

# Documenting the Tomb of Harkhuf Qubbet el -Hawa, Aswan



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## Documenting the tomb of Harkhuf, Qubbet el-Hawa, Aswan

The mission has been carried out in the framework of the project TECH - Technologies for the Egyptian Cultural Heritage, Bilateral Agreement Project, funded by the National a Council of Italy and the Academy of Scientific Research and Technology of Egypt (ASRT).

### The Tomb of Harkhuf

Aswan is the southern gate of Egypt: in ancient times caravan routes left the Nile Valley from this site to reach far away territories and different populations, carrying back exotic and precious wealth. Between the late Old Kingdom and the early Middle Kingdom, the tombs of the nobles at Qubbet el-Hawa testify to ancient journeys, far south explorations, trades and cultural exchanges, in particular, the tomb of Harkhuf, a high official of the VI dynasty (XXIII cent. BC), who led trading and military expeditions into Nubia. The text inscribed on the façade of his tomb is a very important and famous document. This tomb was at first noticed by an Italian scholar, Ernesto Schiaparelli, famous Egyptologist who discovered f.i. the tomb of Nefertary and other important monuments. He was a pioneer of the inter-disciplinary archaeology and Egyptology. He used the photography on the archaeological field.

### Aims of the project

TECH Project aims to check a non invasive methodology for documenting Egyptian monuments and above all Egyptian epigraphy. The tomb of Harkhuf

has been chosen because of its importance, its status and for the old documentation by E. Schiaparelli, that is the point of departure for the work.

The project aims at a very good documentation by photogrammetry, with the support of spectroscopy, geology and climatology, in order to obtain data on the actual state of conservation, to check the decay and the influence of the environment on it.

### Study of the climate of the Harkhuf Tomb

The climate factors affecting the tomb of Harkhuf at Qubbet el-Hawa are air temperature, its diurnal excursion, and wind, and, at some extent, relative humidity. In fact, in Aswan, night time Humidity can be more than 30% during the winter months, while precipitation is a very rare event occurring once every 1 or 2 years, but has important impact due to its high intensity and short duration.

The experiment, designed using portable meteorological instruments, permit to define if the microclimate near the Harkhuf Tomb at Qubbet el-Hawa has the same characteristics of the larger Aswan area. In particular it will help to:

1. determine the temperature gradient along the façade of the tomb in order to understand if the different parts of it are under the influence of physical stress of different intensity;
2. determine if temperatures excursion together with the right level of relative humidity of the air could favor the formation of dew at dawn and of high dew point values.

Preliminary analysis of data collected between 8:00 am and 4:00 pm permitted to detect a differential heating of the façade, with the right part reaching temperatures much warmer than the left and for a longer period, being under the direct sunrays. In the interior, during the day, the temperature excursion is much more moderate. In addition, some measurements of wind intensity and direction, show a persistent wind blowing from N-NE starting mid-morning, around 10:30 am.

The façade of the tomb is partly sheltered from the abrasive effect of the wind due to the presence of the low barrier closing the terrace of the tomb.

### **The Photogrammetric project**

Since the first survey on the site, several and damaged inscriptions preserved on the façade and on the pillars inside the tomb, have been noticed. Most of them are in different conservation state, probably due to the intrinsic characteristics of the rocks and the weathering phenomena. From some observations made during this mission emerged the importance of documenting Harkhuf's inscriptions, that risk to be lost forever. The most important inscriptions are preserved on the architectural façade, but the four pillars inside show reliefs and inscriptions with several funerary formula. The first step of conservation is the documentation of the texts with a not invasive methodology that is able to record the signs and contemporary is able to evidence the degradation. Every inscriptions have been accurately documented through the use of the photogrammetric system. Digital photogrammetry can be considered such

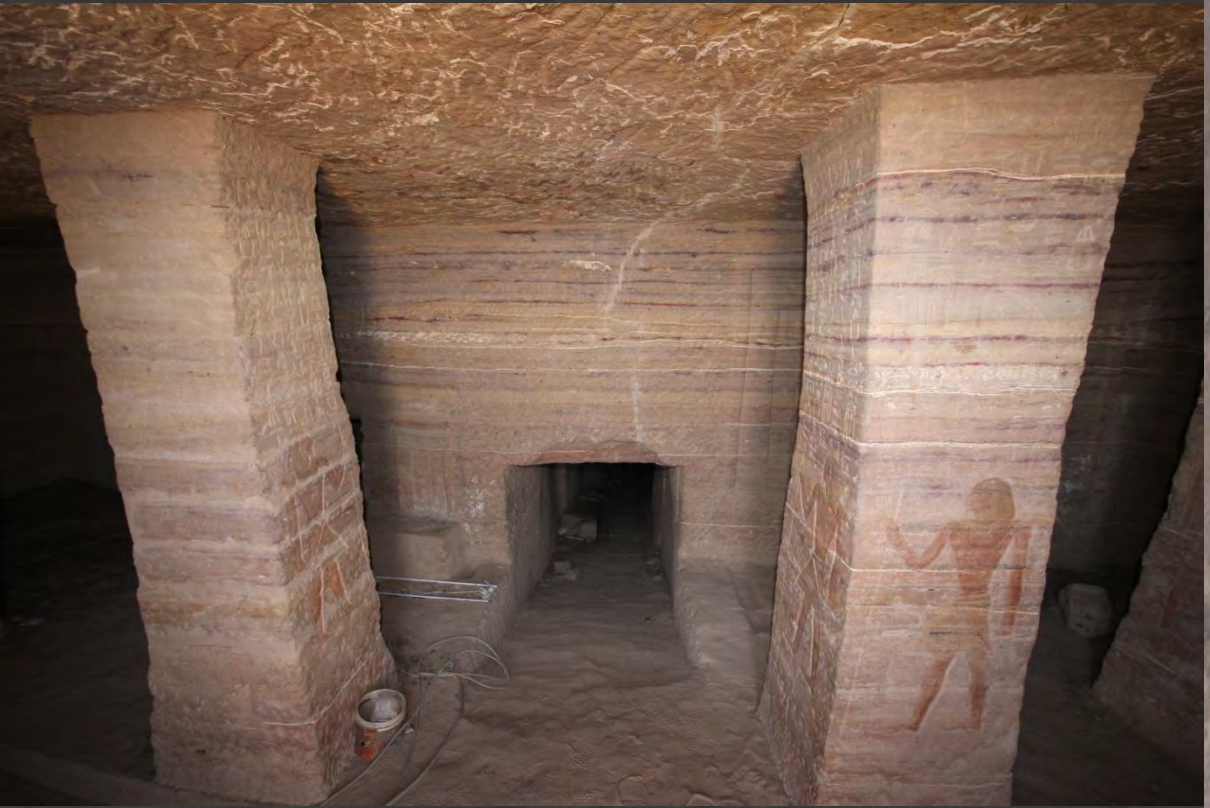
as a valid instrument of investigation and analysis to improve the knowledge in the archaeological field. The hyperbolic development of the camera sensor (up to 40 MP), the manufacturing of the lenses and the more accurate algorithms for the recognition of the homologous points on images, actually allow to reconstruct the whole investigated subject.

