Górnictwo i Geoinżynieria • Rok 30 • Zeszyt 1 • 2006

*Maciej Pawlikowski**

INVESTIGATION OF ROCKS PRESENT UNDER AND OVER HATSHEPSUT TEMPLE — DEIR EL BAHARI — UPPER EGYPT**

1. Introduction

Investigation of Temple [1–3, 7, 8] and rocks present under various parts of the Temple give information concerning the way of preparation of the area for the Temple construction. But for better understanding primary it is necessary to imagine morphological situation of this place before Temple construction.

Geologically and stratigraphically great part of sediments considered represent Eocene [5, 6]. They are represented by clayey, kaolinitic Esna shales present at the lower part of the profile while the upper part is represented by Theban limestones (Fig. 1a — T.L.), Esna shales (Fig. 1a — b–d) are gradually passing into overlaying limestone. This phenomenon is seen as series of limestone layers in shists intercalating deposits of Esna shists.

Eocene sediments mentioned above are covered in some places by Pliocene conglomerates (Fig. 1a — f) and younger slope cones composed of Theban limestone fragments which fall down from cliff (Fig. 1a — g, Fig. 2). Therefore, primary morphology of the area before Temple construction may be reconstructed as shown at Figure 1a, and cross section Figure 1a — W–E.

That means that the Temple of Hatshepsut was built at the contact of two mechanically various types of rocks i.e. lower — soft Esna shist and upper — mixed Esna shist and hard layers of limestone present above the top part of Esna shist. That means that geotechnical conditions of the lower part of the Temple construction (on Esna shists) and the upper part of the Temple (on shists and limestone) were technically various.

* Inst. Mineralogy, Petrography and Geochemistry, AGH, University of Science and Technology, Cracow
** Realization of investigation supported by AGH grant no 11.11.140.158

