A BOREHOLE GEOPHYSICAL LOGGING

bore·hole log \ ‘bō(ə)r-,hōl log \ *n* **1**: A graphic presentation of physical properties of a deep hole of small diameter.

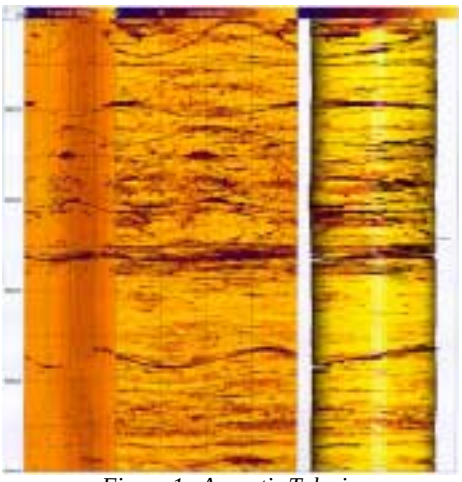

Figure 1: Acoustic Televiewer

"The objective of a well planned borehole geophysical survey is to obtain more information from a well than can be obtained from drilling, sampling and testing" (W. Scott Key, 1989). Implementing this mission is a challenge that SAIC is ready to meet by applying state-of-the art geophysical equipment and methods to each project. By inserting sensitive instruments into a wellbore, SAIC can improve your understanding of the subsurface. Costs for water resource development, contamination cleanup, or construction demonstration can be significantly reduced.

Borehole geophysical surveys provide an independent evaluation of borehole diameter, stratigraphy, and water-bearing zones, in addition to aquifer and well construction characteristics. This information may not be apparent during well drilling, or there may be no geological records available. Borehole logging is the only way to make many in-situ measurements. Some of the logging methods and measured parameters normally investigated are presented in the following text.

Natural Gamma - This probe measures the total count rate of natural gamma radiation. Natural gamma logging is utilized for identification of soil and rock lithology, stratigraphic correlation, and relative porosity of soil and rock based upon naturally radioactive clay content. Natural gamma logs can be run in any borehole conditions (steel or PVC casing).

Spontaneous Potential (SP) - An SP probe measures the voltage developed as a response to electrochemical effects of differences in borehole fluid and oxygen reduction of minerals. Movement of pore fluids also produces voltages. SP logging is utilized to identify soil and rock lithology, stratigraphic correlation, and fracture detection in rock. SP must be run in fluid-filled, uncased boreholes.

Single Point Resistance - The single point resistance probe measures the electrical resistance of soil, rock, and pore fluids. This type of logging is utilized for identification of soil and rock lithology, stratigraphic correlation, and fracture detection in rock. Single point resistance logs must be run in fluid-filled, uncased boreholes.

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Advantages

- ✓ **Well Construction Evaluation**
- ✓ **Bedrock Fracture Location and Orientation**
- ✓ **Mineral Content Evaluation**
- ✓ **Lithologic Characterization**
- ✓ **Characterization of Confining Units**
- ✓ **Void Identification**
- ✓ **Vertical Characterization of Conductive Plumes**
- ✓ **Stratigraphy Correlation**
- ✓ **Water-Bearing Zone Identification**
- ✓ **In-Well Fluid Flow Measurement**
- ✓ **In-Situ Porosity**
- ✓ **Borehole Rugosity**

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Caliper - A caliper measures the diameter of borehole or casing. Caliper logging is utilized to measure borehole or casing diameter for corrections to other logs and measurements. The caliper provides information on fracture identification, lithologic changes, and well construction. Caliper logs can be run in any borehole conditions.

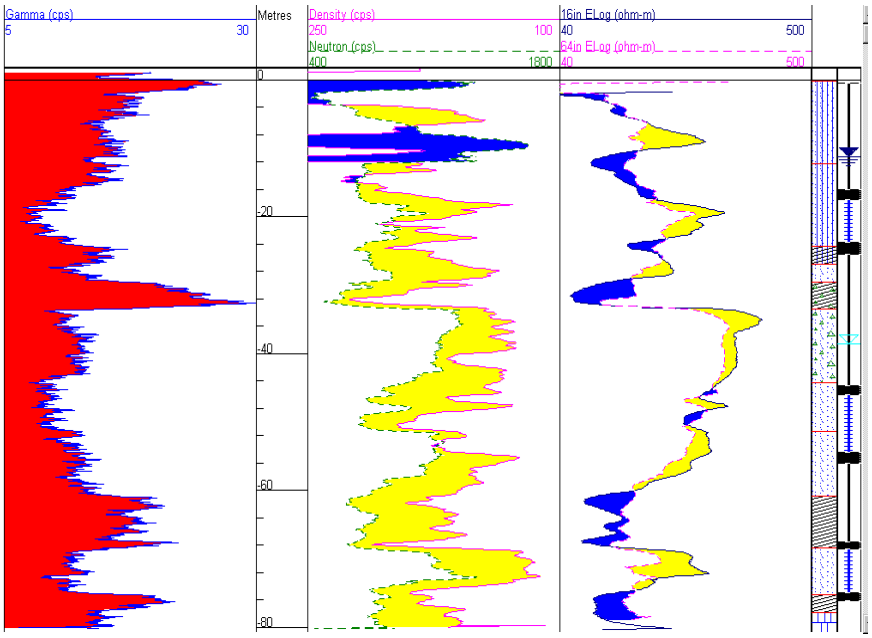
Temperature - The temperature probe measures the temperature of borehole fluids. Temperature logging is used to locate permeable or fracture zones by detecting temperature changes caused by movement of water in or out of boreholes. This log is also used for temperature corrections to other logs and measurements. Temperature logs must be run in fluid-filled boreholes.

Fluid Conductivity - A fluid conductivity probe measures electrical conductivity of borehole fluids. This provides a measure of borehole fluid and specific conductance (total dissolved solids); an assessment of movement of water into or out of the borehole, thus locating permeable or fracture zones; and a determination of the saltwater interface. The fluid conductivity probe must be used in a fluid-filled well.

Induction - An induction probe measures the bulk electrical conductivity of soil, rock, and pore fluids; and magnetic susceptability. Induction logging allows identification of soil and rock lithology and stratigraphic correlation. Clay content is indicated by conductivity. Porosity may be estimated based upon fluid content, and contaminants may be measured based upon fluid conductivity. Induction logs can be run in fluid-filled or dry, open, or PVC-cased boreholes. Metal casing causes interference.

Resistivity - The resistivity log measures the electrical resistivity of soil, rock, and pore fluids. Resistivity logging allows identification of soil and rock lithology and stratigraphic correlation. Also, clay content may be measured based upon resistivity, and porosity may be estimated based upon fluid content. Contaminant level in soil and rock can be measured based upon fluid conductivity. Resistivity logs must be run in fluid-filled, uncased boreholes.

Borehole Camera - The borehole camera provides a visual image of a borehole or casing. Borehole camera logging can be used for identification of lithology; location of fracture cavitities; and inspection of piezometers, wells, or structure. Borehole camera logs can be run in any conditions but work best in clear fluid- or air-filled boreholes with clean walls.



SAIC has found borehole logging to be a valuable tool in characterizing subsurface conditions. Information obtained from borehole logging has saved significant amounts of cost to the client by delivering a more comprehensive evaluation of the subsurface.

An introduction to borehole logging can be found on the World Wide Web at:

http://ny.usgs.gov/projects/bgag/intro.text.html

For More Information, Contact:

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