris I. One of these would have been the lost temple of Re-Horachte in Heliopolis, built for the *sed* festival, where Sesostris I also raised a pair of obelisks (Arnold 1992: 204–206). A sanctuary furnished with typical solar imagery, that is, a pair of pylons, pair of obelisks with high altar and baboons worshipping the sun, existed also to the north of the temples in Abu Simbel during the Nineteenth Dynasty (Arnold 1992: 36–37).

The third group of solar sanctuaries are the temples of Aton from the rule of Echnaton in Karnak and Amarna. The pharaoh raised three small parallel sanctuaries to the Theban triad of Amon, Mut and Chonsu in the fortified town of Sesebi before the sixth year of his reign, to which year dates his religious conversion. He later added in this place a solar sanctuary which consisted of a large square courtyard measuring 11.70 m to the side and an altar standing on a terrace 2 m high. Seti I appears to have taken over this temple, transforming it into his "House of a Million Years". The open sanctuary in the front temple *per-haji* in the *per-iten* area to the east of the royal street at Tell el-Amarna is considered like the complex in Sesebi.

Hundreds of altars were located in this sanctuary, on either side of the front temple, whereas in the center of the courtyard there was the *ben-ben* stone, a rounded stele of quartzite, erected on a podium. The *ben-ben* (from the Egyptian *uben* "to rise") was supposed to show that the first rays of the rising sun fell on the point of the obelisk (Dondelinger 1973: 38). According to Barry Kemp, it became a prototype of many architectural forms and appeared in monumental form in the center of the Fifth Dynasty solar temples, which were associated with the rulers' pyramids (the tops of pyramids and obelisks were called with the female form of the name, *ben-bent* (Kemp 2009: 165). At Tell el-Amarna it was not the centerpiece of the sanctuary, because Echnaton's cult was centered on the solar disk.

A few meters to the south of this sanctuary there was another temple oriented towards the valley and containing the tomb of Echnaton. Three pairs of pylons divided the temenos into three courtyards, of which the first contained a huge central altar surrounded by 108 smaller altars and the third was the sanctuary proper which resembled in many ways the interior of the *per-iten* (Arnold 1992: 72, 179–181).

THE SUN ALTAR IN THE HATSHEPSUT TEMPLE

The Sun Altar stood in the middle of the courtyard of the Solar Cult Complex, which was entered from the Upper Courtyard of the mortuary temple of Hatshepsut in Deir el-Bahari. It was constructed of pale yellow limestone, the blocks being placed directly on the slabs of the courtyard pavement. It was at first a small altar without steps. Six steps were added next on the western side. Then the whole structure was aggrandized; the small altar was engulfed by the structure of the greater altar with its nine steps. The *cavetto* cornice moldings were reused in the new structure, while sections of the torus were cut away and the cut surfaces decorated in relief (Karkowski 2003: 40).

Edouard Naville, who studied and described these stages of rebuilding, noted that the altar was initially lower and smaller. Naville's measurements (1895: 7–8) and data from the 3D scanning of the feature (Kościuk *et alii* 2009) have been juxtaposed in ***Table 1***. The stages of rebuilding were discussed in detail by Janusz Karkowski (2003: 126). The edges of both altars were molded in the form of a torus, which passed into a horizontal form that joined the *cavetto* cornice to create a decorative coping of the altar. Steps on the western side climbed up to the platform of the altar, which was made of irregular slabs [***Fig. 1***].

ARCHITECTURAL RESEARCH

The Sun Altar is among the architectural features that have been examined in detail (for a history of the discovery and multi-disciplinary research on the altar, see Karkowski 2003: 30). Being a key feature of the courtyard and the biggest of its kind in ancient Egyptian architecture, it has been described and studied repeatedly from an archaeological, as well as epigraphical and architectural point of view. Edouard Naville was the first to document the remains (1895: 7–8, Pl. VIII) and to take steps to preserve and conserve the structure. The altar was relatively well preserved compared to other parts of the complex [***Fig. 1***, top and inset].

