



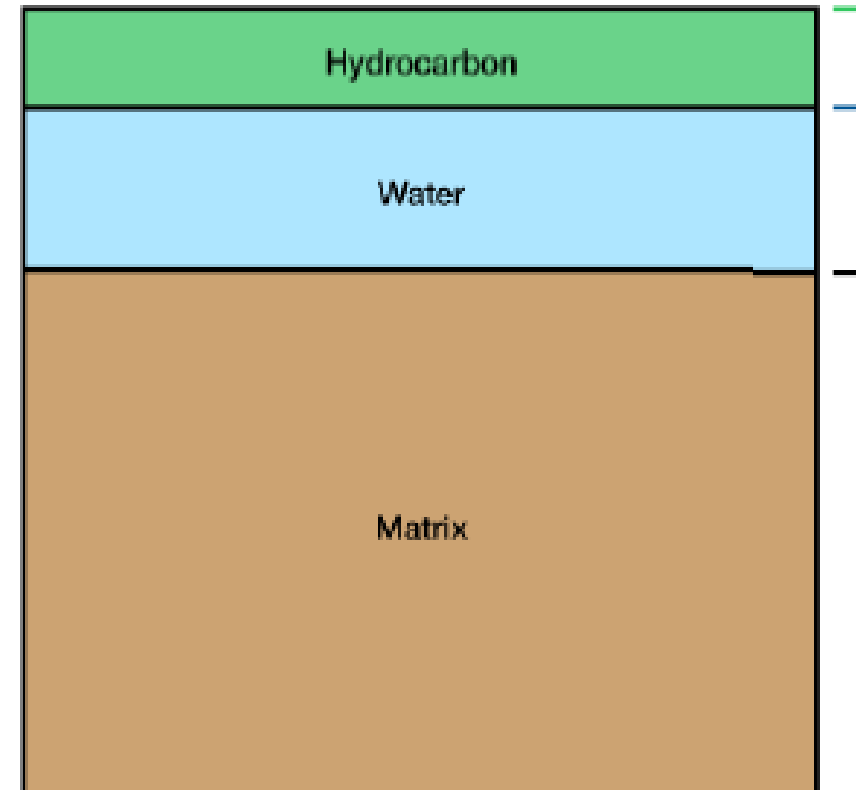
Resistivity interpretation



Bulk Volume



- The formation is mainly consists of matrix and pore volume.
- Inside pore volume there is fluid.
- Fluid may be water, hydrocarbon or both.
- Volume of pore filled with water is ϕS_w
- Volume of pore spaces filled with oil is $\phi(1-S_w)$



Archie Equation



- R_o is the resistivity of formation filled with **water**.
- R_t is the resistivity of formation filled with formation fluid.
- S_w can be found as a ratio between R_o and R_t . $S_w = R_o / R_t$
- Resistivity measured for formation is affected by F (formation factor) and the resistivity of the fluid in the pore volume of the formation.
- $R_o = F * R_w$
- Formation factor is factor that try to compensate for the tortuosity of the formation, means that explain how easy or how hard the current will flow through the formation.

$$S_w^n = \frac{a}{\phi^m} \frac{R_w}{R_t}$$



Invasion zone saturation.

- The same equation can be used to calculate the saturation of the mud filtrate in the invasion zone.
- The resistivity of this zones is the R_{xo} which can be measured from the Micro log
- The fluid that dominate this zone is the R_{mf} so it should replace the R_w in the archie equation.
- Other formation factor parameters should be the same because of the same formation.

$$S_{xo}^n = \frac{aR_{mf}}{\phi^m R_{xo}}$$

Determine R_w and R_{mf} .



- R_w can be determined from the following:
- 1- R_w maps.
- 2- Oil company (the operator)
- 3- From Sp log
- 4- R_{wa} method
- 5- Ratio method
- 6- Water sample

R_w from R_{wa}



- In water zone we assume the S_w is 1. (how do we know?)
- We can rewrite Archie as

$$R_w = \phi^2 R_t$$

Rw from ratio method.