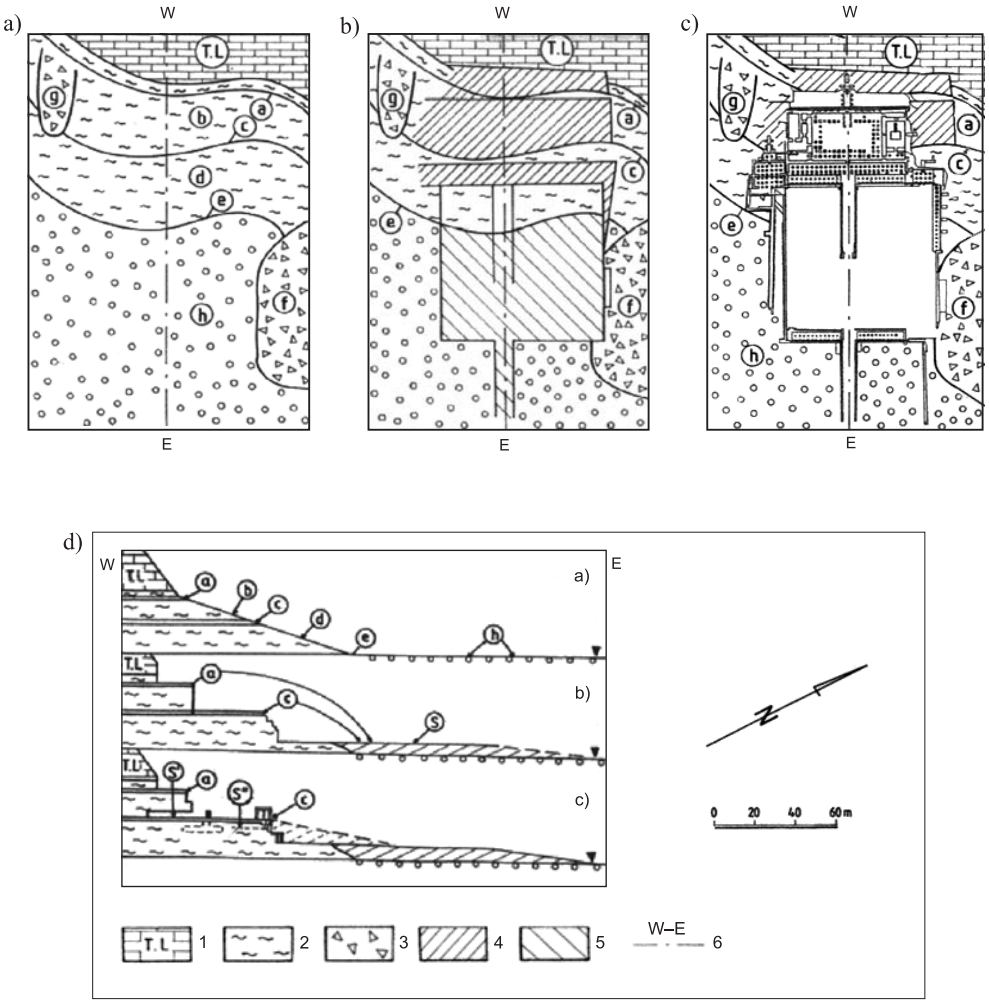


Fig. 1. Reconstruction of sequence of works done during construction of Hatshepsut Temple:
a) The map of geological and morphological situation before the preparation of the area for construction of Temple; b) The map showing localization of engineering works preparing for construction of Hatshepsut Temple; c) The scheme showing present picture of location of Temple Hatshapsut; d) Evolution of area of Hatshepsut Temple (lines of cross sections marked on Figures a)–c)).
Explanation: T.L. — Theban limestones, a — upper limestone used latter as base for construction of upper shelf of Temple, b, d — Esna shists, c — lower limestone used letter as base for construction of upper terrace, e — the line of contact of Esna shists with young sediments filling up Deir el Bahari, f — Pliocene conglomerates, g — young slope cone present on morphological surface of Esna shists, h — young sediments filling up valley of Deir el Bahari.
1 — Theban limestones, 2 — Esna shists, 3 — Pliocene conglomerates (f) and slope cone (f), 4 — areas of transfer of stone material from gebel, 5 — area of deposition of material removed from gebel, 6 — W–E — line of cross section showed at Figures a)–c);
S′ — sanctuary of Hatshepsut, S″ — sanctuary of Hathor

Field examination of profiles and determination of rock present under various parts of Temple showed that works preparing area for object construction were focused on removing of rock material from the gebel and deposition of this material under the medium terrace (mostly). Places and scale of mentioned engineering works are showe at Fig. 1b, as well as at Fig. 1d.

Mentioned observation and investigation document that the most important for construction of Hatshepsut Temple are two layers of limestone i.e. marked as a and d (Fig. 1a — a–d).

2. Upper shelf

Upper primary shelf done by constructors of objeect above the Temple is represented by natural limestone layer (limestone a) present just at highest part of profile of Estan shale just under the bottom of Theban limestones (Fig. 1a, d — layer a).

a)

b)

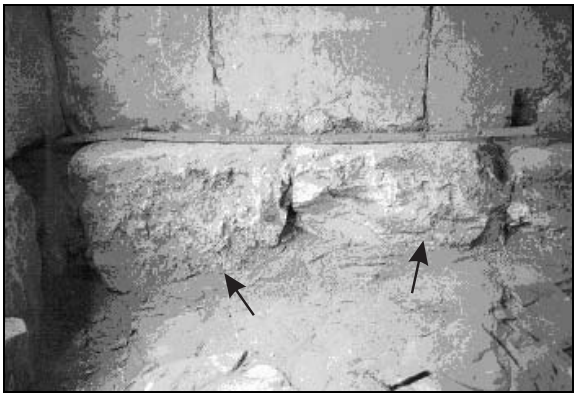


Fig. 2. Rest of slope cone deposited on eroded surface of Esna shales present 30 m to SW from sanctuary of Hathor (a). Undulated natural surface of limestone constituting the base for foundation of Hatshepsut Chapel. Seen blocks of funding with specially prepared bottom surface (arrows). West corner of chapel (b)

Esna shales present between this layer and bottom of Theban limestones were originaly removed during the preparation of the area for temple construction. Mentioned layer of limestone (layer a) was left tendetionally for preservation of Temple against stone blocks falling down from highest part of hills build of Theban limestones.

This natural limestone layer was used for better stabilization of the cliff during the restoration works of Temple. The stabilization was done by constuctional binding of mentioned limestone layer (Fig. 2b) with specially constructed stone wall above the upper terrace of Temple. Because of this works newly constructed artificial shelf composed of natural limestone: layer and cement-stone shelf makes architectonical construction above the upper terrace stabil and well preserved against destruction.

