



The Pseudo-Archaeological Site of UFMG

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Abstract

To improve archaeological site studies one of the important aspects is to characterize the geophysical method response on it. To archeological survey it is important to detect the targets even before the excavation itself. In this project we will address the construction of a pseudo-archaeological site, which simulates actual sites found in the Zona da Mata Mineira – Minas Gerais State, Brazil. Such archaeological sites are characterized as indigenous and, many times, are ancient cemeteries. In order to simulate it as closely as possible, we use ceramic vases of various sizes, containing bones or just clay. So, the area can be surveyed by the geophysical methods like: GPR, magnetometers surveys and others, to obtain the geophysical signatures of those buried material.

Introduction

To enhance the studies of the archaeological site was taken into account the characterization the response obtained by the geophysical method. That is the kind of response when it is used GPR or another method to understand the area of the underground archaeological site.

There are articles about the contribution of geophysics in archaeological work. Borges (2007) pointed out the performance and reliability of geophysical methods when applied on targets with known physical properties. One of their lines of study simulated variations between different geological layers, soil disturbance, urns, and lithic paleo fires. Differently of the UFMG project, the others controlled sites, like Porsani *et al.* (2003) used ceramic vases whole without considering failures, fragments, and bones.

Hildebrand *et al.* (2002) discuss about the comparison between GPR and seismic reflection in a controlled archaeological site in the city of Champaign, USA. In this article it is emphasized the geophysical methods techniques applied on a wooden crypt buried with a pig inside. From these approaches were made diagnoses on the data obtained by geophysical techniques.

Besides the creation of sites checked, there are also several articles published that told about the integration of geophysics with archaeology. Cezar *et al.* (2001) showed the application of GPR in two archaeological sites, Serrano and Morro Grande, both in Rio de Janeiro. The research aimed to study the area, searching for artifacts of clay in different uses. The geophysical techniques were an important tool in the discovery, because the area was suffering from imminent destruction due to urbanization and mining.

The application of geophysics in archaeological sites has been important in developing research in this field. The method of reflection enables the construction of images of the subsurface, such as depth of buried bodies, their structures and positions within a site. One of the geophysical methods applied on the archaeological study is GPR (Ground-penetrating radar). It uses an electromagnetic waves that propagating through the soil into the subsurface, and its reflection on objects and structures that are buried allow the subsurface imaging.

Despite the many advantages of GPR due to its versatility and precision, sometimes its successful application is not easily obtained in field. It depends also on the studies *in situ*. The increase of data measurements trying to improve the subsurface imaging can make the survey costs grow up. The detailed analysis of specific objects and, of course, their geophysical signature, allow saving time and labor. So, to help the subsurface studies, the creation of pseudo-archaeological site would provide improvements on the understanding of trace materials in the subsurface, and consequently, the excavations would occurs on places that are really important. Indeed, this requires studies of the behavior of reflected waves on archaeological objects specifically and on its surroundings.

The importance of pseudo-archaeological site is the possibility to obtain the geophysical signatures of known objects placed in subsurface. These signatures can later be used as a typical response patterns for each type and form of material and thus assist in the study areas, where there is little knowledge of the subsurface, and areas where it is not recommended to use more destructive methods. In Brazil the Indigenous archaeological site consist, many of times, on cemeteries in which ceramics are commonly used as funerary urns. To achieve the objective of the project the pieces-target were buried to simulate features already found in Minas Gerais State. The construction of the site will therefore allow the understanding the response of these objects under a geophysical aspect. After analyzing the data obtained by

extrapolation to this research would facilitate the studies of the new archaeological site.

Method

For the construction of the pseudo-archaeological site it were based on the description of archaeological sites in the Zona da Mata, and in order to better simulation of these sites took into account the features of the ground, vegetation and geography for the choice of the area used.

The Zona da Mata is located in the southeastern portion of Minas Gerais State, one of its twelve mesoregions. The Mapping Project Archaeological and Cultural Zona da Mata Mineira showed that the region has much to offer in terms of information about pre-colonial history of Brazil. The choice of the region for insertion of pseudo-archaeological site was done by several factors, among them: the similarity of the ground and geographical conditions in the Zona da Mata, the ease of access (It is located on the campus of the UFMG) and the absence of local urbanization (Fig. 1).

