Archaeological Research On 'The Protohistoric Sanctuary Of Gastiburu', Arrazua, Biscay, Using Electrical Devices

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Summary

This is a summary of the different electrical devices, applied to the archaeological survey of the Sanctuary of Gastiburu. Choice of the method of survey depends on the characteristics of both the environment and the site itself. In this case, the electrical profiling method was chosen, because we considered this to be the most suitable option, according to our needs. We covered the area using two interelectrodic opening symmetrical devices of 3m and 6 m each. Later, the excavation of half the structures enabled us to correlate the building features encountered with the present anomalies detected. The survey continued after those features were dismantled, which provided us with new results.

Several geoelectrical profiles were done in order to examine the geometrical centre of the lobes. Two mechanisms were used for the profiles: a symmetrical and an asymmetrical device. Data obtained from information provided by these studies made possible a comparison between both profiles. This proved to be very useful, not only in discovering the advantages and disadvantages of every electrodic device, but also in comparing and evaluatig the different archaeophysical campaigns and the results of the excavation.

The Sanctuary of Gastiburu is a site containing clearly recognized structures on the surface. The Sanctuary is situated on the slopes of a short and narrow 'false plain', on a foothill of the mountain chain of Gastiburu, for which the site was named, it is located 1 km away from the Castro de Marueleza.

The Sanctuary is comprised of, from an architectural point of view, four large Lobes, named after the Cardinal points, located in an area which resembles an irregular pentagon. Its fifth vertex corresponds to the presence of the first minor element (ME 1) in alignment with it, at least four smaller architectural structures, that are inserted perpendicularly, with an approximate direction E-W (N87ºE). Thus, two groups of architectural elements can be differenciated: the Lobes and the minor elements (ME) and a central common space, called 'plaza', which is the third of three different sets, so far recognized.

The excavation has mainly focused on the Lobes, whereas the ME´s have been identified on the surface. The set of Lobes have been recognized as a complex architectural structure. Most of the Lobes N and E have been dug, reaching the paleosoil in their final stage of excavation. The minor elements (ME) 1, 2, and partially 3 have been excavated to surface or ruin level.

When the excavation works began to depend directly on the County Culture Board, financial support for the project increased. Therefore, the electrical survey methods were applied, before starting excavation of the whole site.

The Lobes are the architectural elements of greater 'importance', with similar appearance,though each one clearly differentiated from the others. The manner in which they are situated leaves an open space in the East, as big as the space occupied by any of the other Lobes, where the first of the minor elements (ME 1) is located. This structure shares some of the characteristics of the Lobes and also shows some other characteristics more typical of the ME´s.

The way in which the Lobes are arranged forms an inner 'pentagon'-shaped zone. This is their common meeting point, which we assume, functioned as a plaza. Access from the outside to this common space is possible through some gangways, located between the Lobes.

Archaeophysical works were first designed as a means of establishing priorities on the site, making the best use of public financial support by determining site differences or similarities, and establishing special areas, which could be used as a base for scientific premises, as required by such a unique site. There are several problems in the work area, due to the dimensions of the constructions, the presence of an already excavated site, big slopes, a washout cone and also a thickly wooded landscape and a high rocky area on the surface. All these problems were reasons why we decided to use two increasing interelectrodic openinig devices to investigate the outer horizons, as well as areas located more deeply within the site. The first device, which was a 3-m interelectrodic opening, symmetric mechanism, was used in a working area of 3.714 square metres, while a 6-m-symmetric device was used to work on the deeper horizon, covering an area of 1.864 square metres.

We used a symmetric Wenner-like device rather than the dipole-dipole because these ones become more affected by the rocky surface. Similarly, the use of symmetric Schulumberger-like devices were also rejected since it was necessary to bring power electrodes nearer when using the same interelectrodic opening or same investigation depth, which would mean a greater influence exerted by any irregularity on the surface.

The data obtained from the geophysical survey campaign showed two different types of structures. We found a high resistivity structure in two of the Lobes. It had a maximum level of 1,700Ω, and a half-circle shape, similarly looking towards Lobe N. On the other hand, we found much less resistivity –1,000Ω maximum- in the third lobe. There are also sandstone layers interwoven in the substratum, which generated positive anomalies, with a resistivity higher than 2,000Ω.

In the processing and graphic representation of our data, we have used three types of software and two visualization systems, 2D and 3D. Thus, we have used a program of isoline calculation for 2D representation and another statistical processing program for 2D and 3D representation. These two systems are very different; the fact that we were studying data in a rough state encouraged the observation of linear and/or scattered anomalies such as lines, and angles, whereas statistical methods, used to study field data, showed weaker scattered anomalies and highlighted irregular areas. This is due to the fact that the 'importance' of the resistivity measurement, at a certain point, depends on the measuring of that point and the points nearest to it. Results obtained from these calculations were processed to create images which have enabled us to differentiate those irregularities detected.