3. Upper Terrace

Works concerning preparation of surface for construction of upper terrace are well seen in chapels localized there.

For example the sequence of layers present under the Chapel of Hatshepsut confirms that this part of the Temple was constructed on relatively thick and strong layer of limestone present at the upper part of Esna shists (Fig. 1b, d — layer c). Primary morphology of this limestone is slightly undulated and partially destroyed by human activity (Fig. 2b). Observations confirmed the presence of thin 2÷4 cm thick layer of powder-like sediment just between the foundation, and natural surface of limestone. This sediments contains small fragments of dynastic pottery, grains of charcoal, small fragments of wood and small fragments of blue faience (Fig. 3a). The presence of mentioned artifacts in layer between funding and limestone confirms that before the construction of architectonic objects on the Upper Terrace, Esna shists overlaying layer of limestone (layer c — Fig. 1b, c, d) were occupied, quarried. Later part of this limestone was removed. After these works the top surface of limestone layer mentioned was prepared for the construction of this part of the Temple.

Mentioned observations document that not all architectonical objects of the upper part were constructed at the same time. This supposition is confirmed by mentioned, thin anthropogenic layer present just under the foundation of the Chapel of Hatshepsut. The presence of this layer confirm that during the construction of architectonic elements in other parts of the Upper Terrace the area of the Hatshepsut Chapel was used as the area for preliminary and preparing works.

The way of construction of the Chapel of Hatshepsut wall foundations is exciting. The first, most lower layer of the foundation blocks shows a very special shape. The upper surface of the blocks is flat while their bottom face is repeating the morphology of natural top surface of limestone layer. This means that the top surface of the limestone layer was not specially prepared for construction of the foundation while bottom of first blocks of walls were specially adapted (Fig. 3a). This way of works lead to very good fixing of stone walls of temple to natural limestone base.

a)

b)

Fig. 3. Thin anthropogenic layer containing small fragments of pottery, grains of dactyl etc. (arrows) present between top of limestone c and base of fundation of Chapel of Hatshepsut (a). Locations of limestone block present under columns of upper terrace on specially prepared steps cut in Esna shists (b)

Location of the Upper Terrace of the Temple between limestone a and c (Fig. 1b–d) give additionally a perfect opportunity for the construction of Sanctuary of Hatshepsut and chapel of Amun (*etc*.) at soft Esna shale present between mentioned limestone layers. Moreover overlaying layer of limestone a makes roof above the part mentioned Sanctuaries.

Moreover lower limestone layer — layer c (Fig. 1a–d) constitute stabil fundament for construction of upper terrace as well as for other objects localized there. On the other hand this layer c constitute solid roof of tombs present under this part of the Templeas as well as roof above part of Sancturay of Hathor. And other objects localized on the level of medium terrace.

On can add that during preparation of metioned tombs (under upper terrace) firstly works was focused on perforation of limestone layer c. Next traditionally chambers and corridors of prepared tomb were dug under this limestone in soft Esna shale.

One can say that Sanctuary of Hathor was prepared using the same way of works i.e. chambers of sanctuary were dug at soft shale just under limestone c while overlaying limestone was treated as very solid roof for great part of this Sanctuary (Fig. 1b, c).

Moreover one can say that the way of location of foundations of columns was specially prepared (Fig. 3b).

In conclusion one can mention that is possible discovery of other objects (not discovered up to now) which are localized behind the stone walls covering natural exposures of Esna shale at upper terrace (shale between limestones a and c) as well us under limestone c.

