

GeoNeurale

TWO for ONE

2 for 1 *or* $1 + 1 = 3$

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GeoNeurale

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Assume

$$n = 2 \text{ and } S_{xo} = S_w^{1/5}$$

- Appropriate specific exponent per local, or analogue, experience
- $S_{xo} = S_w^{1/5}$ results in relation at right, for which $S_{xo} \sim 70\%$ when $S_w \sim 20\%$

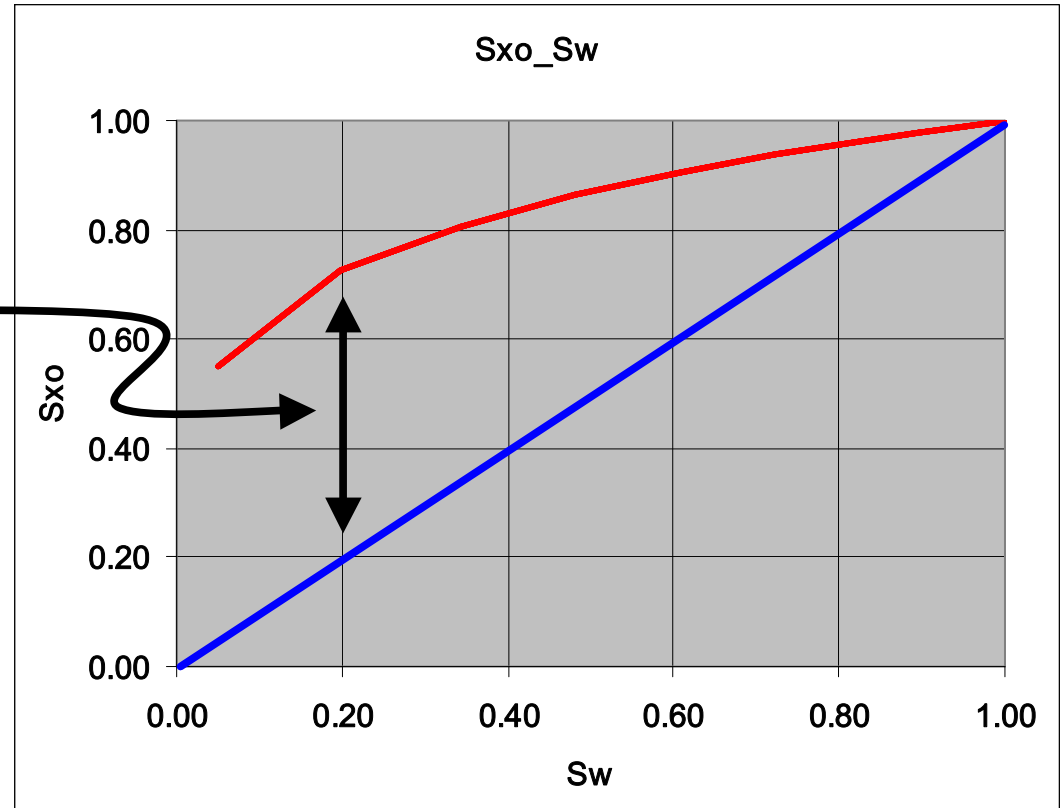


Figure 1

Quick Look *Saturation by Resistivity Ratio*

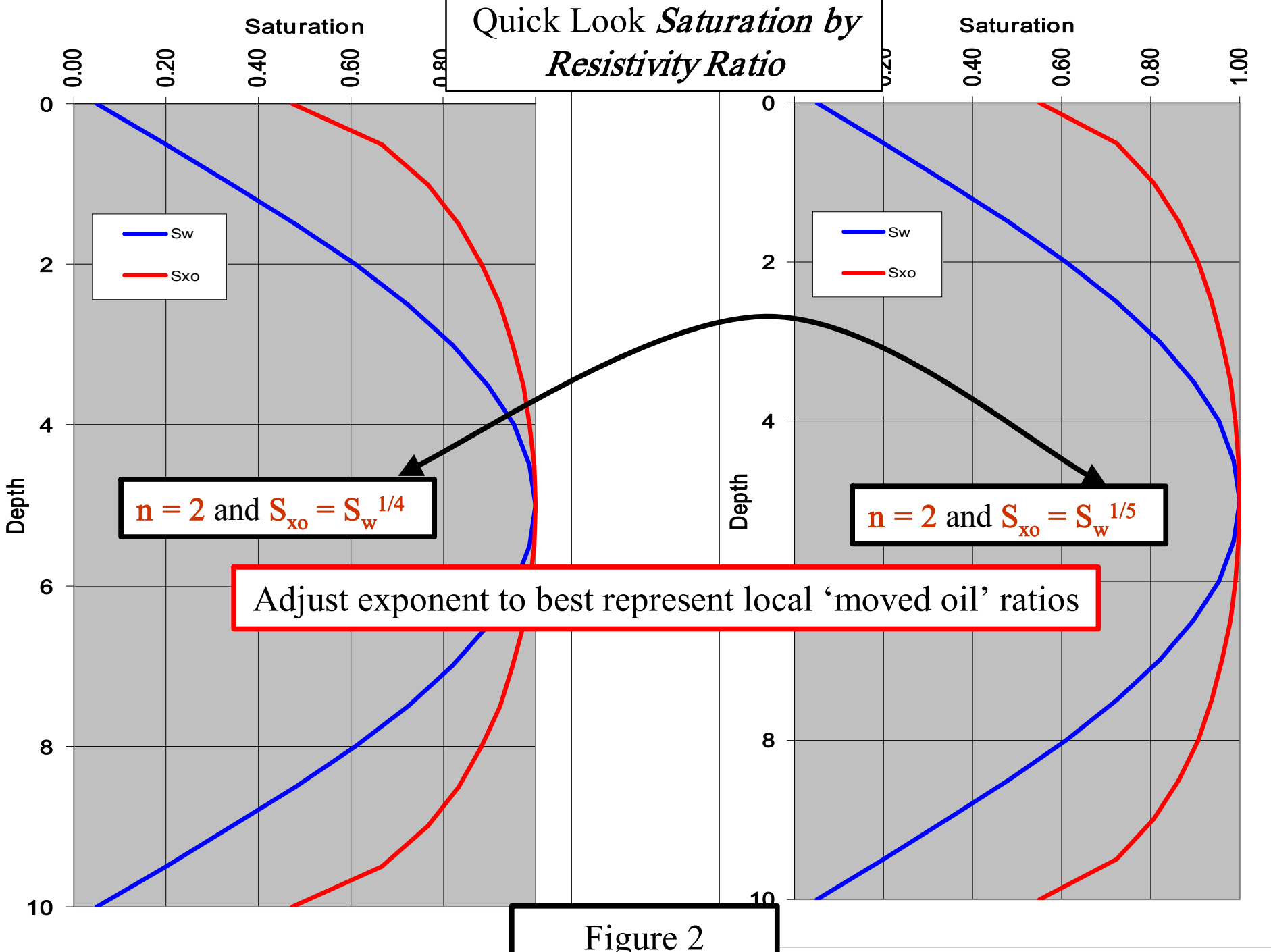


Figure 2

Middle East Carbonate

- Estimation of S_w from $R_{deep} - R_{xo}$ Ratio
 - Porosity not required
 - Requires water zone, or given (R_w / R_{mf}) ratio
- From wet zone
- $(R_{mf} / R_w) \sim (R_{xo} / R_{deep}) \sim (1.0 / 0.23) \sim 4.35$
