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Ministry of High Education and Scientific Research

National Research Institute of Astronomy and Geophysics

Report of

GEOPHYSICAL STUDIES OF HAWARA PYRAMID AREA- FAIYUM

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INTRODUCTION

HAWARA is an archaeological site of Ancient Egypt (Figure 1), south of the site of Crocodilopolis (Arsinoe) at the entrance to the depression of the Faiyum oasis. The first excavations at the site were made by Karl Lepsius, in 1843. William Flinders Petrie excavated at Hawara, in 1888, finding papyri of the first and second centuries, and, north of the pyramid, a vast necropolis where he found 146 portraits on coffins dating to the Roman period, famous as being among the very few surviving examples of painted portraits from Classical Antiquity, the "Faiyum portraits" illustrated in Roman history textbooks.

Amenemhet III was the last powerful ruler of the 12th Dynasty, and the pyramid he built at Hawara (Figures 2 and 3) is believed to post-date the so-called "Black Pyramid" built by the same ruler at Dahshur.

In common with the Middle Kingdom pyramids constructed after Amenemhet II, it was built of mudbrick round a core of limestone passages and burial chambers, and faced with limestone. Most of the facing stone was later pillaged for use in other buildings— a fate common to almost all of Egypt's pyramids— and today the pyramid is little more than an eroded, vaguely pyramidal mountain of mud brick, and of the once magnificent mortuary temple precinct formerly enclosed by a wall there is little left beyond the foundation bed of compacted sand and chips and shards of limestone.

The entrance to the pyramid is today flooded to a depth of 6 meters as a result of the waters from a canal built nearby.

The huge mortuary temple that originally stood adjacent to this pyramid is believed to have formed the basis of the complex of buildings with galleries and courtyards called a "labyrinth" by Herodotus, and mentioned by Strabo and Diodorus Siculus. The demolition of the "labyrinth" may date in part to the reign of Ptolemy II, under whom the Pharaonic city of Shedyt (Greek *Crocodilopolis*, the modern Medinet el-Faiyum) was

renamed to honour his sister-wife Arsinoe; a massive Ptolemaic building program at Arsinoe has been suggested as the ultimate destination of Middle Kingdom limestone columns and blocks removed from Hawara, and lost.

Nowadays Hawara area is entirely abandoned and the underground water has a bad effect on the foundation of Hawara Pyramid and the Labyrinth site. The area require great efforts to conserve this historical place from desertion.

The next discussion will enlighten some notions about Hawara and its Labyrinth throughout the history.

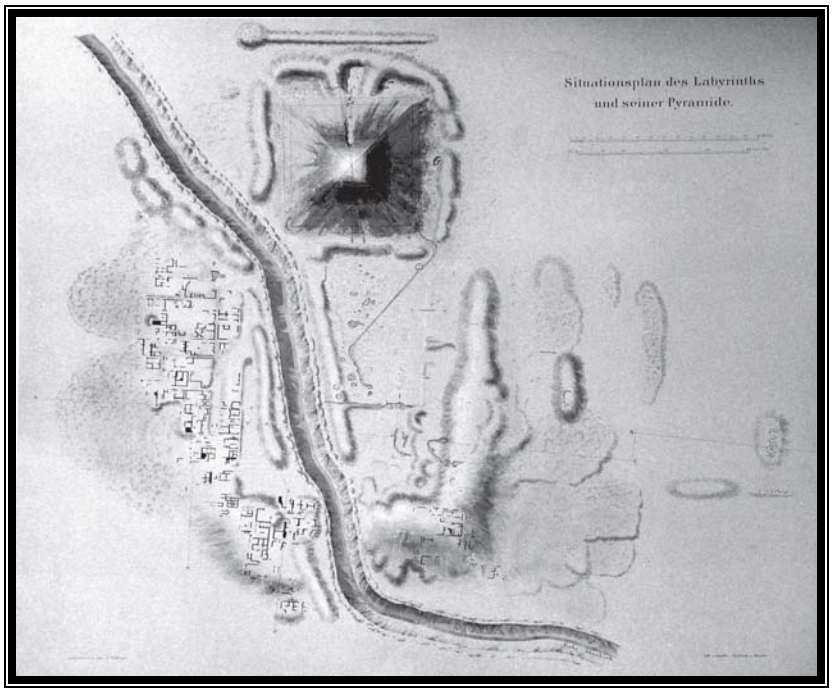

Fig. (1): Hawara area (old photograph).