4. Medium Terrace

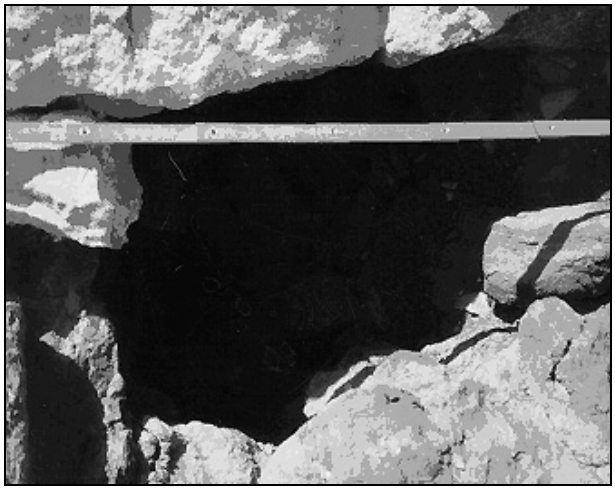
The medium terrace was only partially located on Esna shale. The chapels and columns of this terrace were located on specially prepared surface (Fig. 3b, 4).

Moreover performed observations confirm that greatest part of medium terrace was build on stone material removed from the area prepared for construction of upper as well as medium terrace (Fig. 1a, c, d, 4, 5) sculptures of Pharaoh at upper terrace where is very special.

Top part of Esna shale present stratygraphically under limestone c is well prepared for mentioned constructions. One can see preparing works as steps cut in shale. Blocks of foundation are precisely located ad fixed on these steps (Fig. 3a, 4, 5).

Fig. 4. Medium terrace of temple. One can see gray area of Esna shale removed during preparation for construction of temple. Artificially constructed part of terrace composed of block removed from upper terrace and covered with limestone plates seen deeper on photo

a)



b)

Fig. 5 The hole at the base of wall of medium terrace (a). Block of limestones seen in hole showed above. Blocks constitute fragments of cliff removed from in situ during preparation of place for construction of upper terrace (b)

5. Lower Terrace

The lower terrace is constructed mostly on natural young sediments filling up Deir el-Bahari. They are represented by stream deposits composed mainly of fragments of limestone and sands (Fig. 1c). All mentioned sediments overlay thick layer of limestone present under Esna shel. This most lower limestone is the place of location of next generation of tombs present for example near of Metropolitan House. But it is possible that under lower terrace of Temple of Hatshepsut are present too big not discovered up to now tombs.

6. Summary

The morphological, geological and architectonic details already mentioned lead us into consideration that most probably the upper part of the Temple (the upper terrace) was constructed as the first object. Sediments removed during preparation of the area were transported down where they were used in the construction of the medium and lower terrace of the Temple. The understanding of mentioned works help reconstruct phases of construction of object. Additionally described phenomenon give imagination concerning geological knowledge of constructors as well as confirming great scale of preparing, engineering works done before building of Temple.

Acknowledgements

Author thanks Z. Szafrański (Ph.D.) for scientific discussion.

LITERATURE

[1] *Barwik M.*: The so-called 'Stundenritual' from Hatshepsut's Temple at Deir el-Bahari. [in:] C.J. Eyre (ed.), Proceedings of the Seventh International Congress of Egyptologists (Orientalia Lovaniensia Analecta 82) Leuven 1998, 109–116

[2] *Barwik M.*: New data concerning the IIIrd Intermediate Period cemetery in the Hatshepsut temple at Deir el-Bahari. [in:] Akta Międzynarodowego Sympozjum „Theban Necropolis: Past, Present, Future", Londyn 27–28 VII 2000

[3] *Barwik M.*: The five faces of Queen Hatshepsut. [in:] Z. Szafrański (ed.), Queen Hatshepsut and her Temple 3500 Years Later, Warszawa 2001, 159–175

[4] *Pawlicki F.*: Skarby architektury starożytnego Egiptu. Królewskie świątynie w Deir el-Bahari, Warszawa 2000, 60–173

[5] *Pawlikowski M.*: Geology and geomorphology of investigated Area. [in:] Ginter B., Kozlowski J.K., Astic settlement near Armant. Studien zur Archaeolgie und Geschichte Altaegyptens 1994, band 6, 3–6

[6] *Said R.*: Geology of Egypt, Elsevier 1966

[7] *Szafrański Z.E.*: Upper Terrace of the Temple of Hatshepsut at Deir el-Bahari: Recent Results of Restoration Work. [in:] Z. Hawass and A.M. Jones (ed.), Eighth International Congress of Egyptologists: Abstracts of Papers, Cairo 2000, 177

[8] *Szafrański Z.E.*: Deir el-Bahari. The Temple of Queen Hatshepsut, season 1999/2000, PAM XII 2001, 185–205

. .