After treating data to create plans showing anomalies in 2D, they were processed in 3D. Resistivity measured at each point is taken as its height. In this way we were able to generate images in 3D, which highlighted how high positive and negative anomalies could be. Taking into account that positive anomalies were generated, as a result of the presence of walls or an accumulation of stones, we were able to obtain images of these anomalies, forming real shapes upon a general geoelectrical background.

Finally, we used graphic design software to combine the results obtained, from previous processes, with symbols or excavation plans. Once excavation took place, these final plans, fully elaborated at this stage, were highly useful to compare anomalies detected with the structures from whence they originated. The final assessment of a geoelectrical campaign comprises of a series of thematic plans, which show the differentiated and final stages of interpretation of the geoelectrical anomalies. On the whole, they showed that the analysis of geoelectrical characteristics of the subsoil was equivalent to that of any possible architectural element present within it.

Having a different image from the others, we chose Lobe E, so that excavation works could continue. We found its resistivity to be slightly higher than half the resistivity of the other lobes, under a geoelectrical perfect image, on a grid showing less resistivity in its NE part than in its W area. The image repeated in depth although with some variations, throughout the two geoelectrical campaigns, which have been carried out to date. After the first excavation of the lobe, we observed that it was divided in a series of quadrilateral sandstone walls filled with different materials. Spaces with a greater concentration of sandstone generated higher resistivity, while the compressed dense lutite fillings presented lower resistivity.

These materials were arranged in a chess-like position, which had already been detected in the geophysical campaign. These walls, located between 40 and 60 cm in depth, were dismantled, once they have been recorded, together with their filling materials, reaching a depth of 1.5 metres, until we found a different level of construction. Then, the geophysical survey was carried out again in the central zone. This time we used a 3-meter interelectrodic opening, symmetric device prepared to measure from 0.5 metres to 1 metre from each row; the rows were 0.5 metres apart. On this third campaign, we observed several strong anomalies , which had not been previously detected since compared to the topsoil on which the investigation was initially started (and also because the upper architectural features generated interferences), they were found in a relatively deep position. Those anomalies generated a grid, showing high resistivity lines which delimitate areas of high and low resistivity. The anomalies detected in two campaigns were compared and interpreted as a whole, since there were three levels of investigation containing, consecutively all the materials found from surface to the deeper position.

Another investigation method used on the site was recognition of the geometrical central point formed by the whole group of visible structures. Data collected in the different campaigns, where electrical profiling was used, enabled us to confirm that the above-mentioned centre was filled with low resistivity materials (about 400-Ω and lower). To find out what power these materials had, a brief V.E.S. (vertical electrical survey) was applied. This system allowed us to analyse how the materials were arranged in the subsoil vertically, whereas the profiling was mainly used to recognise side distribution of irregularities. This test pointed out the existence of a low resistivity layer, equivalent to the resistivity measure taken in the profiling campaign, its scope being nearly 2-3m, possibly a well, under which we detected certain materials of resistivity higher than 1,000-Ω.m, possibly rocky fillings or sandstone bedrock levels. In order to compare low and high resistivity materials located under the first ones and on their sides, a series of geoelectrical profiles were carried out. Increasing interelectrodic opening devices were used, as it was then impossible to excavate, since it is still located on a public path with right of way. First, a few profiles with four symmetric devices was done (profile 1a) with increasing interelectrodic openings (between 3 and 12 metres), and then the same profile was repeated (profile 1b) using a dipole-dipole mechanism of the same dimensions.

When we compared the data obtained in both tests we could see that, in depth, both levels of resistivity became similar creating an equivalent geoelectrical image, whereas, the asymmetric device provides us with more irregular results, more gradient between measurements on the surface. This led us to the conclusion that the minor surface irregularities exert a greater influence on asymmetric mechanisms, whereas those irregularities do not come out so clearly when symmetric devices intervene. In order to compare the observed shapes in this profile, another profile (profile 2) was done; this profile was taken 1 meter apart, this time using only the symetric mechanism. The geoelectrical images obtained from the two profiles were equivalent, where the materials with less resistivity formed a 2-3 metre-deep 'hole', which was a round-shaped form of about 10 metres in diameter. When we observed both tests we could recognise this form divided in two lobes by a central zone of higher resistivity, and we also observed the presence of a very high resistivity sandstone part, interwoven in every profile, on they right side, which had already been observed during the electrical profiling campaign. On the left side, we found high resistivity zones generated by the rocky fillings from the S and W lobes.