Resistivity

Introduction

- The first logging tool was the one that used to measure the resistivity of Formation
- It was modified from the electric method used in geophysics as electrical survey on the surface of the land.
- The first electrical log run in1927 by Marcel and Conrad Schlumberger. It was the downhole adaption for the pole dipole method.

Evolution of electric logs with history

- Electric log
- Lateral log
- Induction log
- Microresistivity loge
- Array induction log
- 3d induction log
- Dielectric log
- Micro resistivity imager log
- Cased hole Resistivity log

Electric logs

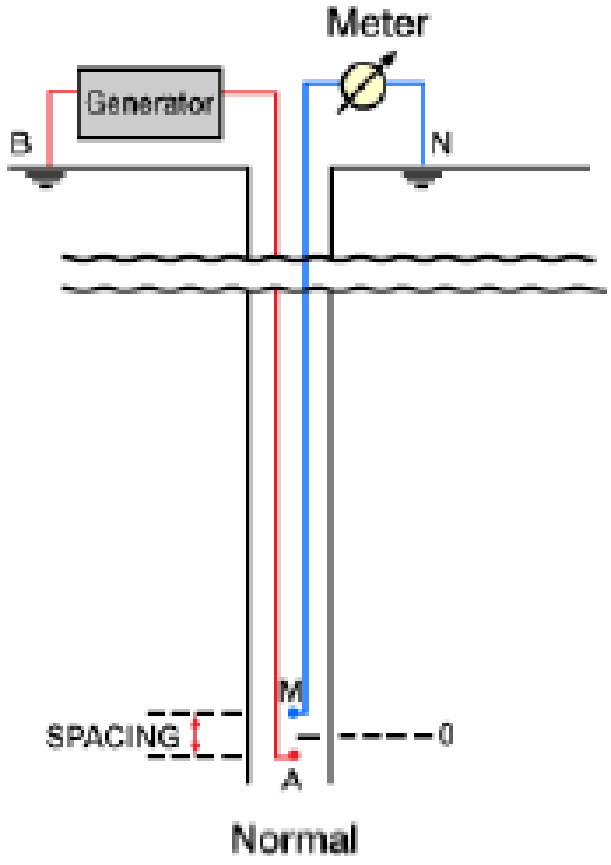
Normal device

- Current pass from A to B
- Measuring electrode will measure the potential between M and N
- AM is electrode spacing
- Similar to Pole-pole geomatry

Lateral device

The current pass from A to B

The measuring electrod will measure downhol.