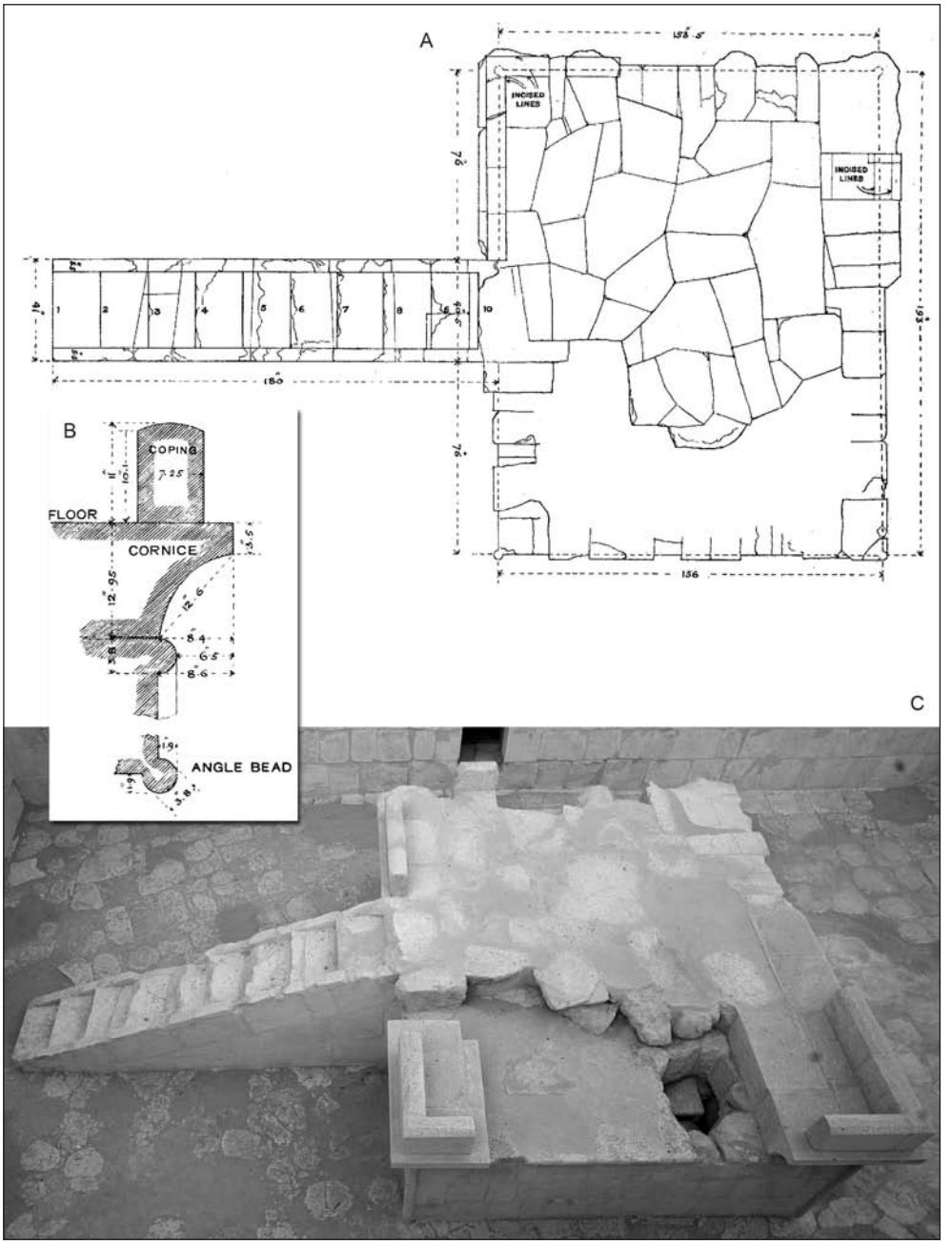

Fig. 1. The Sun Altar, state in 2009 (bottom); plan of the feature; inset: section through the altar cornice and coping (Photo M. Jawornicki; plan and section after Naville 1895: Pls VII–VIII)