Fig. (2): Pyramid of Hawara.

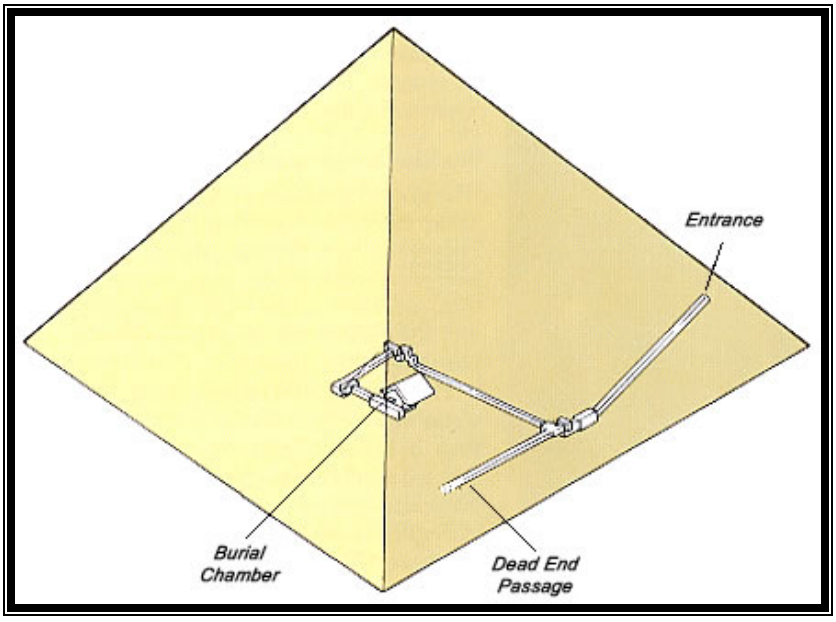

Fig. (3): The internal structure of the Pyramid of Hawara.

List of principal Greek and Roman authors who refer to the Labyrinth

- Herodotus (ca. 484-430 BC)
- Diodorus Siculus (1st century BC)
- Strabo (ca. 64 BC - AD 19)
- Pliny (AD 23-79)
- Pomponius Mela

Herodotus (ca. 484-430 BC): One passage in Histories, Book, II, 148.

In the second book of his History, the Greek writer Herodotus gave the following account of the Labyrinth:

This I have actually seen, a work beyond words. For if anyone put together the buildings of the Greeks and display of their labors, they would seem lesser in both effort and expense to this labyrinth - even though both the temple in Ephesus and the one in Samos are remarkable. Even the pyramids are beyond words, and each was equal to many and mighty works of the Greeks. Yet the labyrinth surpasses even the pyramids.

In it there are twelve courts with roofs, each with facing gateways, six oriented to the north and six oriented to the south. It contains two sets of chambers, one below ground and the other aligned on top, three thousand in number - fifteen hundred in each set. I saw the upper series of chambers myself, passing through, and speak from my own observation, whereas I learned of the underground series by report. For the Egyptian authorities were utterly unwilling to show them saying they contained the burials both of the kings who had caused this labyrinth to be build, and of the secret crocodiles.

So I speak of the lower chambers from listening to others, but have myself seen the upper ones - beyond human labor. For the ways out through the roofed areas and the extremely intricate windings through the courts arose infinite wonder, passing from court to chambers and from chambers to porches (?), to other roofed areas from the porches (?), and to other courts from the chambers. For all of this the roof is of stone, like the walls,

and the walls are covered with carved motives, while each court has a colonnade of white stone exactly joined. At the far end of the labyrinth stands a pyramid of forty orguiae which include the carvature of mighty figures. The way into this is cut below ground.