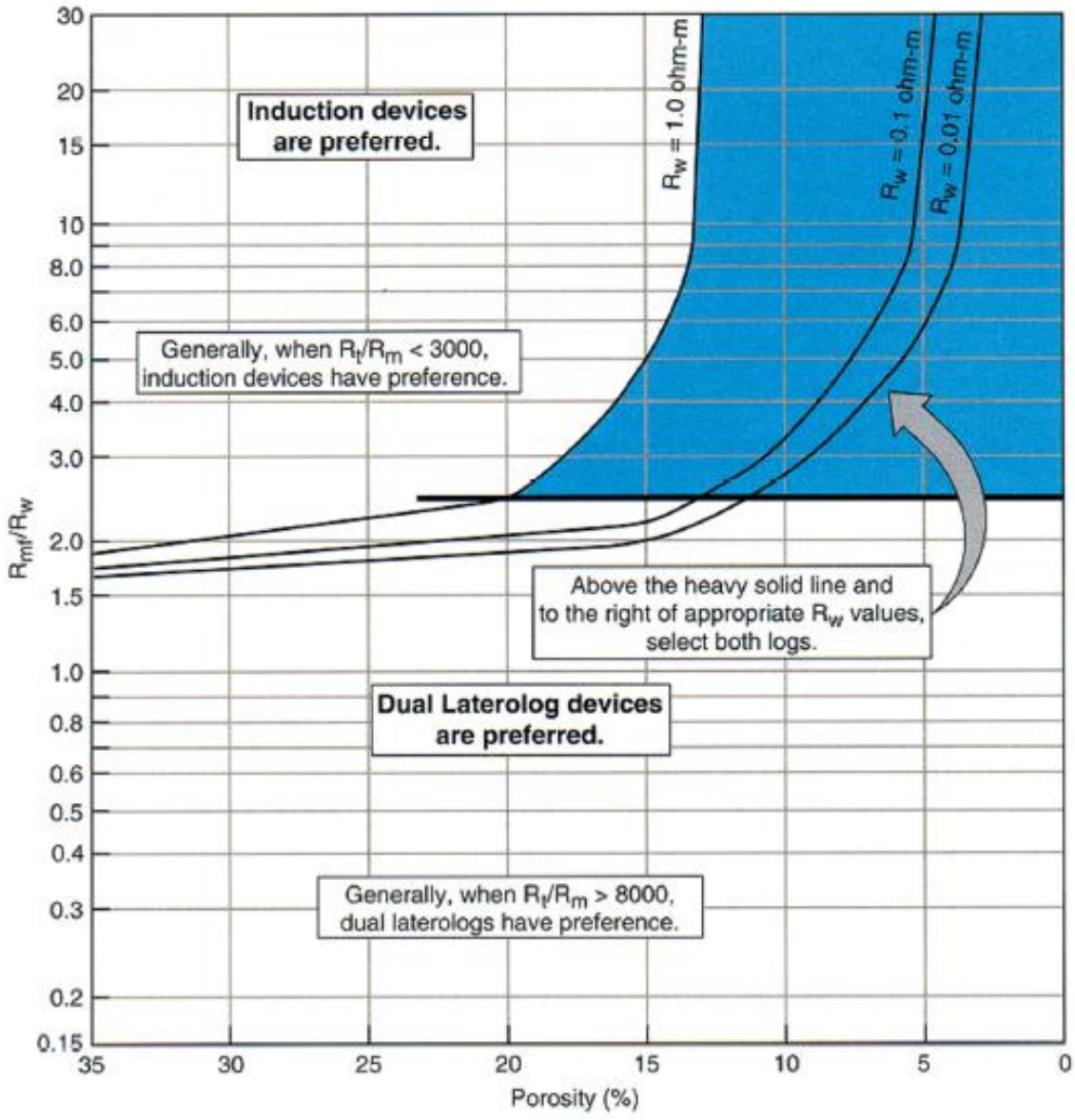
Lateral logs

- Conrad put forward the idea of using 2 guarded electrode in an attempt to improve to improve the electrical log in the time that had undesirable borehole effect.
- Lateral log will work when

1- there is brine or sea water in the hole

2- The Rmf/Rw is less than 3

3- Hole size is less than 16in.



LL3 and LL7

- Electric potential is constant all over the bar,
- The current line will run horizontally in the formation
- The center bar is the focused electrode
- The upper and lower bars are the gaurd electrode/

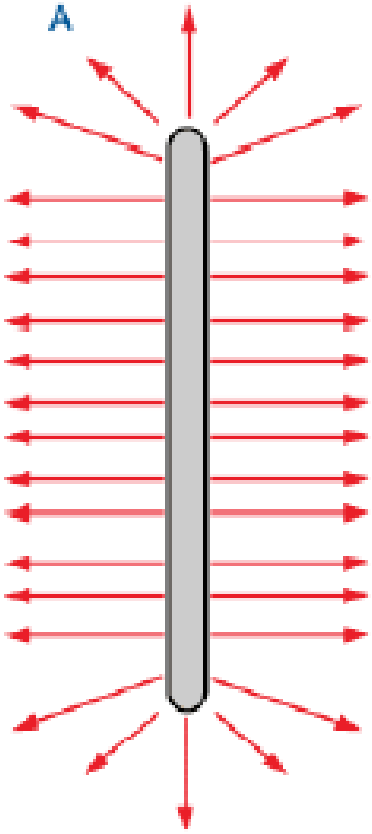
LL7:

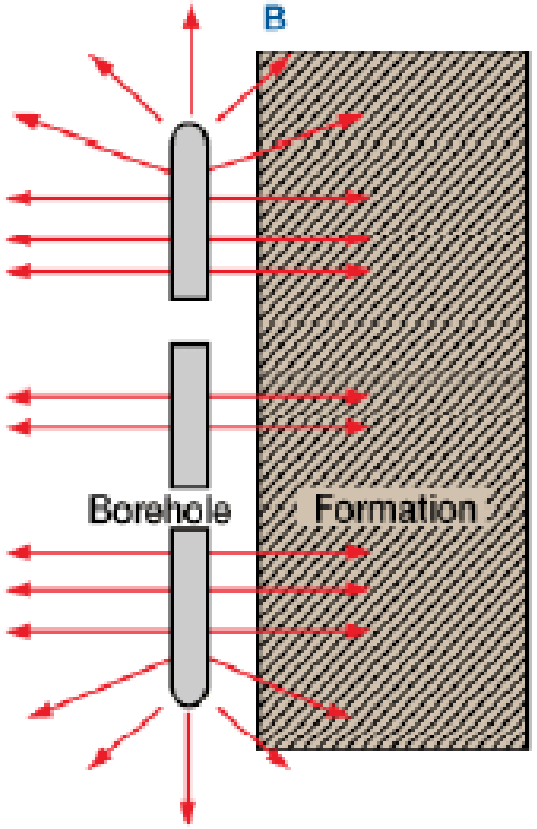
Same design of LL3,

The 2 elctrode that send current also used to measur potintial

2 pair of potintial measuring electrode added

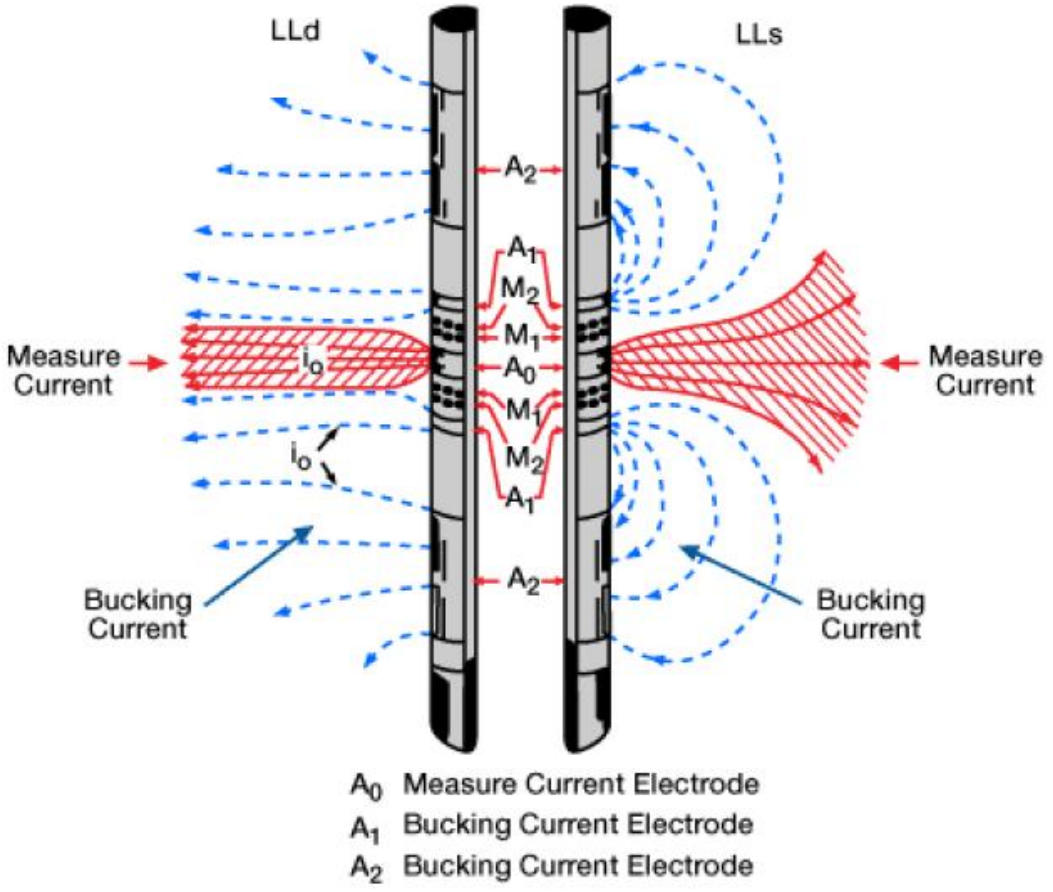
This arrangment to ensure to penterate the invaded zone and improved the measurment of resistivity of the uninvaded zone.





Dual Lateral log

- Combination of LL3 and LL7
- Measure LLd and LLs
- 7 electrode in the center and 2 large bucket electrode positioned above and below the 7
- LLd measurement done by sending surveying current from middle electrode and gurded by the upper and lower electrodes
- LLs / measurement, the bucking current flow from A1 to A2 ubove and below to reduce the depth of investigating
- These 2 measurement are done alternatively using different frequencies.
- Also the Dual laterologs have Micro resistivy log to measure the Rxo zone and the mud cake.



Induction logs

- It works when there is resistive fluid in the borehole.
- There is one transmitter coil and 2 receiver
- The transmitter coils send magnetic field that induce current in the formation. This current will induce current in the reciever coil.

Correction for Rt or Tornado chart

High-Resolution Azimuthal Laterolog Sonde (HALS)

Formation Resistivity and Diameter of Invasion—Open Hole