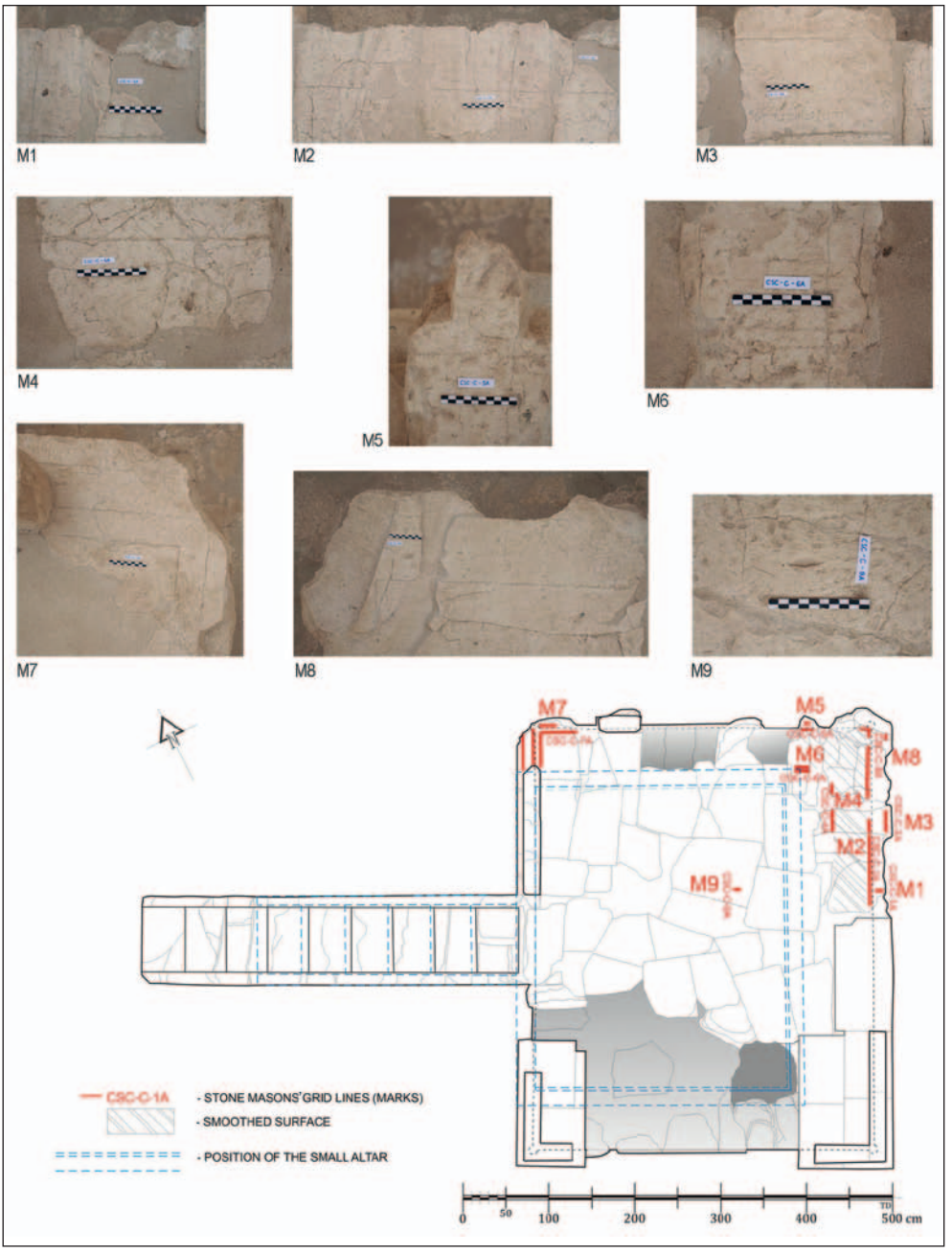

Fig. 2. Plan of the altar with location of stonemasons' grid lines CSC-C-1A to CSC-C-9A (M1–M9) (Drawing T. Dziedzic; photo M. Jawornicki)

The southwestern upper part of the altar was missing along with a fragment of the balustrade and a few blocks from the walls found scattered in the neighborhood. Missing fragments from the southeastern corner revealed the presence of an earlier phase in the form of a small altar. The remains were documented and preserved by E. Newberry in 1893–1894 (Karkowski 2003: 30).

Janusz Karkowski's discussion of research on the altar was supplemented by the present author with the results of architectural studies and a description of the conservation work (Kaczor 2010), although the newest finds from the Solar Cult Complex were mentioned only in passing as they are currently under study. New data were documented in research carried out between 2001 and 2008, supplemented with 3D scanning of the complex in 2010 [*Figs 2, 3*].

An analysis of markings found on the platform indicated that on the published plan [*Fig. 1*, top] Newberry had marked the existence of markings CSC-C-3A (M3) and CSC-C-7A (M7). These markings clearly positioned the missing parts of the balustrade. Karkowski's detailed documentation of the markings (Karkowski 2003: Pl. 6) included all of the traces with the exception of CSC-C-1A (M1) and CSC-C-9A (M9), but he did not suggest any interpretation for their presence or purpose. None of the researchers, however, had noted the presence of wear marks in the northeastern corner of the platform [*Fig. 4*]. An examination of the altar platform, wherever the stone surface was in sufficiently good condition, revealed uniform dressing with a stonecutter's hammer. Equally uniform signs of wear from frequent walking were observed in some sections, set off distinctly from areas demonstrating dressing with tools. The character of this dressing suggests that some kind of architectural feature may have stood there.