DIODORUS SICULUS (1st century BC): Two passages in his history, Book I, 61 and 66.

When the king died the government was recovered by Egyptians and they appointed a native king Mendes, whom some call Mares. Although he was responsible for no military achievements whatsoever, he did build himself what is called the Labyrinth as a tomb, an edifice which is wonderful not so much for its size as for the inimitable skill with which it was build; for once in, it is impossible to find one's way out again without difficulty, unless one lights upon a guide who is perfectly acquainted with it. It is even said by some that Daedalus crossed over to Egypt and, in wonder at the skill shown in the building, built for Minos, King of Crete, a labyrinth like that in Egypt, in which, so the tales goes, the creature called the Minotaur was kept. Be that as it may, the Cretan Labyrinth has completely disappeared, either through the destruction wrought by some ruler or through the ravages of time; but the Egyptian Labyrinth remains absolutely perfect in its entire construction down to my time.

And seized with enthusiasm for this enterprise they strove eagerly to surpass all their predecessors in the seize of their building. For they chose a site beside the channel leading into Lake Moeris in Libya and there constructed their tomb of the finest stone, laying down an oblong as the shape and a stade as the size of each side, while in respect of carving and other works of craftsmanship they left no room for their successors to surpass them. For, when one had entered the sacred enclosure, one found a temple surrounded by columns, 40 to each side, and this building had a roof made of a single stone, carved with panels and richly adorned with excellent paintings. It contained memorials of the homeland of each of the kings as well as of the temples and sacrifices carried out in it, all skillfully worked in paintings of the greatest beauty. Generally it is said that the king conceived their tomb on such an expensive and prodigious scale that if they had not been deposed before its completion, they would not have been able to give their successors any opportunity to surpass them in architectural feats.

STRABO (ca. 64 BC - AD 19): Three passages in his geography, Book 17, I, 3 and 37 and 42.

The total number of nomes was equal to the number of the courts in the Labyrinth; these are fewer than 30.

In addition to these things there is the edifice of the Labyrinth which is a building quite equal to the Pyramids and nearby the tomb of the king who built the Labyrinth. There is at the point where one first enters the channel, about 30 or 40 stades along the way, a flat trapezium-shaped site which contains both a village and a great palace made up of many palaces equal in number to that of the nomes in former times; for such is the number of peristyle courts which lie contiguous with one another, all in one row and backing on one wall, as though one had a long wall with the courts lying before it, and the passages into the courts lie opposite the wall. Before the entrances there lie what might be called hidden chambers which are long and many in number and have paths running through one another which twist and turn, so that no one can enter or leave any court without a guide. And the wonder of it is the roofs of each chambers are made of single stones and the width of the hidden chambers is spanned in the same way by monolithic beams of outstanding size; for nowhere is wood or any other material included. And if one mounts onto the roof, at no great height because the building has only one storey, it is possible to get a view of a plain of masonry made of such stones, and, if one drops back down from there into the courts, it is possible to see them lying there in row each supported be 27 monolithic pillars; the walls too are made up in stones of no less a size.

At the end of this building, which occupies anarea of more than a stade, stands the tomb, a pyramid on a oblong base, each side about 4 "plethra" in length and the height about the same; the name of the man buried there was Imandes. The reason for making the courts so many is said to be the fact that it was customary for all nomes to gather there according to rank with their own priests and priestesses, for the purpose of sacrifice, divine-offering, and judgement on the most important matters. And each of the nomes was lodged in the court appointed to it.

And above this city stands Abydos, in which there is the Memnonium, a palace wonderfully constructed of massive stonework in the same way as we have said the Labyrinth was built, though the Memnonium differs in being simple in structure.

PLINY (AD 23-79): One passage in his natural history, Book 36, 13.