The technique used, well known as Structure From Motion (SFM), is able to reconstruct point clouds starting from unordered images by using specific algorithms. Normally it allows to use simple camera images because is able to calibrate the radial distortion of the lenses and subsequently to find the homologous points among the images, reducing the possibility to get in error. From the high resolution 3D model it is possible to carry out all the measurement about length, width and deepness of the engraving and to get information about the geometry, morphology and the global visualization of the object. With the integration of different point clouds management software is possible to make a series of elaborations in order to get a better organization and comprehension of the data. It is possible to fit the models with other points and afterwards can interpolate them with surfaces through the common meshing techniques. In order to distinguish original signs from casual ones and the degradation of the stones it is possible to generate Digital Elevation Model (DEM) and other specific maps able to evidence the deepness of different traces.



The Harkuf's Tomb at Qubbet el-Hawa, Aswan





The Architecture of the Tomb





The Hieroglyphics Documentation Project



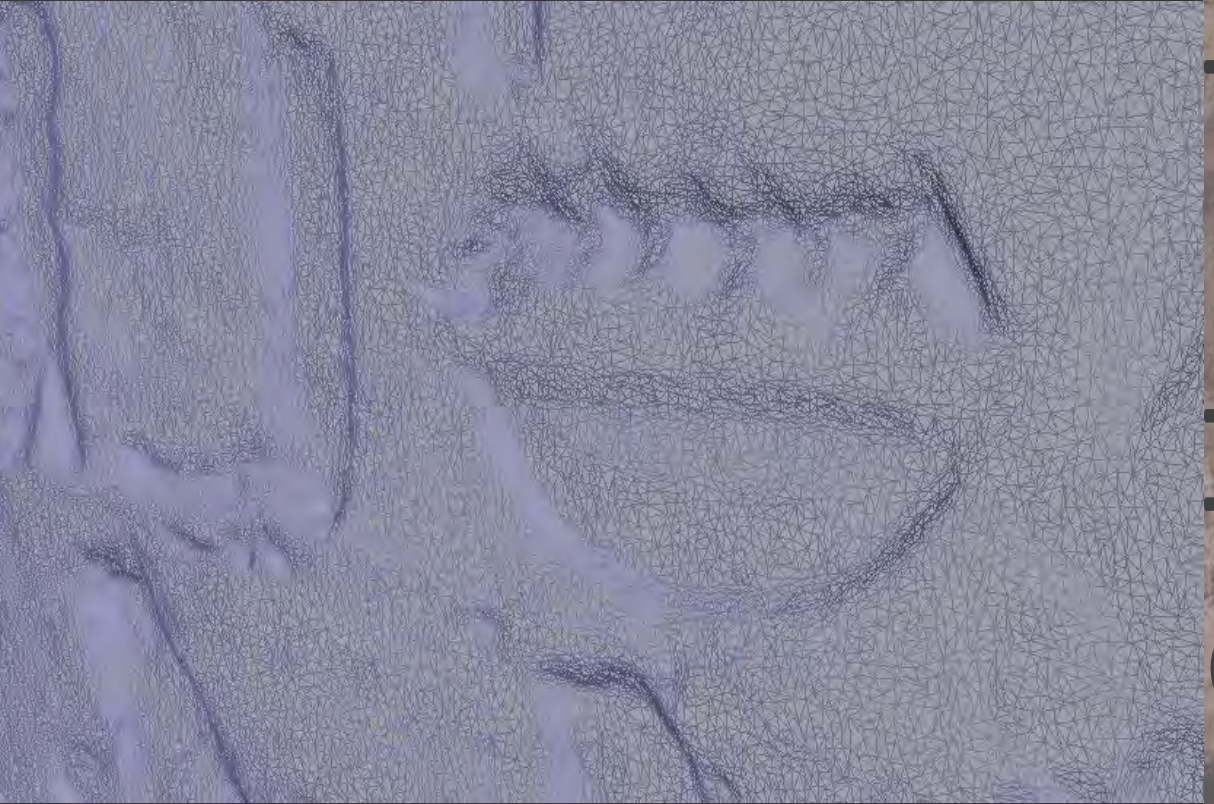


The Photogrammetric system





The accurate 3D models of the inscriptions





Climatic investigation





Geological investigation