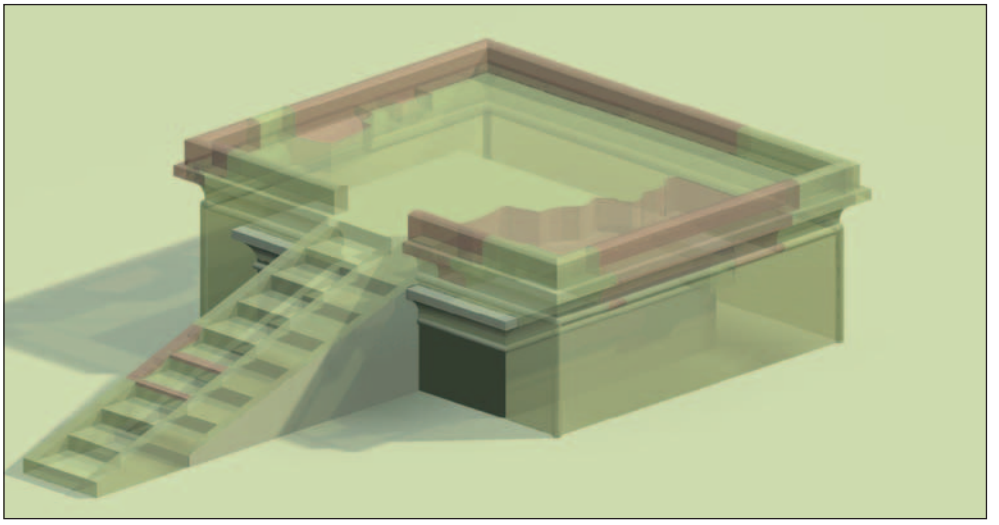

Fig. 3. The small and greater altars based on 3D scanning documentation (Rendering P. Srokowski)

The Sun Altar was constructed in the open courtyard of the Solar Cult Complex applying a modular grid based on 1½ royal cubit, that is, approximately 0.80 m. The modular grid was assumed by the team's architect Waldemar Połoczanin in his original study of the remains (Połoczanin, n.d., unpublished report), based on his examination of contemporary measuring instruments from the tomb of Tutankhamun (Eighteenth Dynasty), now preserved in the Egyptian Museum in Cairo (Inv. 61315 through 61320). It is very likely that similar wooden measuring

