Penilaian Formasi Lanjutan

Clean Formation Interpretation

Resistivity-Porosity Crossplot

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Agenda

1. Clean Formation Interpretation
2. Resistivity-Porosity Crossplots
3. The Hingle Plots
4. The Pickett Plots
5. Range of Uncertainty in Calculated Water Saturations

Clean Formation Interpretation

- Archie Water Saturation Equation:

$$S_w = c\sqrt{\frac{Rw / Rt}{\phi}}$$

Where: c = 0.9 for sands and 1.0 for carbonates

Difficulties to determine right values of the parameters Rw, Rt and ϕ :

- Water-bearing formations are not obvious?
- SP is poor?
- No sample or catalog values are available?
- Derivation of porosity when only a Density or Sonic log is run?
- Appropriate values of matrix density or travel time are not known?

Resistivity-Porosity Crossplots

1. Porosity-resistivity crossplot is a convenient method of analyzing an interval, where:
    1. Rw is unknown but should be constant over the interval
    2. Matrix density and/or velocity are not known
    3. At least a few water-bearing zones of different porosities in the interval are present
    4. Formations of interest are clean

- Crossplot types:
    1. Hingle plot
    2. Pickett plot

The Hingle Plots

1. Values of Rw and matrix density or velocity applicable to the interval can be derived
2. Values of porosity and water saturation for individual levels can be read directly from the plot

Porosity-resistivity crossplot (Hingle method)

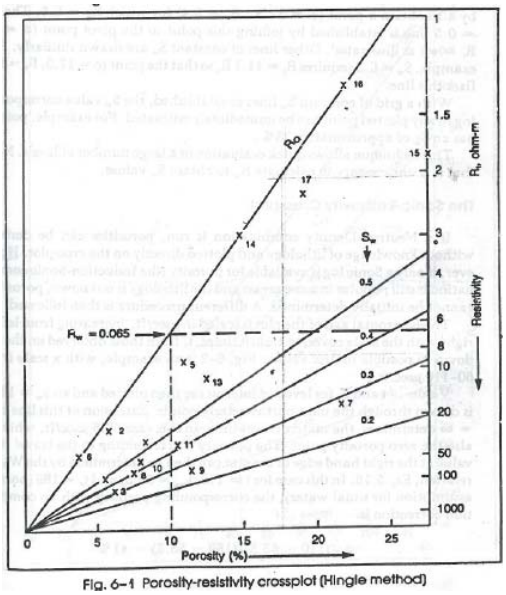

Fig. 6–1 Porosity-resistivity crossplot (Hingle method)

Sonic-resistivity crossplot (Hingle method)

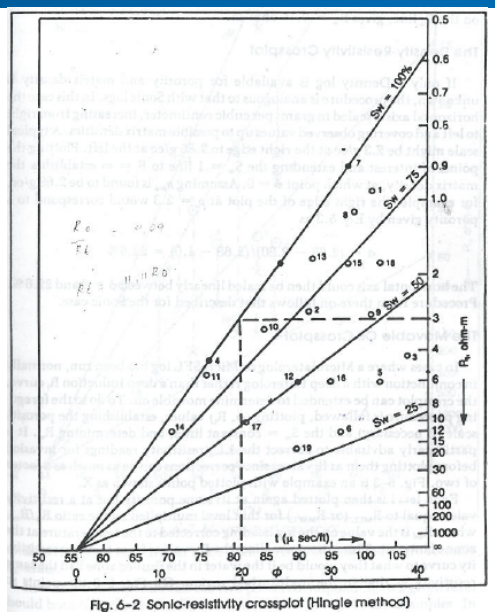

Fig. 6–2 Sonic-resistivity crossplot (Hingle method)

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Movable oil crossplot

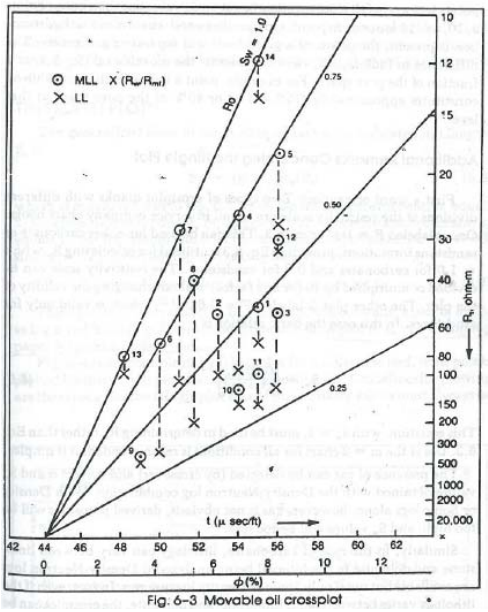

Fig. 6–3 Movable oil crossplot

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The Pickett Plots

1. Values of Rw can be derived but not matrix density or velocity
2. The value of cementation component, m , is obtained

Porosity-resistivity crossplot (Pickett method)