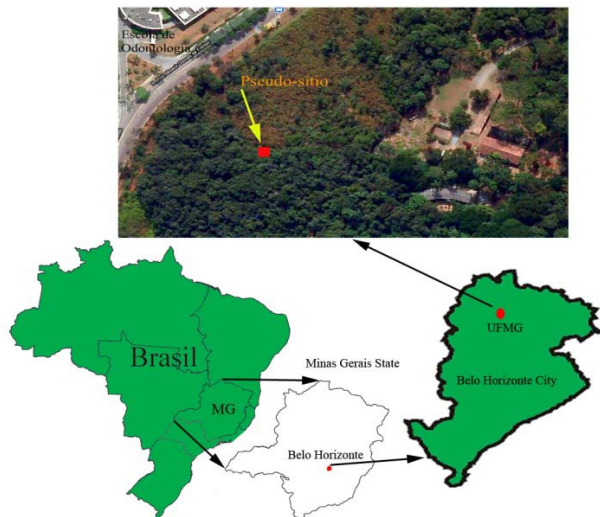


Figure 1 – Localization map of the UFMG pseudo-archaeological site

The Ecological Station of Universidade Federal de Minas Gerais is an urban conservation area with one hundred and fourteen hectares of vegetation that consists of typical semi-deciduous forests and savannah. It also presents a variety of native plant species. This scenario is ideal to test the behavior of the remains buried in front of the biome that is found (EC-UFMG, 2011).

Besides the soil of the region is composed by sandy and clay sediments, the most common class of soil in the area belongs to the group of Cambisols. The advantage of this local (Fig. 2), however, is partly because it remains geomorphologically in a dynamic equilibrium since last hundred years past.



Figure 2: Photo of the chosen area of the pseudo-archaeological site.

Results

After choosing the area, the opening of the ditch was made to locate the objects. The ditch has the following dimensions: three meters long by three meters wide and a meter and half deep. The volume chosen should be enough to put all the objects for study, however, not completely overlapping each other. The objects were placed in the ditch, taking the project in CAD format (Fig. 3) as a parameter, and there may be some variations in the positions of the pieces.

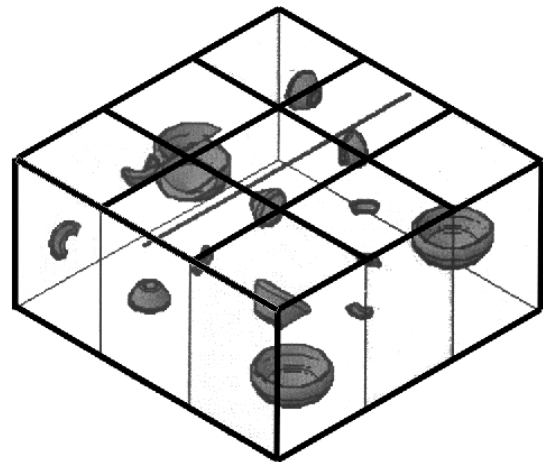


Figure 3: 3D Sketch of the pseudo-archaeological site project.

By using a digital theodolite, the topographic survey was performed together with its surroundings with the objective of obtain a local map. The selection of objects were based on archaeological and anthropological studies carried out at indigenous archaeological sites discovered in the Zona da Mata Mineira, in which pottery vases of various sizes were found, some of them containing bones, others containing only clay, and pieces of broken small containers. The selected pieces to compose the pseudo-archaeological site were characterized with aid of the archaeologist from the MAEA-UFJF. There are three dimensions of ceramic

pottery: small: 15cm height and 15 cm of radius; medium: 40cm height and 25cm of radius; big: 60cm height and 30cm of radius.

Those pieces were arranged on it, and they are unbroken and broken pottery vases of various sizes, filled or not with clay and bones (Fig. 4), in selected locations. Cattle bones were buried in a direct way to simulate the presence of bones in local, as usually founded in real archaeological sites. Small fragments of ceramic vases were still planted on the site to represent areas of disposals of broken urns, and also spread pieces of broken vases.



Figure 4: Photo of a ceramic vase with bones simulating a funerary urn.

We left a few roots of trees with the purpose to achieve a great similarity to the situation found in the real sites. Furthermore, these roots can be surveyed to obtain the response of the geophysical method for natural subsurface materials.

Following the closing of the ditch, another topographic survey was conducted with the aim of obtaining data representative of the actual position of the buried objects. These acquired data were used to generate the topographic plant of the pseudo-archaeological site (Fig. 5)

Conclusions

The creation of the UFMG pseudo-archaeological site for controlled testing is a project that seeks to improve the geophysical application on real archaeological sites. The patterns of archaeological site found so far in the Zona da Mata Mineira were well represented on the site created.