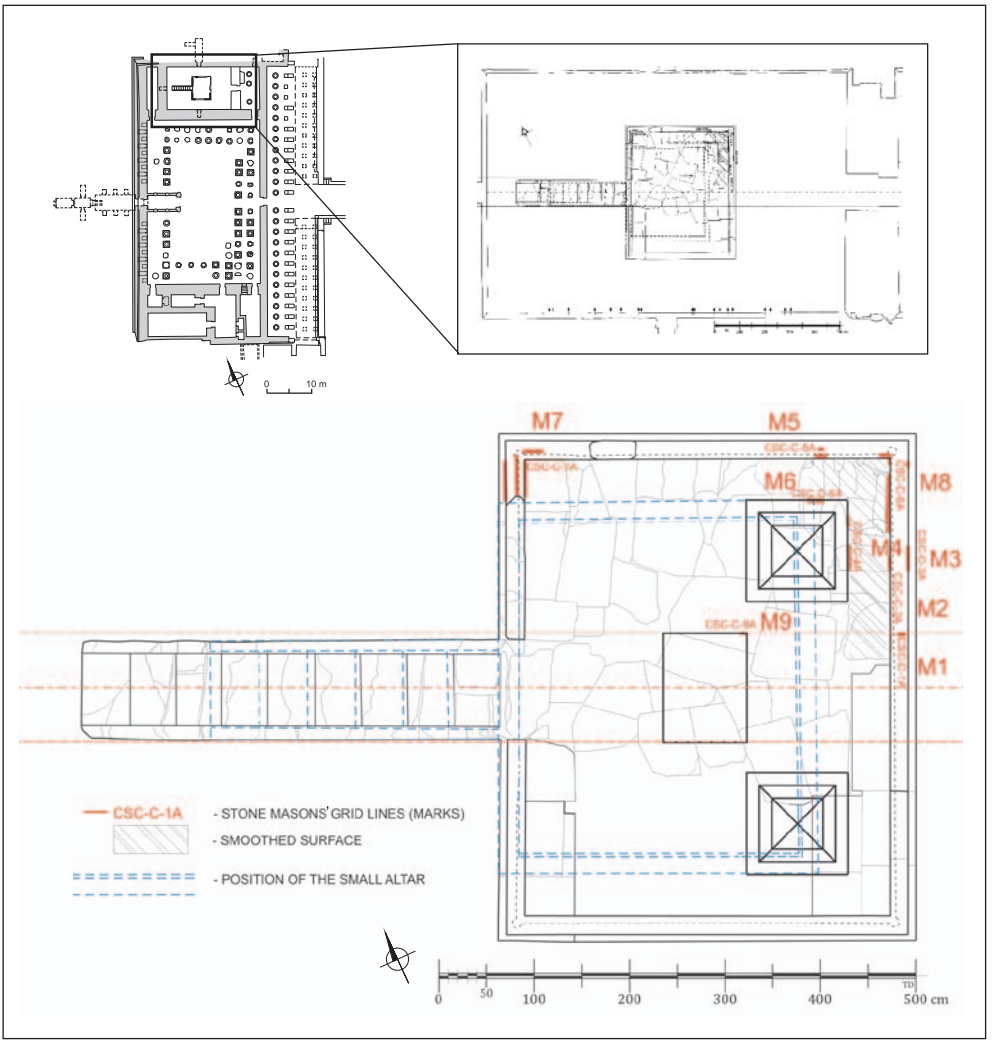

Fig. 4. Plan of the altar with a theoretical reconstruction of its form; inset, position of the altar in the courtyard of the complex on the Upper Terrace of Hatshepsut's Temple (Drawing T. Dziedzic)

rods were used in the Temple of Hatshepsut despite the existence of model instruments of stone or precious metal.

The modular grid was reconstructed by Janusz Karkowski (2003) as well as Zygmunt Wysocki (1987: 273) before him, both of whom also positioned the markings found on the south wall of the courtyard [see ***Fig. 4***], which they linked, however, to the designing of the courtyard (Wysocki even suggested 12 columns originally in a colonnade inscribed in the modular grid as the first phase of the project).

Table 1. Comparison of the known dimensions of the small and greater altars after E. Naville (1895) and according to the 3D-scanning of the feature

	After E. Naville (1895: 7–8) inches (in) recalculated into cms	**3D-scanning (Kościuk *et alii* 2009)**
SMALL ALTAR		
Body of altar	30 in less than the greater altar (on the level of the torus) = 76.2 cm less, i.e., 414.02 and 320.04 cm	328 cm 294 cm
Height of altar with *cavetto*	42 in = 106.68 cm	107.5 cm
Length of staircase	–	323.5 cm
GREATER ALTAR		
Altar platform	–	436.41–439.18 cm ~437 cm 531.51–537.28 cm ~535 cm
Body of altar	193 in = 490.22 cm 156 in = 396.24 cm	49.71–492.09 cm ~491 cm 391.58–398.02 cm ~395 cm
Height of altar	61.5 in–62.35 in = 156.21–158.115 cm	157.45–158.05 cm ~158 cm
Length of staircase	180 in = 457.2 cm	457.9 cm
Width of staircase	40.5 in = 102.87 cm – W 41 in = 104.14cm – E	102.66 cm – W 104.63 cm – E
Width of steps	29.5 in = 74.93 cm	75.8 cm
Height of balustrade	11 in = 27.94 cm	28.5 cm
Width of balustrade	7.25 in = 18.41 cm	19 cm
Height of *cavetto*	12.95 in = 32.89 cm	32.83 cm
Width of torus	3.8 in = 9.65 cm	9.8 cm

THEORETICAL RECONSTRUCTION OF THE SUN ALTAR

The following theoretical reconstruction of the largest sun altar in Ancient Egypt is based on the documentation, parallels and current scholarly discussion coupled with the author's own architectural research. The first step in this work was to position all the elements of the furnishing of the altar platform.

An analysis of cut markings and zones of wear on the altar platform indicates the presence of walking surfaces as well as areas occupied by different features. Gridlines CSC-C-2A, CSC-C-3A, CSC-C-5A, CSC-C-7A and CSC-C-8A confirm the circular course of the balustrade, the only opening being on the west side where the steps leading to the altar platform were situated. Markings CSC-C-4A and CSC-C-6A suggest a corner of some kind of standing feature. The presence of an object of some kind is further demonstrated by wear signs on the floor surface running alongside the markings. A straight line drawn between two markings, CSC-C-1A and CSC-C-9A, turns out to be aligned with the western side of the steps. Extending the line to the east across the altar and mirroring it on the other side of the altar's long axis gives two parallel lines that are aligned exactly with the sides of the doorway in the east wall of the courtyard [***Fig. 4***]. Mirror markings are to be expected on the southern side of the platform, but damage to the stone surface as well as stone replacements in this area have obliterated all evidence of this kind.

