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# Estimation of Spontaneous Potential of Borewell and Its Application in Real Life

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**ABSTRACT:** Current work had been taken in to account for Determination Of Spontaneous Potential Of Borewell in the state of Telengana (India). The purpose of this experiment is to study the potential differentiation characteristics of an open well.. This determination will be accomplished by using an electrical resistivity meter. The potential of borewell surface varies with depth at different areas; by finding out the potential difference using electric resistivity meter we can find out the nature of formation evaluation of soil. This current work over the importance of spontaneous potential logging technique in drilling technology with the help of case study from Lords Institute of Engineering & Technology.

**KEYWORDS:** Consolidated Rocks, Probes, Winches, Weathered Rocks.

## I. INTRODUCTION

### 1.1 Spontaneous potential:

Spontaneous potential (SP), also called self-potential, is a naturally occurring electric potential difference in the Earth, measured by an electrode relative to a fixed reference electrode. Spontaneous potentials are often measured down boreholes for formation evaluation in the oil and gas industry, and they can also be measured along the Earth's surface for mineral exploration or groundwater investigation. The phenomenon and its application to geology was first recognized by Conrad Schlumberger, Marcel Schlumberger, and E.G. Leonardon in 1931, and the first published examples were from Romanian oil fields.

Spontaneous potentials (SP) are usually caused by charge separation in clay or other minerals, due to presence of semi-permeable interface impeding the diffusion of ions through the pore space of rocks, or by natural flow of a conducting fluid through the rocks.

The most useful SP component is the electrochemical potential, since it can cause a significant deflection opposite permeable beds. The magnitude of the deflection depends mainly on the salinity contrast between borehole and formation fluid, and the clay content of the permeable bed. The SP log is therefore useful in detecting permeable beds and to estimate formation water salinity and formation clay content. Due to the nature of the electric current, SP can only be recorded in conductive mud.<sup>[3]</sup>fuel).[7]

### 1.2. Spontaneous Potential Log

The SP curve is a continuous recording vs. depth of the electrical potential difference between a movable electrode in the borehole and a surface electrode.<sup>[1]</sup> Adjacent to shales, SP readings usually define a straight line known as the shale baseline. Next to permeable formations, the curve departs from the shale baseline; in thick permeable beds, these excursions reach a constant departure from the shale baseline, defining the "sand line." The deflection may be either to the left (negative) or to the right (positive), depending on the relative salinities of the formation water and the mud

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filtrate. If the formation-water salinity is greater than the mud-filtrate salinity (the more common case), the deflection is to the left.

The relevant features of the SP curve are its shape and the size of its departure from the shale baseline. Because the absolute reading and position of the shale baseline on the log are irrelevant, the SP sensitivity scale and shale-baseline position are selected by the logging engineer for convenience. The SP log is typically scaled at 100 mV per log track. If the resistivities of the mud filtrate and formation water are similar, the SP deflections are small and the curve is rather featureless. An SP curve cannot be recorded in holes filled with nonconductive muds, such as oil-based muds (OBMs). Deflections of the SP curve are the result of electrochemical and electrokinetic potentials in the formations that cause electric currents to flow in the mud in the borehole. <sup>[2]</sup>

### Shape of the SP curve

The slope of the SP curve is proportional to the intensity of the SP currents in the borehole at that depth. Because the current intensity is highest at the boundaries of the permeable formation, the slope of the SP curve is at a maximum, and an inflection point occurs at these bed boundaries.

## II. EQUIPMENT USED

### 2.1 Electrical resistivity meter

Electrical resistivity meter is a device used for geophysical exploration methods. The basic parts of resistivity measurement system includes a source of electrical current, a voltage measuring system and cables to connect these components to the electrodes



Fig 1. Electrical resistivity meter

### 2.2 Winches



Fig: 2 Winches

A Winch is a mechanical device used to pull in or let out or adjust the tension of a wire or a rope in its simplest form it consist of a spool and attached hand crank.

### 2.3 Probes

It is usually an iron rod with a pointed metal tip for making electrical contact with a circuit element being checked. In SP Logging we use a ground probe and a surface probe in order to check the potential difference.

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Fig.3 Probe

### III. PROCEDURE

1. Set up the configuration for well logging properly.
2. One probe of voltmeter is placed 4-5m away from borewell surface.
3. Second probe is dipped into the borewell by connecting it with winches.
4. Make sure the probe touches the inner surface of borewell.
5. Potential readings are shown in the resistivity meter when it touches the surface.
6. The potential value at ground level is null.
7. Take the potential readings for each 2m depth in millivolts.
8. Respective potential values are measured according to the depth.

