THE POSSIBILITY TO DISTINGUISH SOME CLASSES OF TOMBS IN SHAHR-I SOKHTA GRAVEYARD WITH GEOPHYSICAL SURVEY

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During the 1978 excavation campaign, in the Shahr-i Sokhta graveyard geophisical methods have been used to carry on an investigation over wide areas of burials.

The great number of the tombs and the extension of the Shahr-i Sokhta necropolis, indeed represent two factors which limit a full comprehension of several of its aspects.

Presently the archaeologist's work is based on a « traditional » research, where the excavation is a phase preliminary to the elaborations. For this reason it was thought to be usefull to look for alternative tecniques of research, to program future studies, so that, at the same time, an interpretation partial as it might be, of wide areas of the graveyard where in the future it will be impossible to extend the excavations — will be feasible.

As well-known, geophisical methods are often used for the location of buried remains, where it is possible to measure the differences between physical characteristics present in archaeological structures and those of surrounding terrain.

The only in-homogeneous element, given the instruments at our disposal, and the physical parameters characterizing the Shahr-i Sokhta graveyard, was the intensity of magnetization of the ceramic forniture.

Therefore, the magnetic method seemed to be the most suitable, among methods that geophisicists normally use. In fact the ware has a magnetic characteristic higher than its clay counterpart. Because one of the antiferromagnetic phases, commonly presents in clay, Ironoxide Hematite, trasforms itself, at high temperature, into ferromagnetic forms, Maghaemite. The stability of which depends, among others things, on the bulk composition of the original clay. The range of temperatures needed to fire the ware found in Shahr-i Sokhta graveyard, had to be definitly higher — all investigations prove it — than the phase transformation temperature of ironoxide from the antiferromagnetic phase to ferromagnetic ones.

In order to extimate the influence of the other factors, included in the ground, as clay, gravel, and salt, two models of tombs, in agreement with the above mentioned hypothesis, have been artificially built and filled up to the original level.

After that, several mesurements of the magnetic field intensity, have been carried out. For this purpose a differential proton magnetometer, has been used. The results have suggested that the magnetic method, even with such simple and schematic reconstruction, gave sufficient information about the presence of the tombs.

In order to obtain a decisive answer, a preliminary survey on the HYT square of 100 sqm. has been carried out.

Mesurements were made on the intersection of a 50 cm. square grid, while the detector was kept 40 cm. higt from the ground. The mesurements obtained have been contoured on a map which shows several magnetic anomalies, whith low intensity (4/5 γ).

Fig. n. 1 shows the map of the magnetic data overlapped on the one where the subsequently excavated tombs appear. The location of the graves corresponds quite precisely whith that of the magnetic anomalies.

The goodness of the results, have permitted to extend the investigation to the following additional zones of the graveyard:

a. At the center of the graveyard (3000 sqm.) near the extensive excavation (IP/IU sq.) where a group of catacomb tombs (phase 3) had been found.

b. Towards the southern limit of the graveyard; on an area of 400 sqm. choosed to verifie the possible presence of tombs with collective depositions, similar to the GTT 1003 (phase 8/9) found during the previous 1977 campaign.

c. A third area of 200 sqm. has been choosed on the northern section (IR/IW sq) to verifie the application of the magnetic method, in an area

of the plateau where the graves have been dug in clay rather than gravel.

The distance between successive mesurements and the highness of the detector have been kept constant.

Fig. n. 2 shows the map of magnetic data of the « b » area, where is indicated with « + » the magnetic anomalies which are likely caused by the tombs.

Fig. n. 3 displays the map of « c » area, where the magnetic anomalies marked by « — » are related to existence of the tombs.

Therefore the real possibility to locate with a good approximation the graves, permitted to proceed to the second phase of our program: the elaboration of a methodology which will enable to distinguish some peculiar types of tombs.

The comparision between some tomb's characteristic parameters and those the magnetic anomalies produced by the tombs, permited to elaborate a scheme:

Models of tombs constructed to find the influence of their various physical parameter on the peculiarities of the magnetic anomalies recordered at ground level, showed that intensity of magnetization was not a parameter relevant to the characteristic of the latter ones. On the contrary both the dimensions of the tombs and their depth influence them.

An exemple of the modelling is shown (fig. n. 4), where different ware sample have been represented.

For this reason the tombs have been represented by an uniformely magnetized cylinder where its volume is occupied by the ceramic forniture.

Therefore, a classification of the tombs has been made on the base of geometrical parameters only.

Fig. n. 5 shows the analogy between the signals obtained from the theoretical model, based on the real tomb's dimension and depth, and those recordered over the real tombs: the full-line representing the intensity of the recordered field over tomb 746, and the dashed-line, the intensity obtained from its magnetic model.

The same can be said about fig. n. 6 (G 749).

In conclusion it appears that wave parameters can be filtered mathematically in order to reveal certain classes of magnetic signal representing a particular typology of graves.

Althought the elaboration of the data of Shahr -i Sokhta is presently in progress, it seems clear already by now that encouraging results will be obtained.

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