Working on the assumption that markings CSC-C-4A and CSC-C-6A formed a corner that established the position of the base of an obelisk, another obelisk was reconstructed theoretically in a symmetrical position on the southern side of the altar [see ***Fig. 4***, top right]. Dualism of this kind is well attested in ancient Egyptian architecture, e.g., the pair of obelisks founded by Sesostris I in the temple of Re-Horachte in Heliopolis (Arnold 1992: 204–206) or the pair of obelisks set up by Hatshepsut or Tuthmosis in the sanctuary of Amon in Karnak (Arnold 1992: 119). Markings CSC-C-1A and CSC-C-9A also served to position an offering table in the central part of the platform [see ***Fig. 4***], as suggested already in his theoretical reconstruction by Dieter Arnold (2003: 8).

The next step in the research was to determine the height of the reconstructed feature or features. In Ancient Egypt building proportions were regulated by a sense of harmony and by mathematics, which played an important role in architectural design. Proportions in designing were determined by a triangle, the most common triangle being one with sides equal to 3, 4 and 5 units (Choisy 1899: 53–54; see also Rossi 2006) [***Fig. 5***, top]. The origin of the Egyptian "sacred triangle" was discussed by Dušna Magdolen (2000: Table 1) who observed that most of the royal pyramids from the Fourth to the Sixth Dynasty in the Giza, Saqqara and Abusir areas had sides inclined about 53° and came to the conclusion that this was the effect of daily tracking of the sun in the neighborhood of the pyramids (Magdolen 2000: 211–214) [***Fig. 9***, bottom].

A combination of triangles was used in preparing a theoretical reconstruction of the Sun Altar [***Fig. 6***]. The simulation

in the figure uses red to trace a triangle with the following proportions: base equal to 3 units, vertical side measuring 4 units and the hypotenuse 5 units. The triangle was "anchored" at the corner traced by markings CSC-C-4A and CSC-C-6A [see ***Fig. 4***]. The assumed module unit was 2.5 royal cubits, that is, 131.25 cm.

The results of the simulation justified the proposed two obelisk and offering table arrangement on the altar platform [***Fig. 7A***]. The obelisks had square bases measuring 2 royal cubits, that is, 105 cm to the side, and 26.25 cm, which makes for half a royal cubit. The height of the obelisk can be calculated at 9½ royal cubits, that is, 498.75 cm. The size of the offering table was small with a width equal to approximately 118.125 cm, i.e., 2¼ royal cubits. A hypothetical depth suggested for the feature was about 91.875, that is,

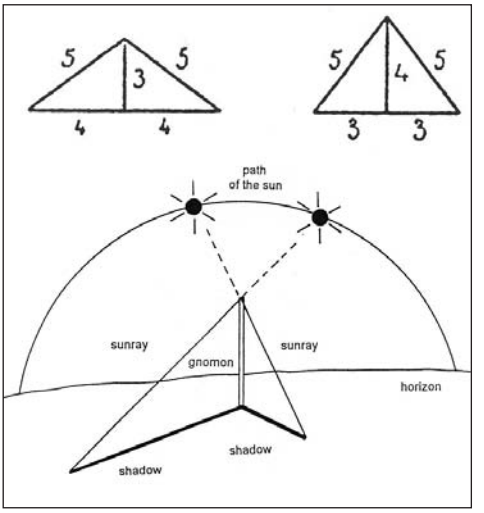

Fig. 5. Designing proportions: triangles used by the Egyptians (top) and a right-angled triangle traced using a gnomon (top, after Choisy 1899: 54, Fig. 3; bottom, after Magdolen 2000: 210, Fig. 1)