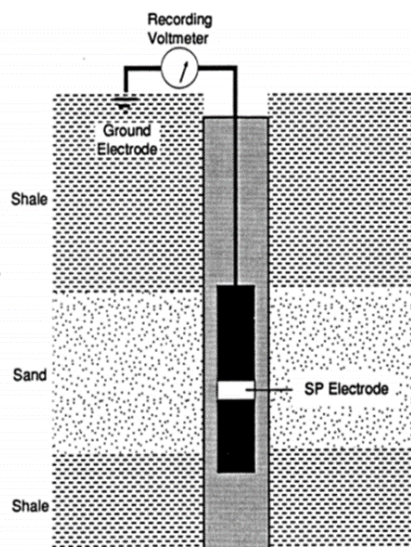


Fig.4 SP Log Configuration

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Fig.5 Equipments Used

## IV. OBSERVATION

Table.1 Depth vs Potential Readings

Depth (m)	Voltage (mV)
2	-2
4	-10
6	-7
8	-4
10	-6
12	-3
14	-7
16	-5
18	-1
20	-6
22	-9
24	-10
26	-11
28	30
30	28
32	25
34	15
36	8
38	-2
40	-9
42	-15
44	-12
46	-7
48	-8
50	-12
52	-11

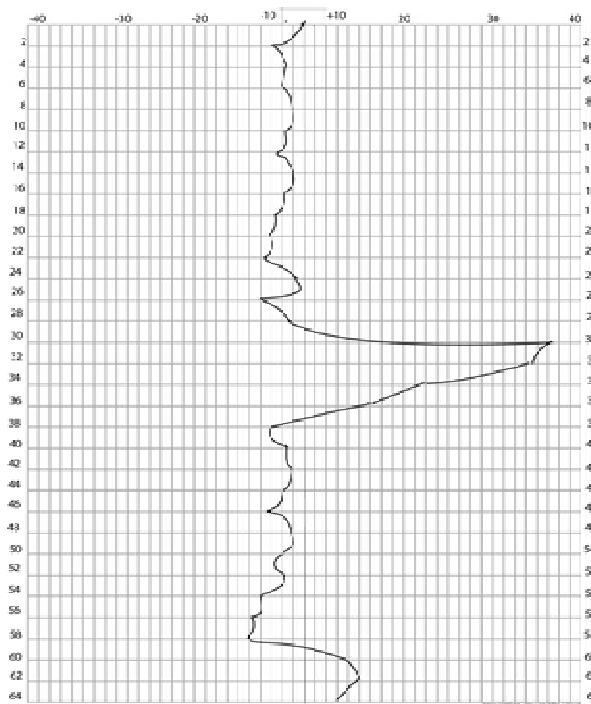
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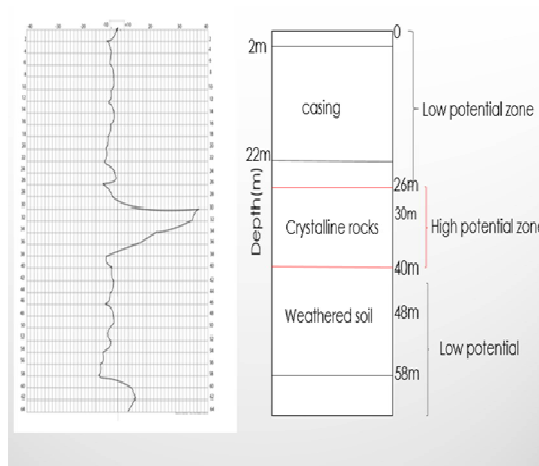
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## V. GRAPHICAL INTERPOLATION



The graph shows graphical representation of voltage vs depth.  
X axis shows the spontaneous potential in millivolts.  
Y axis shows depth in metres.  
Graph shows the relation between potential vs the depth of borewell.  
It gives the details of formation evaluation in the borewell.

## CORRELATION



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## 5.1 Observation

- At initial depth the graph is having negative potential
- Till 25m there is only small deflections in potential but it remains in low potential zone
- On reaching 26m the value takes a huge deflection and goes to high potential zone
- From 32m onwards the value begins to fall and reaches low potential zones
- From 38m to 60m potential values remains in low potential zone with small
- Deflections and then shows a deflection towards positive zone

## 5.2 Assumption

- In higher potential zones there may be presence of hard bedrocks, crystalline consolidated rocks or surfaces.
- In lower potential zones there may be presence of weathered soil or a fractured zone.

## VI. CONCLUSION

It is concluded that the wet well observed in LORDS Institute may have the presence of weathered rocks and soil inside with a saturated conductive zone.

## VII. ACKNOWLEDGEMENTS

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