Geophysical diagnosis in recharge area of the Guarani aquifer in the mountain range of Itaqueri, Ipeúna (SP)

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Abstract

The problem of the water crisis is a concern even in countries with large amounts of fresh water, such as Brazil. In the State of São Paulo, after the long period of drought in the years 2014 to 2015, the issue of water crises became the focus of several studies. Some of these studies propose the use of groundwater to avoid water crises, however many of them do not understand or ignore the hydrological processes of aquifer recharge and discharge. There is a large scientific gap regarding the hydrological processes of aquifers, and this deficit makes it difficult to plan the sustainable use of reservoirs. Understanding the recharge and discharge processes is essential to prevent problems related to aquifers and to better understand the exchange relationships between surface and underground reservoirs. Geophysical studies are used to study these hydrological processes, however there is little bibliography about the use of the Electrorestivity method in this type of study. The present work delimited an area close to the escarpment of the Cuesta Basáltica front in the municipality of Ipeúna (SP), in order to study the recharge and discharge processes using the Electrorestivity method and a stratigraphic survey. The chosen area is in an upwelling area of the Guarani Aquifer System (SAG), a place known to be important in the recharge of this transboundary aquifer. The stratigraphic survey was carried out by walking along the access road to the study area. In the geophysical survey, it was necessary to carry out 10 parallel lines of electrical tomography in Schlumberger arrangement. The measured resistivity values ranged between 5000 Ω.m and 20 Ω.m. Data collected in fields were processed and represented in two-dimensional and three-dimensional logarithmic models. With the correlation between stratigraphy and 2D models, it was possible to locate where the porous and fractured aquifers were located, as well as to relate the resistivity values with the rocks present in the area, which are: Basalts, Sandstones and Silicified Sandstones. The porous aquifer acts as a large reservoir, water is stored in it before flowing into the fractured aquifer below. The 3D allowed a better visualization of the presence of water in the geological framework, and the visualization of resistivity values in the dimensions. The 3D block model made it possible to visualize the water inside a large sandstone lens that flows towards the front of the Cuesta, and not to the reverse as expected. The joint analysis between geophysics and stratigraphy allowed us to understand the geological framework, its relationship with groundwater flow and hydrological processes. The work also reduces the gap in geophysical studies in the SAG and the use of Electrorestivity to understand the hydrological processes of aquifers.