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TOPIC:- BOREHOLE LOGGING

SUBMITTED BY-

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Disclaimer:

This presentation is a part of the assignment for MSc III Semester Mineral Exploration theory paper. This is an attempt to enable the students to collect and review the literature, prepare powerpoint presentation and present the work, independently. The data and literature used here has been taken from various sources, and duly acknowledged. This can help as a guideline, and should not be treated as final.

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BOREHOLE LOGGING

Well logging, also known as borehole logging is the practice of making a detailed record (a well log) of the geologic formations penetrated by a borehole. The log may be based either on visual inspection of samples brought to the surface (geological logs) or on physical measurements made by instruments lowered into the hole (geophysical logs). Well logging is performed in boreholes drilled for the oil and gas, groundwater, mineral and geothermal exploration,

METHODS

[1] RESISTIVITY LOGGING

[2] SPONTANEOUS POTENTIAL LOGGING

[3] RADIATION LOGGING

[3A] NATURAL GAMMALOGGING

[3B] GAMMA-GAMMA LOGGING

[3C] NEUTRON LOGGING

[4] CALIPER LOGGING

[5]TEMPERATURE LOGGING

[6] MISCELLANEOUS LOGGING

[6A] TELIVISION LOGGING

[6B] SONIC LOGGING

[6C] CASING LOGGING

1 RESISTIVITY

Resistivity logging measures the sub-surface electrical rasistivit , which is the which is the ability to impede the flow of electric current. This helps to differentiate between formation filled with salty water [good cunductuors electricity] & those filled with hydrocarbons [poor conductuors of electricity]

This using 4 Electrodes ,2 for emitting current & 2 for the potential measurement ,constitute the system recorded curves are termed normal or lateral [depending on the electrode arrangement]

Normal :- effective spacing is considered to be the distance ***AM***

Lateral :- taken as the distance ***AO*** [one point ***A*** & second point midway between the electrodes ***M*** & ***N***]

