



GPR geophysical investigations to guide archaeological research in the Santo Ângelo Custódio Jesuitic ruins (RS, Brazil)

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A number of thirty Jesuitic settlements were constructed in South America during the XVI and XVIII centuries. Seven of them are actually in southern Brazil (Rio Grande do Sul state). The Jesuitic settlements include the main church, a number of houses and offices, cemetery and external walls and its purpose was to convert into Christian the local Indians. These buildings are in different stages of preservations in each of the Jesuitic settlements. As the remains of Santo Ângelo Custódio, the last Jesuitic settlement to be built in South America, are buried under the modern city of Santo Ângelo, the best preserved remains unearthed are regarding its main church.

To carry constructions and reforms at Pinheiro Machado Square (Santo Ângelo county, RS, Brazil), in front of the actual Santo Ângelo church, Brazilian archaeological regulations demand a number of investigations for preservation and historical recovering purposes. In this way, a cooperation was developed between Universidade Regional Integrada do Alto Uruguai e das Missões (URI) and the Laboratory of Geological and Environmental Modeling (MODELAGE-UFRGS) in order to carry out a GPR geophysical investigation in the Santo Ângelo Custódio settlement.

The Ground Positioning Radar (GPR) is a non-invasive geophysical method, for high-resolution imaging of shallow surface structures. GPR enables to perform an identification of the constitutive layers of the sub-soil and any buried objects based on the principle of the propagation of electromagnetic (EM) waves and at enough contrast of electrical impedance between the studied materials. For the case of different un-earthed built architectural structures, as foundations and other building components, stones and brick pavements embedded in lateritic soils, the electrical properties contrasts are sufficiently high. The selected frequencies of 1000 and 500 MHz, enabling to carry out electromagnetic (EM) penetration at depths of 1.0-1.2 m and 3.0-4.5 m respectively. The EM wave propagate underground and are reflected and refracted according to the presence of dielectrical discontinuities established by the building structural remains and other objects.

The GPR geophysical survey covered an area of 17.000 m² in the top hill of the Santo Ângelo city, around the actual Santo Ângelo main church. It was possible to locate a large number of foundations of the buildings making part of the Santo Ângelo Custódio architectural complex; they include some remains of the ancient church, the school house, the cemetery and the “cabildo” - the administrative building for the tribal chief. The GPR survey, then, showed to be important in defining the most perspective areas for the archaeological excavations in the Santo Ângelo Custódio Jesuitic architectural complex. The excavations were performed through “archaeological windows” to access the buildings remains and objects. A number of archaeological objects of Jesuits and Guarani Indians were also found during excavations. They are still being cataloged and studied at the Nucleus of Archeology (URI).

The non-invasive method and the archaeological excavation do permit developments in different areas, increasing the cultural tourism in the region, and improving a variety of new researches in archeology and geophysics in the Rio Grande do Sul state (Brazil). The GPR survey and archaeological excavations also enabled the technicians to trace the new streets on the modern and historical town of Santo Angelo city.