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...YOUR GEOPHYSICAL NEWSLETTER

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Induced polarization - resistivity – spontaneous potential – magnetometry – electromagnetics - seismics – well-logging
MINING – GROUNDWATER – ENGINEERING - ARCHAEOLOGY

CHEERS!

Our geophysical activity commenced during the first years of the 1960 decade, mainly doing Electrical Resistivity studies for groundwater, under the guidance of our old friend S. Parker Gay, world-wide known geophysicist. In 1963 and in 1967 we took significant part in the discovery of the two most important Peruvian regional aquifers now in extensive production. Almost all other existing water wells have been drilled in alluvial free aquifers. The Zapallal and Capillune-Maure confined aquifers are an important source of water for populations, agriculture and mining. We would like to share with you some details of the extraordinary results obtained with routine application of vertical electric soundings to determine occurrence of the most promising horizons in Tertiary formations. An interesting feature of both discoveries was that all initial decisions were based solely on geophysical interpretations, with geological participation following the discovery test holes.

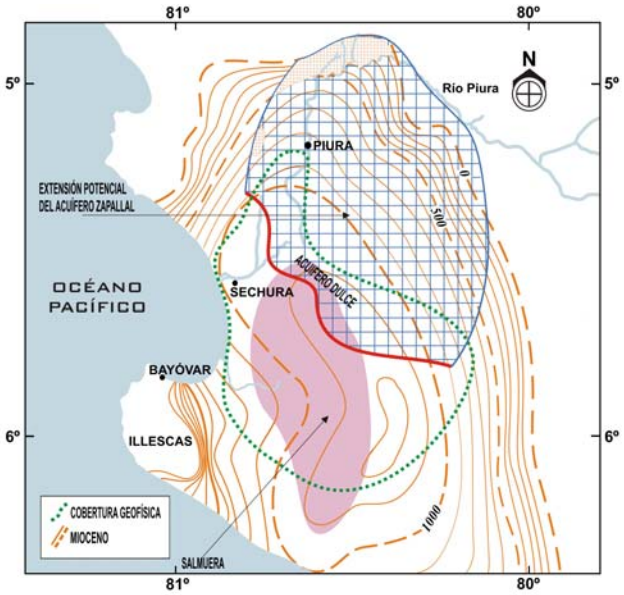
José R. Arce

INSTRUMENTS

The Zapallal and the Capillune-Maure aquifers were first studied with locally built resistivity equipment, energized with dry-cell batteries, with up to 600VDC and 3A maximum outputs.

ZAPALLAL

The Sechura desert in northern Perú extends from 5°S to 6.5°S and from 80°W to 81°W, almost totally covered with the Zapallal marine formation of Tertiary age, and with a relatively thin sand overburden. Although lithology is mostly clayey with phosphate-rich beds, there is a neat sand horizon that carries fresh groundwater, recharged at the Andes foothills along the eastern border of the tertiary basin. High salinity water saturates the entire formation but the sand layer has been washed out and fresh water is now moving westwards until reaching a north-south limit where a change of facies has caused the disappearance of the sand horizon.



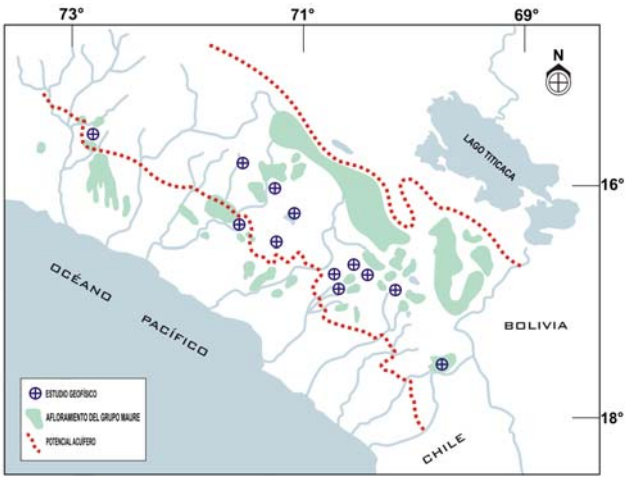
Brackish and salt water then saturates all the Zapallal. Application of 281 vertical electric soundings in eight surveys (1963 to 2006) with the Wenner array, chosen to overcome the prevailing low resistivities, provides information to trace the fresh-brackish-salt limits and determines appropriate drilling depths.

The map shows the following information: Miocene basin that includes the Zapallal formation, the brine reservoir area, geophysical coverage, fresh-water occidental limit determined with electrical soundings, and probable extension of the Zapallal aquifer.

CAPILLUNE-MAURE

The Cuajone porphyry-copper deposit was being subjected to final studies in 1966 by Southern Perú Copper Corporation, when they found that the existing surface water supply for the Toquepala mine, thought to be adequate for all three copper projects (including Quellaveco), was barely sufficient for the first operation. Sea water desalination feasibility study determined that an additional multimillion dollar project was needed. A Resistivity survey, intended to provide elements to improve surface drainage to Lake Suches, the main water reservoir of the entire system, found that shallow saturation did not occur in selected channels for a drainage network, and it was decided to run vertical tests with Resistivity soundings. Presence of interesting values at several sites suggested that regional prospective conditions justified drilling of an exploratory borehole. Impressive water pressure was detected in this test hole that penetrated a series of volcanic/sedimentary beds, later found to belong to the Capillune formation of the Maure Group. Many more water wells have been drilled and are under pumping at the present time, providing water to both Toquepala and Cuajone.

Between 1967 and 2001, we executed 949 vertical electric soundings in 12 surveys, in the region extending from 15.5°S to 17.7°S and 69°W to 73°W. With available public geological information it is now considered that the aquifer potential cover an area of some 300km by 100km in Peruvian territory, with possible continuation into Bolivia and Chile.



Until next time...

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