



## Ground Penetrating Radar survey at the archaeological site of Qubbet El-Hawa, Aswan, Egypt

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The necropolis of Qubbet el-Hawa is located in West-Aswan, Upper Egypt. It looks like a huge dune covering the massive Nubian Sandstone Group, hosting one of the most densely occupied cemeteries of Ancient Egypt, dating back to c. 2500 B.C. to the Roman Period. Here we present the used methodology and the conducted ground-penetrating radar (GPR) survey accomplished in the Qubbet El-Hawa site.

Three different geological formations have been differentiated in the studied area. From bottom to top, the Abu Agag, the Timsah and the Um Barmil formations, which mainly belong to the Nubian Sandstone Group. The conducted GPR survey was accomplished in the Timsah Formation, the most heterogeneous formation of all of them, in which along its outcrops can be observed several stratigraphic discontinuities, being usually the alternation of lutite (mainly claystone), sandstone, and iron oxides, arranged in alternating layers varied in thickness from 5 to 10 cm, and from 30 to 50 cm thick blocks.

The studied area, 20 m width × 45 m length, showing a near-constant slope of about 35°, was surveyed using 250 and 500 MHz shielded antennas in a dense array pattern. Although dry eolian sand and sandstone rocks do not display a clear difference in their electromagnetic characteristics, the conducted survey was able to discriminate/define the interface among the underlying sandstone and the sand cover. This good behavior could be attributed to the different overlapping layers including ferruginous sediments and claystone. This was possible even when the studied area exhibits a steep slope, as well as many loose rocks in some parts, coming from the outcrops, that made the measurement difficult to carry out in some cases.

The interface among the underlying sandstone formation and the sand cover is acceptably resolved, providing some very useful data to archaeologists about the near-surface shape of the bedrock and their possible willingness to host some graves.