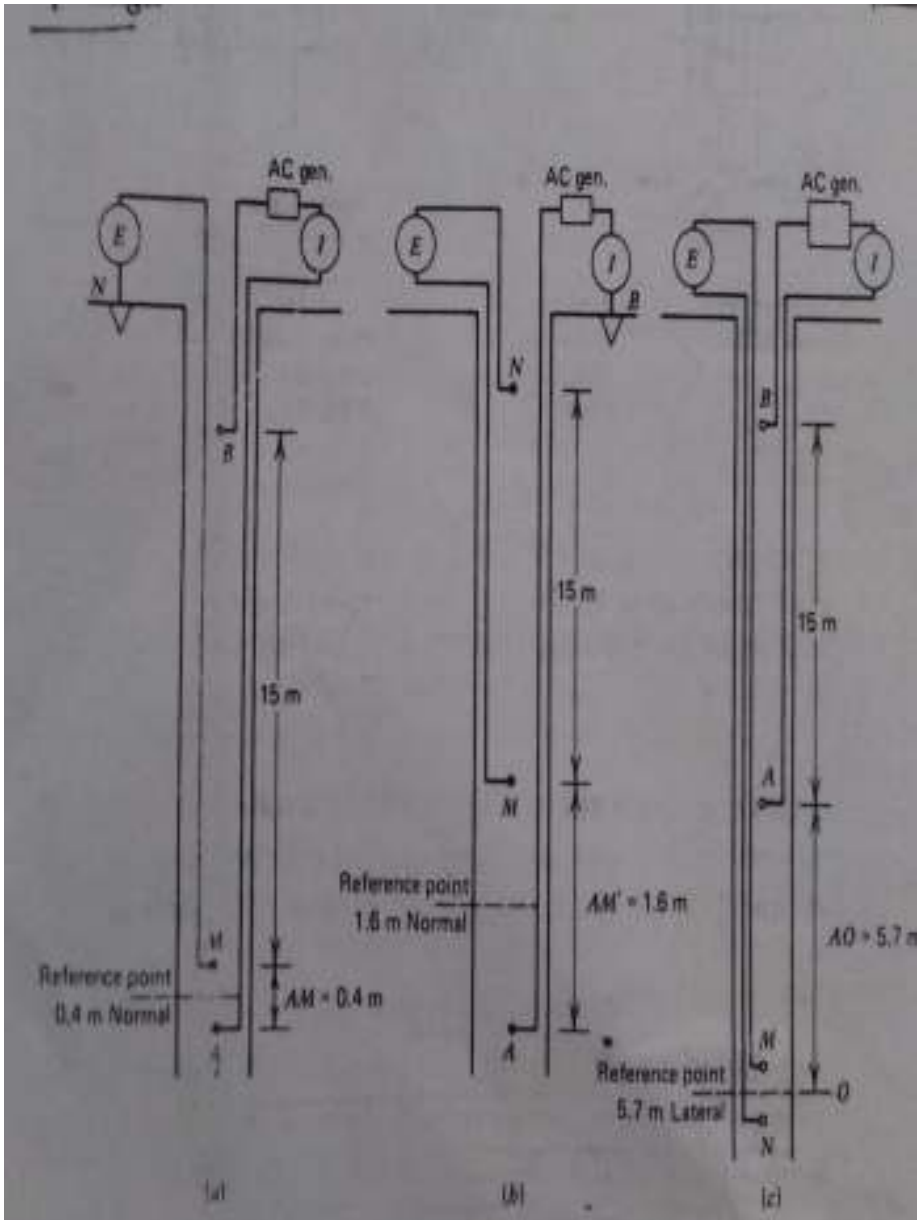


Fig. 12.5 Typical electrode arrangements and standardized distances for resistivity logs. (a) Short normal. (b) Long normal. (c) Lateral (after Keys and MacCrary[27]).

