

Preliminary characterization of groundwater in Las Tablas and surroundings

LUIS PEREZ¹, ALBERTO CABALLERO², JUAN JAEN³, CARMELO BAYARD⁴, MARINA ZORITA⁵, JUAN BENAVIDES⁶ & JOHN PIERSOL⁷

¹National Institute of Aqueduct and Drain (IDAAN); E-mail: luis_perez_m@hotmail.com

²Laboratory of applied isotope hydrology and geophysics, Panama University, Panama

³Characterization and Analysis of Chemical Structures

⁴Lab of water quality and air, Panama University

⁵Lab of Inorganic Chemistry

⁶SINAPROC

⁷Waterloo University, Canada

Abstract: The water exploration in the region of Las Tablas in the Republic of Panama is described. The region consists of volcanoclastic sediments and weathered volcanic rocks. The geological, geophysical and hydrogeological investigations were performed. The geophysical testing determined the presence of layers, which were recommended for drilling. The hydrogeological tests defined the direction of groundwater flow and the aquifer type.

Keywords: water exploitation, geology, hydrogeology, geophysics, hydrochemistry.

INTRODUCTION

The Las Tablas and Guarare regions are located in the prairie of the Cost in the Azuero peninsula of Panama. Since many years this area has been confronting with serious problem of getting potable water. These problems became the worst in the period when the so-called "Phenomenon of the kid" appeared. This phenomenon brought a lot of consequences such as an extending period of drought in the American Pacific.

The Phenomenon of the kid is known as abnormal water overheat in the Tropical Pacific, which caused many changes and an alteration in the hydrological cycle. These changes are manifested in the climate changes in a global level. In Panama this phenomenon produces an alteration in the constant raining – there is less raining in the areas located in the Pacific and Caribbean side. As a result the water wells that supply the citizens of Las Tablas and Guarare started to consume themselves. For this reason citizens and the economic of these areas have been affected.

The main goal of the presented research work was to isolate the favourable geological structures that could be refined with sufficient water during the drought periods or when the

Phenomenon of the kid appears. The negative effects of the described procedure were brought into the focus. Different methodologies were used to get objective purpose. They based on geological, hydrogeological, hydrological, geophysical and hydrochemical research methods.

RESULTS AND DISCUSSION

The kinematic evolution of the south area of the Azuero Peninsula has tried to explain how to interact the Panama bloc with the surrounding tectonic plaques. This theme has emerged as an interesting one because of the high rate of historical earthquakes and the existent topography along the Azuero Zone fault, which is included in the south-occidental of this Peninsula.

Eastern of the fracture of Panama the Nazca plaque is moving to the east and to the north-east. This moving is in an oblique form in a direction to the Azuero Peninsula. The following was deduced:

- 1) The Azuero Zone fault could be an extinction of the South Panama fault, in which the Zuerian Peninsula and Las Palmas (Sona) are included. It pounds characteristics of a fault that moves obliquely and right laterally.
- 2) The Nazca plaque is located under the Peninsula in the north-east direction and moves 35mm/year on an average. The volcanic rocks are predominated in the south. An igneous complex that is basic and ultra basic makes up the oldest rocks. It could be of a Mesozoic origin. The volcanic eruptions caused filter and andesitic, piroclastic and basaltic rocks until the Pliocene. In this period the volcanic activity has been successively reduced and disappeared in the Pliocene-Pleistocene period. Two sedimentary formations are presented. Ocu Formation consists of the limestone with the seaweed (aquatic plant, alga) and corals of the upper Eocene age. The second sedimentary formation is Continental Tobas of the Oligocene age and the Upper Lutitic-Arenacea formation.

The geology in the Las Tablas-Guarare area is represented by cluster and andesitic metamorphic rocks in the surface. According to the stratigraphy of some drill holes, which are maximally 92 m deep, strata in the area are: clay some places with mudstone (4-6 m), weathered and leached andesites (3 m), andesitic agglomerates (76 m), breccia-tuff and basalts as bassement. The rocks are of volcanic origin and could represent the layer of the water-bearing zone in exploitation.

The geophysical testing determined the presence of layers, which were recommended for drilling. The following methods were used: electro-resistant method, Schlumberger method, Wenner method and magnetic method.

The hydrogeological tests were performed in the boreholes. They defined the hydrogeological characteristics of boreholes, direction of groundwater flow and types of aquifers.

The physical-chemical parameters of groundwater were monitored in 22 boreholes. From representative boreholes the groundwater was also sampled for chemical analyses. Chemical data were studied by Piper and Stiff diagrams. The study of the conductivity variation with depth was also performed to identify the contamination by saline intrusion.

CONCLUSIONS

The results obtained with different research methods are:

- the groundwater refers to a fissured system where the groundwater cape is located in the metamorphic rock zone,
- the preferential groundwater flow depends on the evolution of fissured zones,
- the more productive boreholes are those located in fissured zones with more than one fissured system,
- two main directions of the groundwater flow were identified - NNE and NNW,
- according to the total hardness of the groundwater samples the groundwater should circulate through sediments of marine origin.

REFERENCES

- CAMACHO, E., SÁNCHEZ, L., TAPIA & COWAN, H. (1996): Seismic of the Azuero Region, Southwest Panama, Central America.
- DEL GIUDICE, D. & RECCHI, G. (1969): *Geology of the area of Proyecto Minero de Azuero*. Technical Report, Panama government.
- TRENKAMP, R., KELLOG, J., FREYMULLER, J. & MORA, H. (2002): *Wide Plate margin deformation, Southern Central America and Northwestern South America*. CASA, GPS observations.
- PARASNIS, D. S. (1997): *Principles of applied geophysics*, Fifth Edition. London: Chapman & Hall.
- UDIAS, A. & MESCUA, J. (1997): *Fundamentos de geofísica*. Madrid: Alianza Editorial.