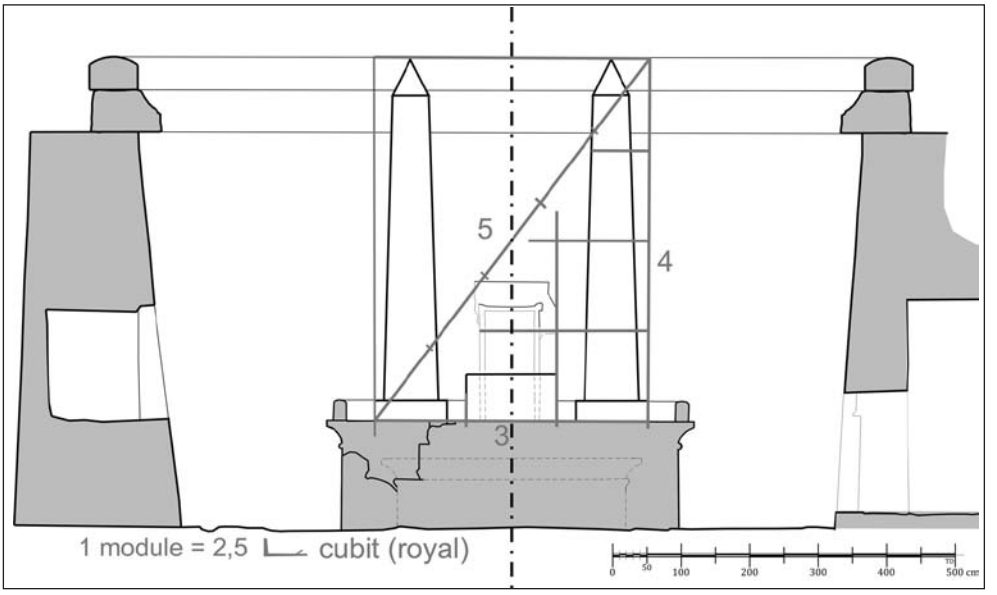

Fig. 6. Section through the courtyard and altar presenting a reconstruction of the altar based on the Egyptian "sacred triangle" principle (Drawing T. Dziedzic)

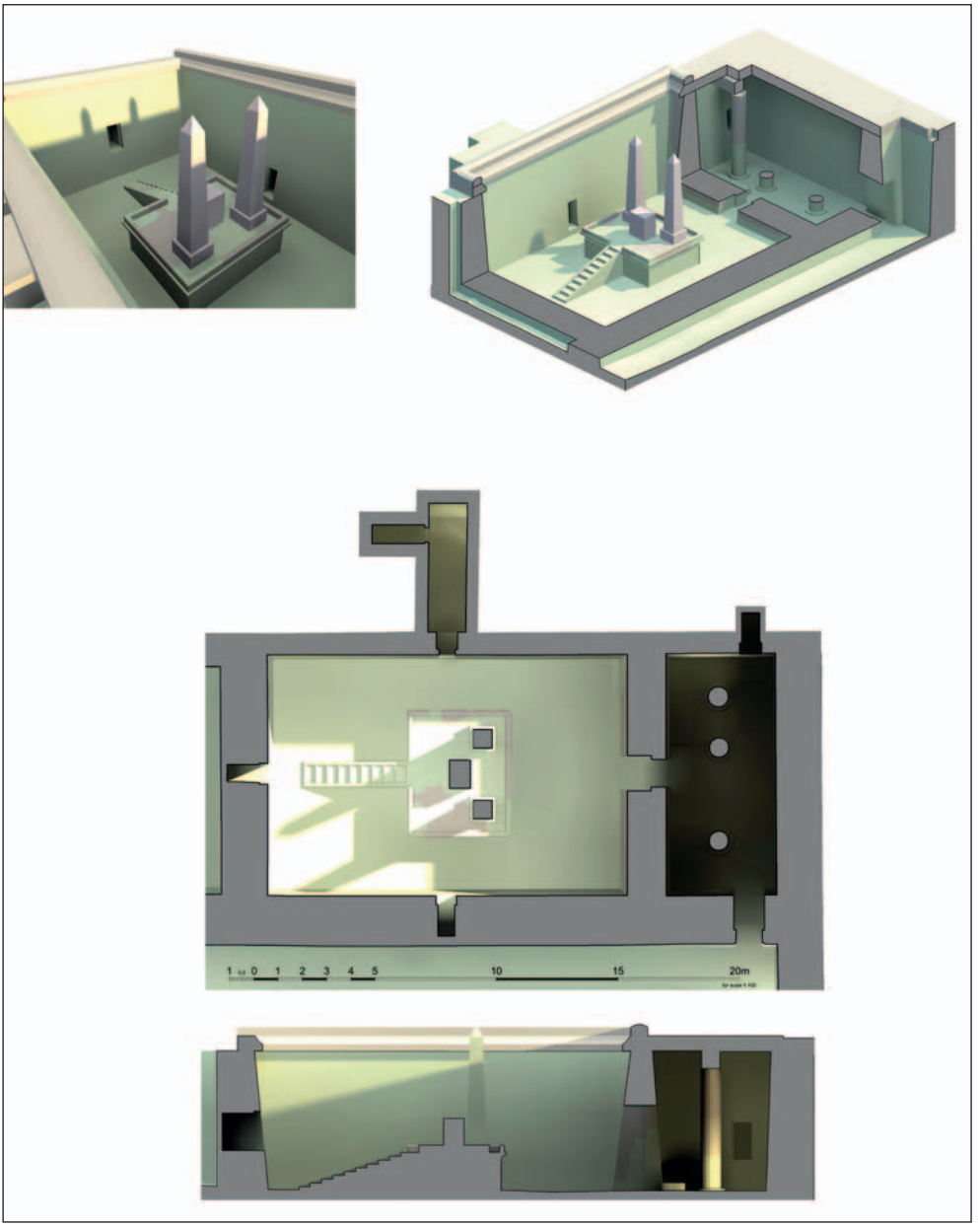

Fig. 7A–B. Theoretical reconstruction of the Sun Altar in the Solar Cult Complex (plan, section and isometric view from the southwest), assuming the presence of A) two obelisks and offering table (this page) and B) only the offering table in the center (opposite page) (3D rendering P. Srokowski)