So this site will enable to characterize the signature pattern of the different buried pieces that is usually found in real archaeological sites by using the geophysical methods like: GPR, magnetometer survey, resistivity profile survey, and others.

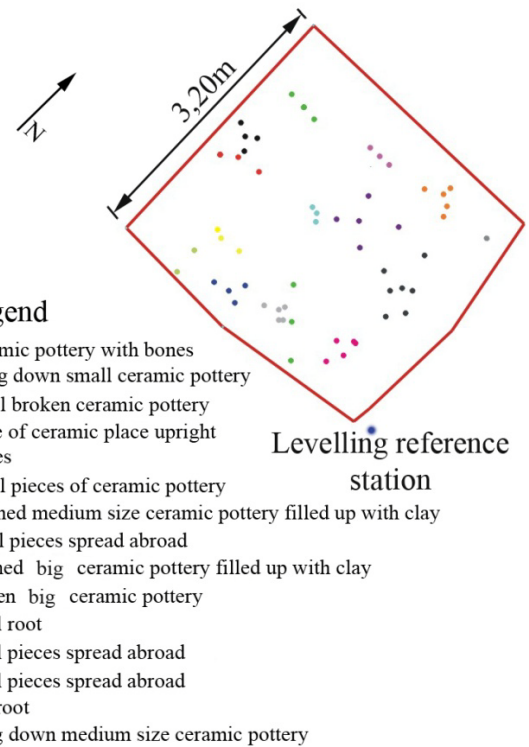


Figure 5: Map of the pseudo-archaeological site

Acknowledgments

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References

Porsani, J.L., 2003. Instalação de área para testes controlados de geofísica rasa no IAG/USP. In: III Workshop de geofísica aplicada à engenharia e meio ambiente. São Paulo: Édile Serviços Gráficos e editora Ltda.

Cézar, G.S.; Rocha, P.L.F.; Buarque, A. & Costa, A., 2001. Two Brazilian archaeological sites investigated by GPR: Serrano and Morro Grande. Journal of applied Geophysics, V.47.

Aranha, P.R.A., 2006. Possibilidades e limites da aplicação do geo-radar em arqueologia: Teixeira Lopes e Emílio Barão, Juiz de Fora, MG. In: Oliveira, A.P.P.L. (Org) Arqueologia e patrimônio da Zona da Mata mineira. Juiz de Fora: Editar, 2006.

Aragão, P.C.; Luiz, J.G. & Lopes, P.R.C., 2005. Metodologia geofísica aplicada a salvamento arqueológico de área adjacente a mineroduto no Nordeste do Pará. In: Congresso Internacional da Sociedade Brasileira de Geofísica. Salvador: 2005.

Conyers, L.B., 2004. Ground penetrating radar for archaeology. Series: Geophysical Methods for Archaeology. Altamira Press.

Oliveira, A.P.P.L., 2010. Movimentos e sentidos: arqueologia preventiva nos condutos do conhecimento. (Org.) Oliveira, A.P.P.L. Juiz de Fora: Ed. UFJF.

EC-UFMG, 2011. Estação Ecológica da UFMG, 2011. Belo Horizonte. Available in: < http://www.ufmg.br/estacaoecologica/index.php?option=com_content&task=view&id=12&Itemid=26 > Accessed: April, 16th, 2011.

Silva, G.I., 2011. Zona da mata de minas gerais. Available in: < <http://www.tratosculturais.com.br/zona%20da%20mata/univlercidades/geografia/index.htm> >. Accessed: April, 16th, 2011.

Oliveira, A.P.P.L., 2004. Arqueologia e patrimônio da zona da mata mineira: São João Nepomuceno. (Org.) Oliveira, A.P.P.L. Juiz de Fora: Editar.

Hildebrand, J.A., Wiggins, S.M., Henkart, P.C. & Conyers L.B., 2002. Comparison of seismic reflection and ground-penetrating radar imaging at the controlled archaeological test site. Champaign, Illinois, USA. 2002.

Borges, W.R., 2007. Caracterização geofísica de alvos rasos com aplicações no planejamento urbano e meio ambiente: Estudo sobre o sítio controlado do IAG/USP. 2007. 256p. Tese (doutorado) – Instituto de Astronomia, Geofísica e Ciências Atmosféricas, Universidade de São Paulo, SP.