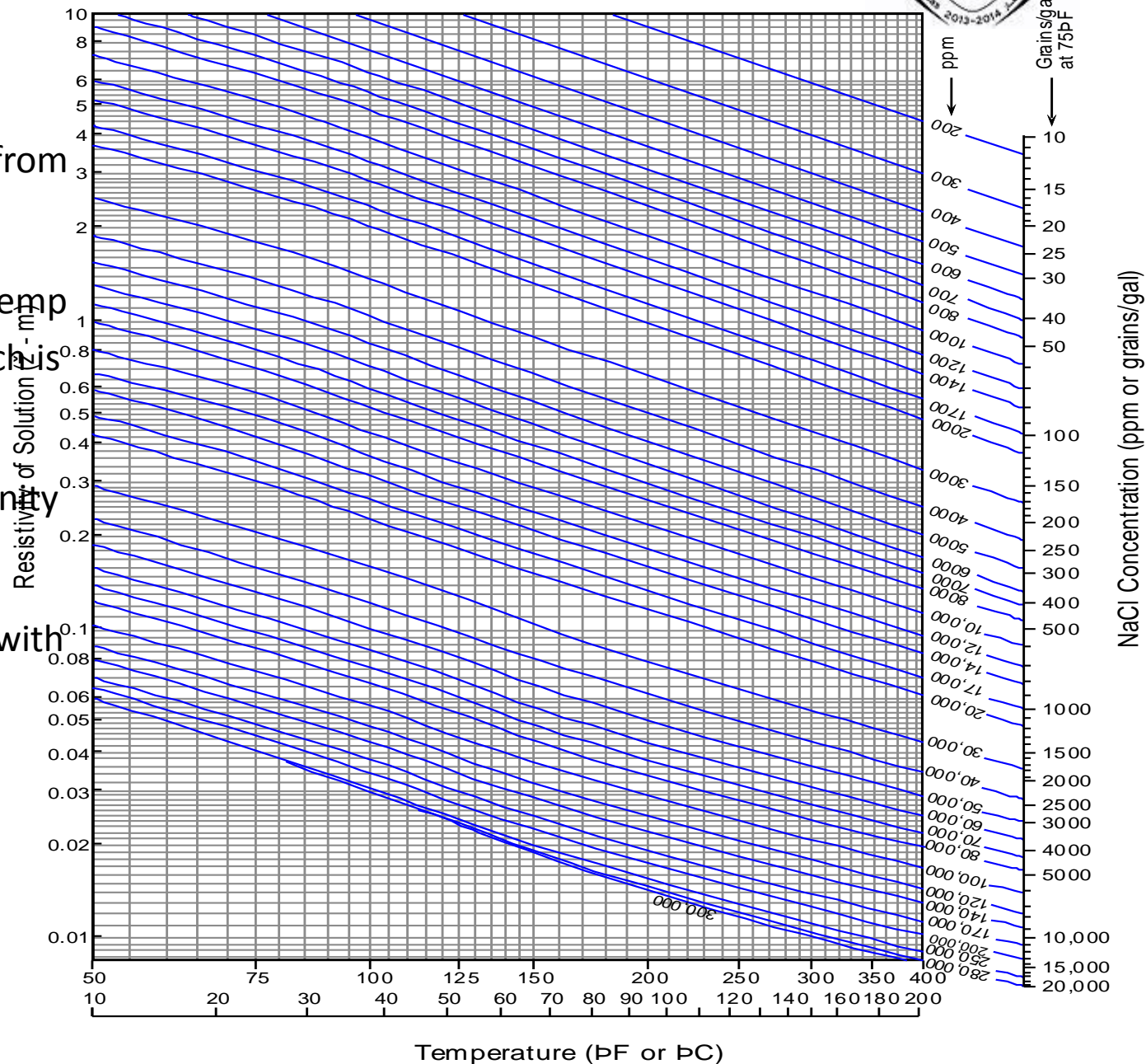
- In well drilled with water based mud and in water zone we have $S_w = S_{xo} = 1$
- Then we put 2 equation equal to each other then we solve R_w .

$$\frac{R_w}{R_{mf}} = \frac{R_t}{R_{xo}}$$

Find Rmf(today lab)

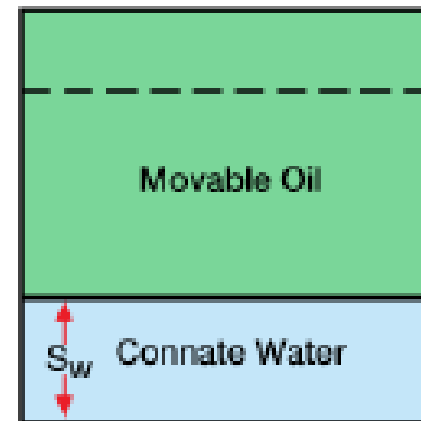


- The blue line are the lines of fixed salinities
- You can convert the resistivity of Rmf from surface temperature to BHT
- Chose the resistivity of the y and the temp at which this resistivity measured which is surface.
- The point found will be located on salinity lines
- Now you can chose the BHT intersect with the same line you found
- Read the resistivity of the new point

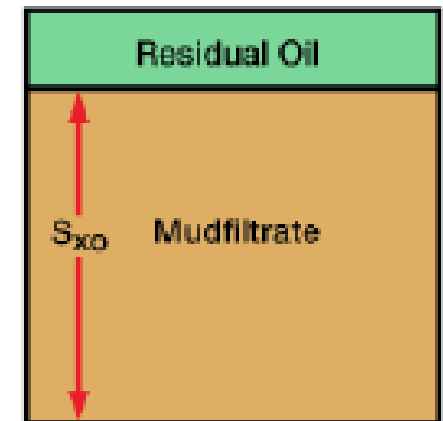


Sxo and movable oil

- Before invasion S_w will represent the connate water that didn't move when oil invade the rock.
- $1 - S_w$ is oil saturation
- After invasion the saturation of water in the flushed zone is S_{xo} which represent also the saturation of the mud filtrate.
- $1 - S_{xo}$ represent residual oil
- You can find movable oil by??
- Think about it



Undisturbed
State



After
Drilling