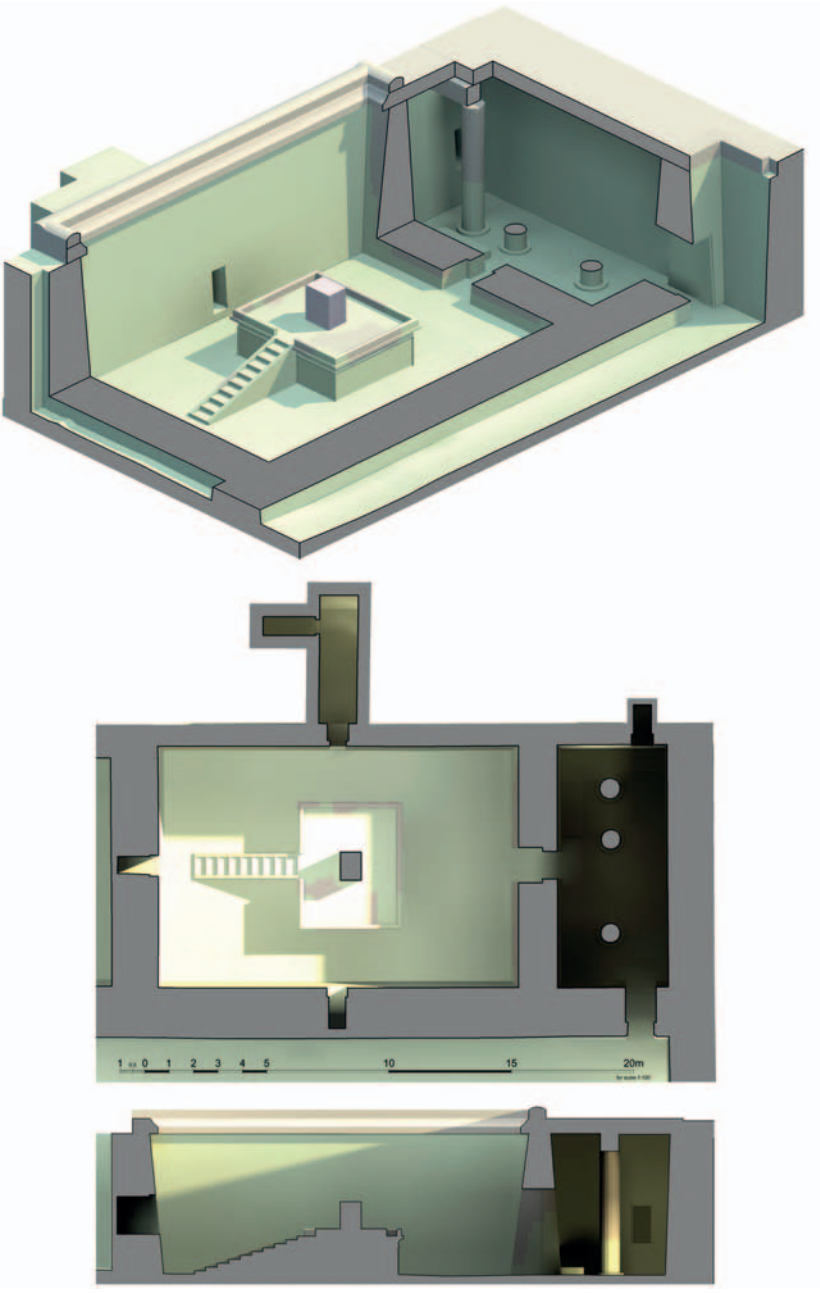

Fig. 7B.

1 ¾ royal cubits, while the height, also hypothetical, was proposed as 1¼ royal cubits, that is, 65.625 cm. The results of this line of thinking were confronted with a visualizing based on the conception of Dieter Arnold (2003: 8), who assumed the presence of only an offering table on the altar platform [***Fig. 7b***].

Teresa Dziedzic
Wrocław University of Technology, Faculty of Architecture
50-317 Wrocław, Poland, ul. Bolesława Prusa 53/55
teresa.dziedic@ pwr.wroc.pl

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