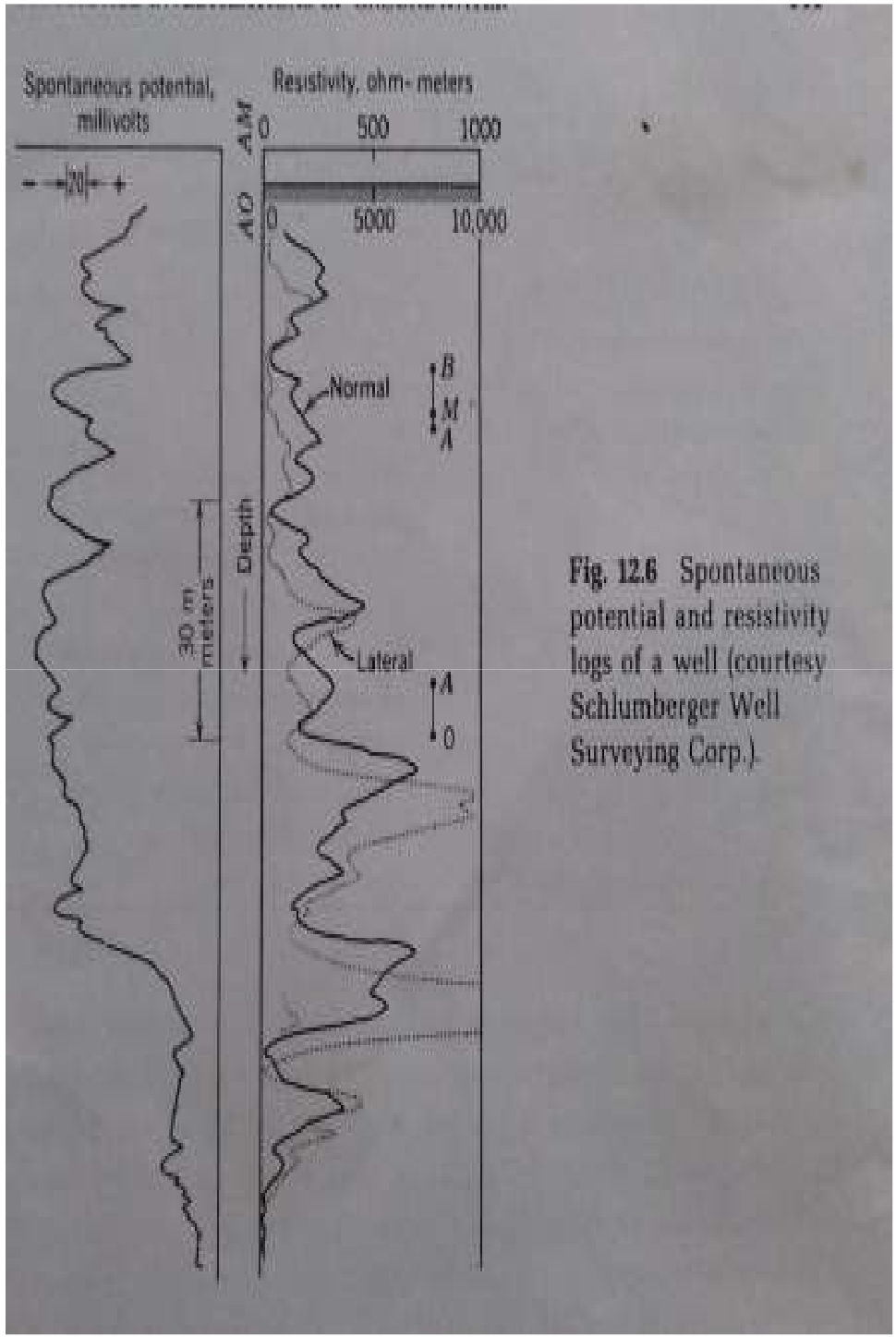
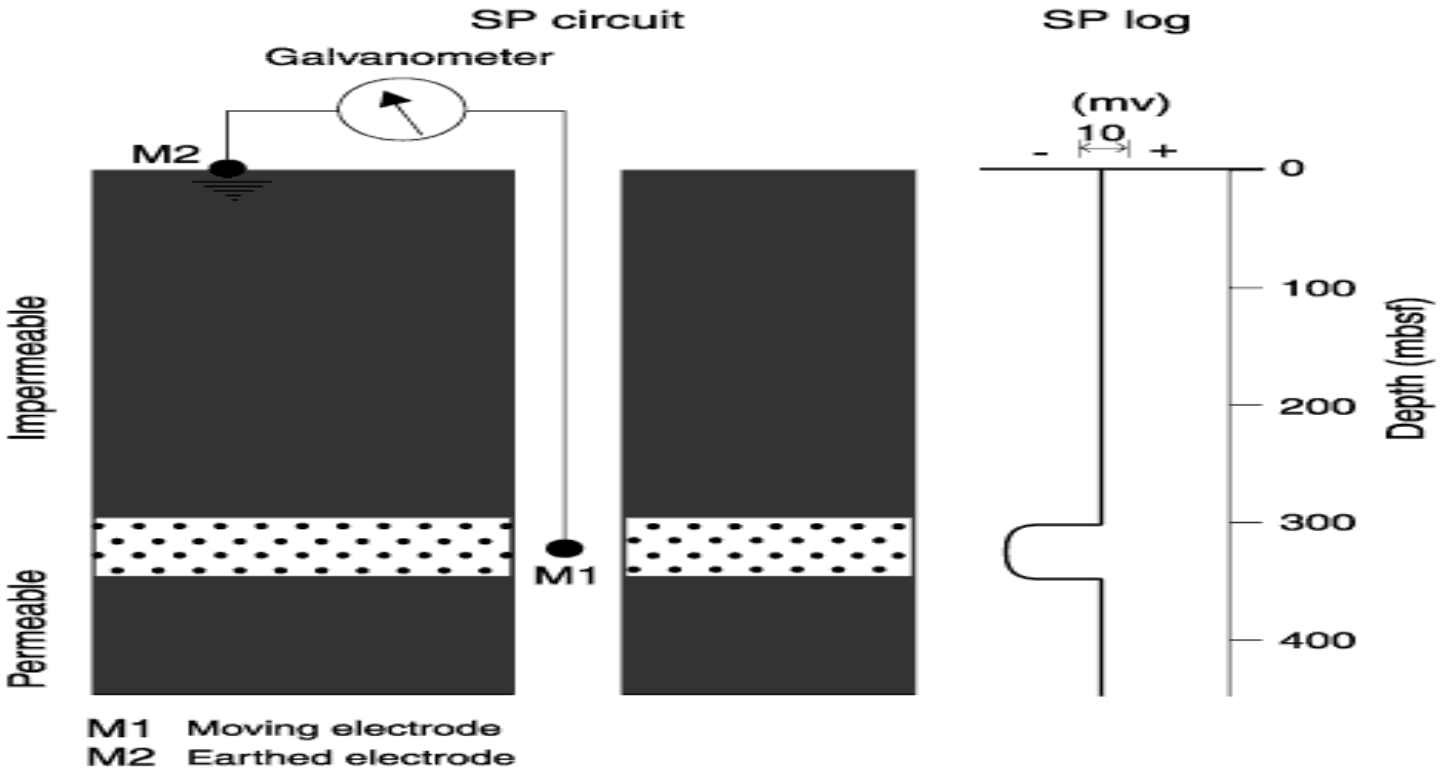


Fig. 12.6 Spontaneous potential and resistivity logs of a well (courtesy Schlumberger Well Surveying Corp.).

