Resistivity is the ability of a substance to impede the flow of an electrical current. This is a very important rock property in formation evaluation as it helps to differentiate between formations filled with salty waters (good conductors of electricity) and those filled with hydrocarbons (poor conductors of electricity). Hence, a difference in resistivity exists between rocks filled with hydrocarbons and those filled with formation water. Resistivity and porosity measurements are used to obtain values of water saturation to help evaluate productibility of the formation. Multi-spacing resistivity logs are used for lithology determination, aquifer quality, & qualitative estimates of hydraulic conductivity (permeability). Resistivity is a quantiative, repeatable, petrophysical property or rocks.

The spontaneous potential log, commonly called the self potential log or SP log, is a passive measurement taken to characterise rock formation properties. The log works by measuring small electric potentials (measured in millivolts) between depths in the borehole and a grounded voltage at the surface.

The change in voltage through the well bore is caused by a buildup of charge on the well bore walls. Clays and shales (which are composed predominantly of clays) will generate one charge and permeable formations such as sandstone will generate an opposite one. This build up of charge is, in turn, caused by differences in the salt content of the borehole fluid and the formation water (connate water). The potential opposite shales is called the baseline, and typically shifts only slowly over the depth of the borehole. Whether the mud contains more or less salt than the connate water will determine the which way the SP curve will deflect opposite a permeable formation. The amplitudes of the line made by the changing SP will vary from formation to formation and will not give a definitive answer to how permeable or the porosity of the formation that it is logging.

The SP tool is one of the simplest tools and is generally run as standard when logging a hole, along with the gamma ray. SP data can be used to find:

• Where the permeable formations are
• The boundaries of these formations
• Correlation of formations when compared with data from other analogue wells
• Values for the formation-water resistivity