Let us speak also of labyrinths, quite the most extraordinary works on which men have spent their money, but not, as may be thought, figments of the imagination. There still exists even now in Egypt in the Heracleopolite Nome the one which was built first, according to tradition 3,600 years ago by king Petesuchis or Tithois, though Herodotus ascribes the whole work to Twelve Kings and Psammetichus, the latest of them. Various reasons are given for building it. Demoteles claims that it was the palace of Moteris, Lyceas the tomb of Moeris, but the majority of writers take the view that it was build as a temple to the Sun, and this is generally accepted. At any rate, that Daedalus used this as the model for the Labyrinth which he built in Crete is beyond doubt, but it is equally clear that he imitated only 100th part of it which contains twisting paths and passages which advance and retreat-all impossible to negotiate. The reason for this is not that within a small compass it involves one in mile upon of walking, as we see in tessellated floors or the displays given by boys on the Campus, but that frequently doors are buried in it to beguile the visitor into going forward and then force him to return into the same winding paths. This was the second to be built after the Egyptian Labyrinth, the third being in Lemnos and the fourth in Italy, all roofed with vaults of polished stone, though the Egyptian specimen, to my considerable astonishment, has its entrance and columns made of Parian marble, while the rest is of Aswan granite, such masses being put together as time itself cannot dissolve even with the help of the Heracleopolitans; for they have regarded the building with extraordinary hatred.

It would be impossible to describe in detail the layout of that building and its individual parts, since it is divided into regions and administrative districts which are called nomes, each of the 21 nomes giving its names to one of the houses. A further reason is the fact that it also contains temples of all the gods of Egypt while, in addition, Nemesis placed in the building's 40 chapels many pyramids of 40 ells each covering an area of 6 arourae

with their base. Men are already weary with travelling when they reach that bewildering maze of paths; indeed, there are also lofty upper rooms reached by ramps and porticoes from which one descends on stairways which have 90 steps each; inside are columns of imperial porphyry, images of the gods, statues of kings and representations of monsters. Certain of the halls are arranged in such way that as one throws open the door there arises within a fearful noise of thunder; moreover one passes through most of them in darkness. There are again other massive buildings outside the wall of the Labyrinth; they call them "the Wing". Then there are other subterranean chambers made by excavating galleries in the soil. One person only has done any repairs there-and they were few in number. He was Chaermon, the eunoch of king Necthebis, 500 years before Alexander the Great. A tradition is also current that he supported the roofs with beams of acacia wood boiled in oil, until squared stones could be raised up into the vaults.

POMPONIUS MELA (1st century AD): One passage in his chorographia, Book I, 9, 56.

The building of Psammetich, the Labyrinth, includes within the circuit of one unbroken wall 1000 houses and 12 palaces, and is built of marble as well as being roofed with the same material. It has one descending way into it, and contains within almost innumerable paths, which have many convolutions twisting hither and thither. These paths, however, cause great perplexity both because of their continual winding and because of their porticoes which often reverse their direction, continually running through one circle after another and continually turning and retracing their steps as far as they have gone forwards with the result that the Labyrinth is fraught with confusion by reason of its perpetual meandering, though it is possible to extricate oneself.

The nineteenth and early twentieth century work at Hawara

1800 31 December: survey by two engineers of the French expedition, Caristie and Martin, published by Jomard in Description de l'Egypte, Antiquites, volume IV (Pancoucke edition, Paris1821), 478-485 Comment: valuable as the first scientific survey, carried out earlier than the cutting of a canal across the site

1820s: date uncertain: survey by John Gardner Wilkinson, published in his Modern Egypt and Thebes, being a description of Egypt, including the information required for travellers in that country, volume II (London, 1843), 337-340

1837: survey by Howard Vyse and Perring, published in their Operations carried on at the Pyramids of Gizeh in 1837, volume III (London, 1842), 82-83 Comment: first record of the present canal across the site

1840s: survey and excavation by the expedition under Richard Lepsius, published in his Denkmaeler aus Aegypten und Aethiopen I (Berlin, 1849), plates 46-49, with posthumous publication of his notes in Denkmaeler Text II (Berlin, 1904), 11-30 Comment: this is the most accurate published account of the site, from a time when the ruins of the Hellenistic and Roman village survived over the area of the Labyrinth (Lepsius interpreted those ruins as part of the original complex)