2 Spontaneous potential logging:- Commonly called the seif potential log or SP log is a passive measurement taken by oil inductry well loggers to characterise rock formation properties.

The spontaneous potential method measures natural electrical potentials found within the earth. Measurements usually in milivolts are obtained from a recording potentiometer connected to two like electrods one electrode is lowered in an uncased well and the other is connected to the ground Surface .



3 Radiation logging :- **also known as nuclear or radioactive logging. involves the measurement of fundamental particles emitted form unstable radioactive isotopes**

Type :- 3 types namely 1 natural gammal logging 2 gamma gamma logging

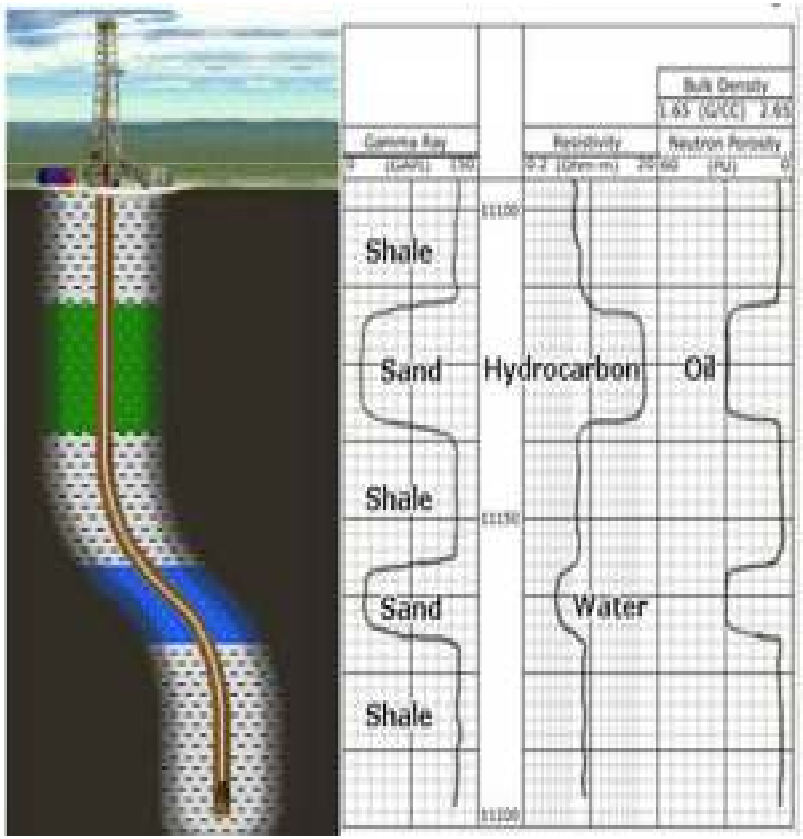
Groundwater exploration
Subsurface geophysical methods
Radiation logging