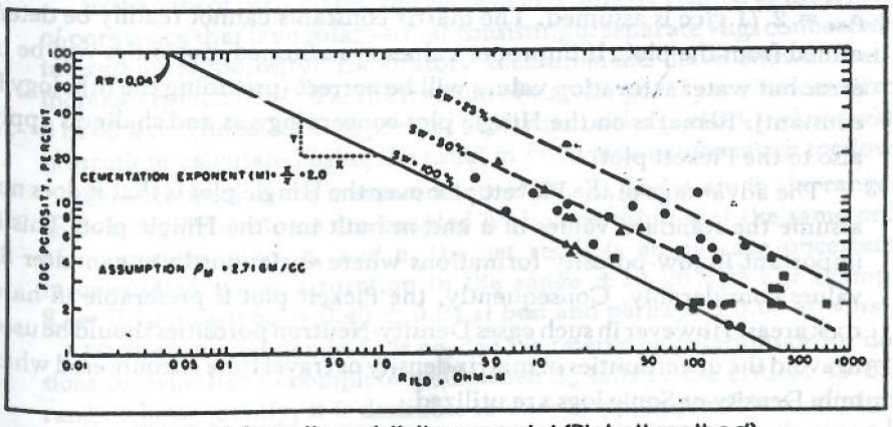

Fig. 6–4 Porosity-resistivity crossplot (Pickett method)

Range of Uncertainty in Calculated Water Saturations

Uncertainty in calculating water saturations:

1. Deviation of the constant m, n, and c from the average values
2. Measurement of Rw, Rt, and ϕ

Value m and n for Various Formations

TABLE 6-1 VALUES OF m AND n FOR VARIOUS FORMATIONS

	Lithology	Ave m	Ave n
Wilcox, Gulf Coast	SS	1.9	1.8
Sparta, So. La. (Opelousas)	SS	1.9	1.6
Cockfield, So. Louisiana	SS	1.8	2.1
Government Wells, So. Texas	SS	1.7	1.9
Frio, So. Texas	SS	1.8	1.8
Miocene, So. Texas	Cons. SS	1.95	2.1
	Uncons. SS	1.6	2.1
Travis Peak and Cotton Valley	HD. SS	1.8	1.7
Rodessa, East Texas	LS	2.0	1.6
Edwards: So. Texas	LS	2.0	2.8
Woodbine, East Texas	SS	2.0	2.5
Annona, No. Louisiana	Chalk	2.0	1.5
Nacatoch, Arkansas	SS	1.9	1.3
Ellenburger, W. Texas	LS and Dol.	2.0	3.8
Ordovician Simpson, W. Texas and New Mexico	SS	1.6	1.6
Pennsylvanian, W. Texas	LS	1.9	1.8
Permian, W. Texas	SS	1.8	1.9
Simpson, Kansas	SS	1.75	1.3
Pennsylvanian, Oklahoma	SS	1.8	1.8
Bartlesville, Kansas	SS	2.0	1.9
Mississippian, Illinois	LS	1.9	2.0
Mississippian, Illinois	SS	1.8	1.9
Pennsylvanian, Illinois	SS	1.8	2.0
Madison No. Dakota	LS	1.9	1.7
Muddy, Nebraska	SS	1.7	2.0
Cretaceous, Saskatchewan, Canada	SS	1.6	1.6
Bradford, Pennsylvania	SS	2.0	1.6
Frio, Chocolate Bayou, Louisiana	SS	1.55–1.94	1.73–2.22
Frio, Agua Dulce, South Texas	SS	1.71	1.66
Frio, Edinburgh, South Texas	SS	1.82	1.47, 1.52
Frio, Hollow Tree, South Texas	SS	1.80, 1.87	1.64, 1.69
Jackson, Cole Sd., South Texas	SS	2.01	1.66
Navarro, Olmos, Delmonte, So. Texas	SS	1.89	1.49
Edwards Lime, Darst Creek Co.	LS	1.94, 2.02	2.04, 2.08
Viola, Bowie Field, No. Texas	LS	1.77	1.15
Lakota Sd. Crook Co., Wyoming	SS	1.52	1.28

Source: G.R. Coates and J.L. Dumanoir, "A New Approach to Log-Derived Permeability," *SPWLA Logging Symposium Transactions* (May 1973)

Resources

- Course Materials: http://www.geocities.com/ridwanwd/PFL/
- The Society of Petrophysicists and Well Log Analysts: http://www.spwla.org
- Society of Petroleum Engineers: www.spe.org
  Formation Evaluation: http://www.spe.org/spe/jsp/basic/0,,1104_1714_1003934,00.html
- Schlumberger Interpretation Chart: www.slb.com or http://content.slb.com/Hub/Docs/connect/reference/Chartbook/

Question and Answer