1862 August: excavations around the site by Vassalli, published in the journal Recueil de Travaux 6 (1885), 37-41

1888-1889: excavations and survey by William Matthew Flinders Petrie, published in his reports Hawara, Biahmu and Arsinoe (London,1889) and Kahun, Gurob and Hawara (London, 1890): his letters home are now in the Griffith Institute, Oxford (the 'Petrie Journals'), and his pocket books (the 'Petrie Notebooks') are in the Petrie Museum (published with Secure Data Services in the Petrie Museum Archives CD-ROM, 1999) Comment: the main achievement of Petrie lies in his survey of the pyramid and its inner chambers, and in his discovery and rescue of the famous encaustic mummy portraits from the Roman Period burials north of the pyramid. In other areas the quality of his work falls

below modern standards, reflecting the early date in the history of archaeology and in his own career. His survey of the area around the pyramid is inadequately recorded, and most of the tombs were emptied by workmen without Petrie himself ever seeing the finds in place.

1892: exploration of the Roman Period cemeteries at Hawara by R. v. Kaufmann, mentioned as the discoverer of a group burial containing eight mummies, in Renate Germer, Das Geheimnis der Mumien, Ewiges Leben am Nil (Berlin 1998), 150-151

1911: excavation of the Labyrinth area and the Hellenistic and Roman Period cemeteries by William Matthew Flinders Petrie, published in his The Labyrinth, Gerzeh and Mazghuneh (London 1912), and Roman Portraits and Memphis IV (London 1911) Comment: in this season Petrie uncovered some of the most remarkable sculpture fragments, as well as more structures within the area of the Labyrinth.

Recent research on the Labyrinth

1989 Blom, I., Sculpture Fragments and Relief Fragments from the Labyrinth at Hawara in the Rijksmuseum van Oudheden, Leiden, OMRO 69, 25-50 Photographs and description of the finds from the Labyrinth, which are now in Leiden.

1992 Obsomer, C., in: Amosiadès (Mélanges offert au professur Claude Vandersleyen par anciens étudiants, Louvain-la-Neuve, 221-324.

2000 Uphill, E.P., Pharaoh´s Gateway to Eternity, The Hawara Labyrinth of King Amenemhat III, London and New York.

2000 Belgian survey "the Hawara 2000-survey of the Faiyum Project" (Netherlands-Flemish Institute in Cairo) (Katholieke Universiteit Leuven - Section: Ancient History). - Willy Clarysse (General director) - Inge Uytterhoeven (Field director) - Anny Cottry

(Photographer) - Katrien Cousserier (Archaeologist) - Bart Demarsin (Archaeologist) - Lieven Loots (Archaeologist) - Sylvie Marchand (Pottery specialist - IFAO) - Veerle Muyldermans (Archaeologist) - Ilona Regulski (Egyptologist) - Katrien Slechten (Archaeologist) > - Ayman Mohammad Sedik el-Hakim (Inspector) - Ashraf Sobhy Rezkalla (Inspector)

CURRENT RESEARCH ON HAWARA AND THE LABYRINTH

The present research has planned to be an integrated geophysical study at the area of Hawara Pyramid and the Labyrinth zone.

The geophysical techniques became very advanced and well adapted for archaeological investigation. Geophysical techniques are well known as a non-destructive procedures that lead to a precise outcomes indicating the subsurface archaeological features and structures.

The main question we need to answer through this study is “is there something left from the Labyrinth or it is just ruins?”

The suggested geophysical techniques are:

1- Soil conductivity measurements .

2- Vertical heterogeneity mapping using VLF technique.

3- Electromagnetic regional and detailed survey “TEM”.

4- Electrical resistivity tomography “ERT”.

5- Ground penetrating radar “GPR”.

6- Geomagnetism.

The integration of the six tools could answer our question and it could cause the rising of new questions!

Fig. (4): View of Hawara area.

Fig. (5): Electrical resistivity tomography at Hawara area.

Fig. (6): Nodes of electrical resistivity tomography at Hawara area.

Fig. (7): Ground penetrating radar survey at Hawara area.

Fig. (8): Electromagnetic survey at Hawara area.

Fig. (9): Very low frequency survey at Hawara area.