Natural-Gamma logging

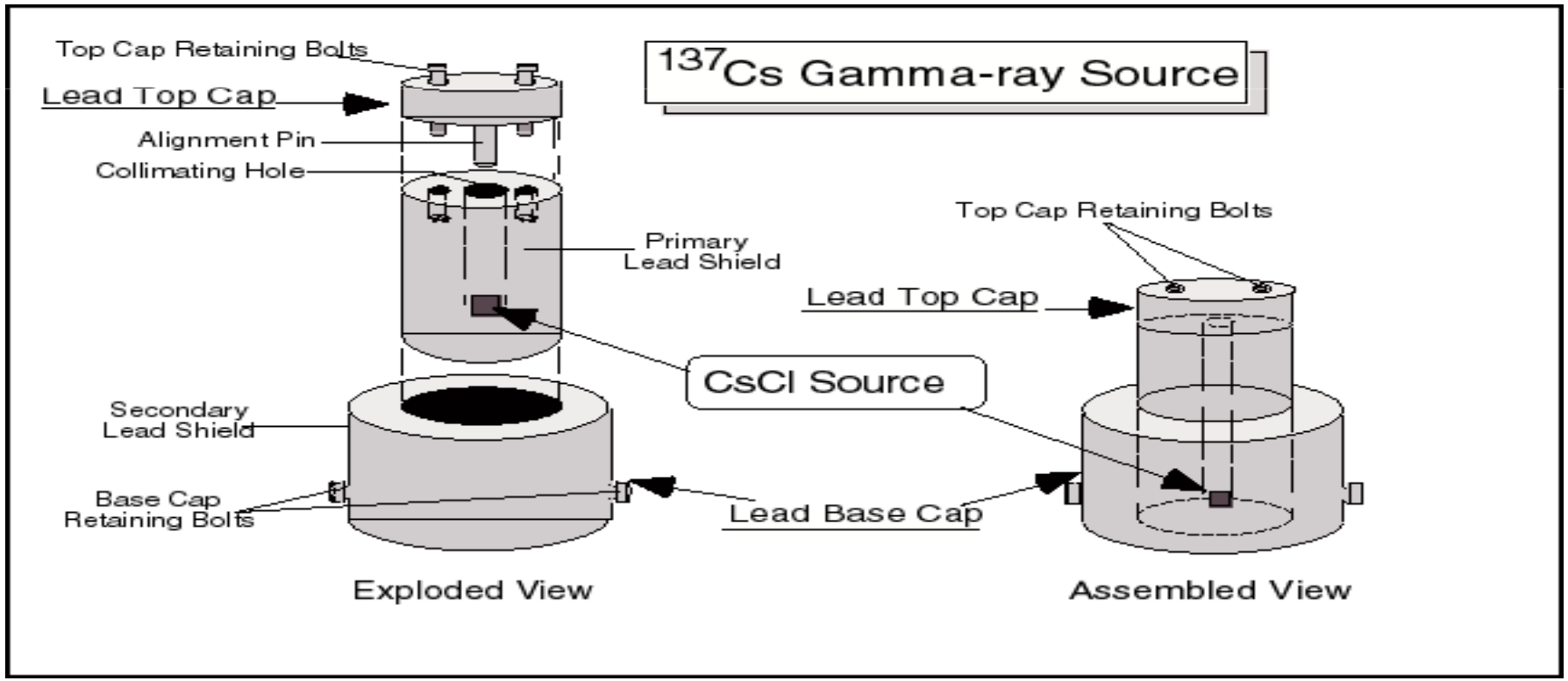
♦all rocks emit natural gamma radiation originating from unstable isotopes (potassium, uranium, and thorium)

♦Clayey formations (shale, clay) emit more rays than gravels and sands.

♦Can be used to differentiate between sand, clay and gravel (this is identifying lithology, the primary application)

