



Effects of environmental factors on monuments: the Harkhuf Tomb in Aswan, Egypt

Marina Baldi

CNR - Institute of Biometeorology, Roma, Italy (m.baldi@ibimet.cnr.it)

The tombs of the nobles excavated in the rocks on the Nile west bank at Qubbet el-Hawa in Aswan (Egypt) testify the role of the city as the southern gate of Egypt. In old times Aswan was the starting point of caravans travelling far south in uncovered territories and bringing back precious and exotic goods. Inscriptions on the tombs reflect the explorations and trades of that time and the cultural exchanges with southern territories. Nowadays the tombs, exposed to the environmental factors – wind, sun, rainfall - and to air pollutants originated from the town of Aswan are under a fast deterioration process. It is therefore necessary a full documentation of the tombs and of their façade and a study of the deterioration process due to the impact of the environmental factors. As a case study the tomb of Harkhuf at Qubbet el-Hawa has been chosen, because of its importance, its status of decay, and for the old documentation by the Italian Egyptologist E. Schiaparelli.

The climate factors affecting the tomb of Harkhuf 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 with devastating impact on manufacture and structures in the area.

The experiment, designed using portable meteorological instruments, permitted to define if the microclimate near the Harkhuf Tomb has the same characteristics of the larger Aswan area which can be derived by the meteorological station located at the Aswan airport. However differences in the microclimate are evident and preliminary analysis of data collected between 8:00 am and 4:00 pm during some consecutive days will be presented.

The study permitted to identify and measure the 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 for a longer period. In the interior, during the day, the temperature excursion is much more moderate, but some dew formation has been observed which contributes to the mold formation in parts of the walls of the tomb. In addition, some measurements of wind intensity and direction show a persistent wind blowing from N-NE starting mid-morning, around 10:30 am until late afternoon.

In particular, the observations permitted:

- > to understand if the different parts of the façade of the tomb are under the influence of physical stress of different intensity due to the temperature gradient detected along the façade itself;
- > to determine if and in which conditions the temperatures excursion together with the right level of relative humidity of the air favor the formation of dew at dawn and of high dew point values.

This study is part of the multidisciplinary project TECH (Technologies for the Egyptian Cultural Heritage) funded by the National Research Council of Italy and by the Academy of Scientific Research and Technology of Egypt (ASRT).