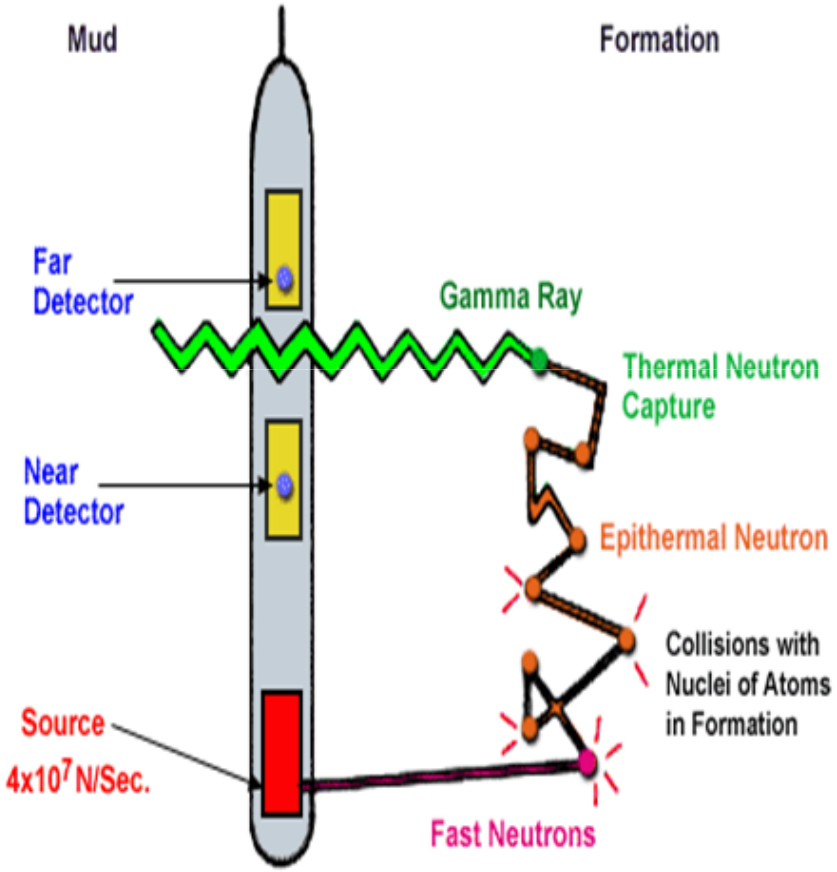


Gamma gamma logging:-gamma gamma logging originating form a source probe and recorded after it is backscattered and attenuated within the and surrounding constituted gamma gamma logging. The source probe generally contains **cobalt-60 or cesium-137**



Neutron Logging

- The Neutron Log is primarily used to evaluate formation porosity, but the fact that it is really just a hydrogen detector should always be kept in mind
- It is used to detect gas in certain situations, exploiting the lower hydrogen density, or hydrogen index
- The Neutron Log can be summarized as the continuous measurement of the induced radiation produced by the bombardment of that formation with a neutron source contained in the logging tool which sources emit fast neutrons that are eventually slowed by collisions with hydrogen atoms until they are captured (think of a billiard ball metaphor where the similar size of the particles is a factor). The capture results in the emission of a secondary gamma ray; some tools, especially older ones, detect the capture gamma ray (neutron-gamma log). Other tools detect intermediate (epithermal) neutrons or slow (thermal) neutrons (both referred to as neutron-neutron logs). Modern neutron tools most commonly count thermal neutrons with an He-3 type detector.



Temperature logging :-**ordinarily temperatures will increase with depth in accordance with the geothermal gradient ,amounting to roughly 3 C for each 100 m in depth.departures from this normal gradient may provied information on circulation or geologic conditions in the well.abnormally cold temperatures may indicates the presence of gas or ,in deep well , may suggest recharge from ground surface .likewise,abnormaly warm water mayoccur from water of deep seated origin. Temperatures may indicate waters from different aquifers intersected by a well.**

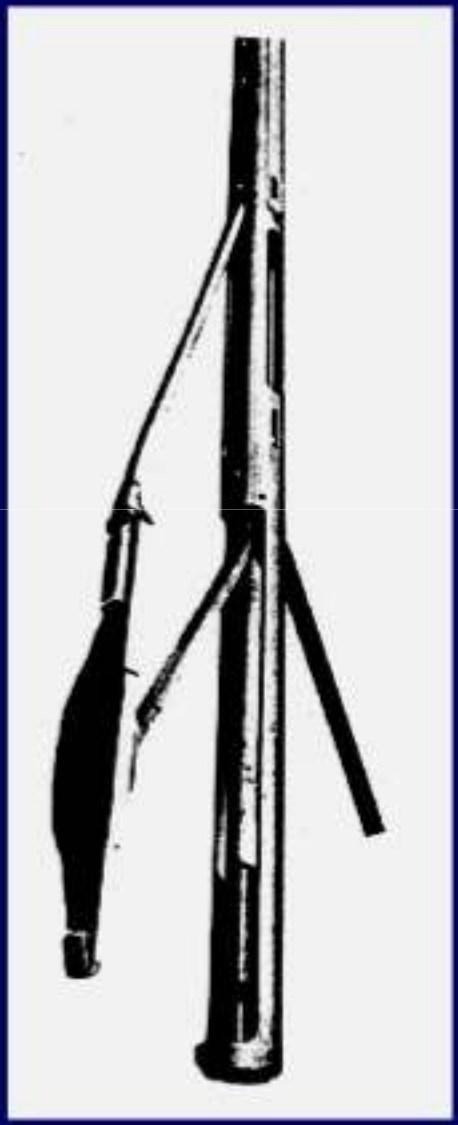
Caliper Logs

What Do They Measure?

Size and shape of a recently drilled hole.

How Do They Work?

- Mechanical arms record hole size
- Hydraulic systems with calibrated potentiometers.



How Are They Used?

- Hole size used to correct other logs
- Hole volume for cementing
- Lithologic information
  - washouts indicative of formation properties
- Stress field from hole break-out

Miscellaneous:- **1 TELEVISION**

2 SONIC

3 CASING LOGGING

THANK YOU