- In the 'pay'
 - $S_w^{8/5} = (R_w / R_{mf}) * (R_{xo} / R_{deep}) = (1/4.35) * (1.2 / 1.5)$
 - $S_w^{8/5} = 0.184$ & $S_w = 0.35$
 - ***Be careful reading logarithmic scales*** - it's easy to mis-judge the numerical (actual) value

Schlumberger Arabia Well Evaluation Conference - 1975

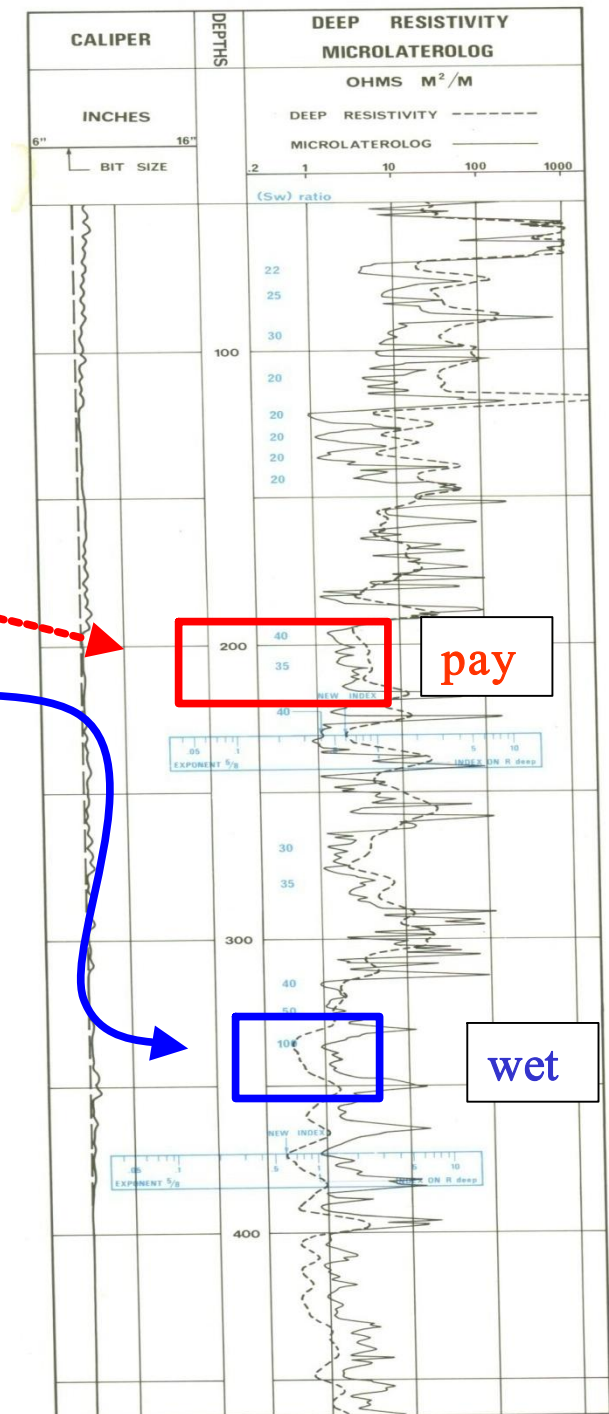


Figure 3

Quick Look S_w Evaluation of the Kansas City - Lansing, Anadarko Basin

- *Moveable Hydrocarbon Index* calculated according to
$$MHI = S_w / S_{xo} = \text{Sqrt}[(R_{xo} / R_t) / (R_{mf} / R_w)]$$
- *Quick Look water saturation* calculated according to
$$S_w(R_{at}) = [(R_w / R_{mf}) * (R_{xo} / R_{deep})]^{(0.625)}$$
- Kansas City- Lansing Formation, northwestern shelf, Anadarko basin.
- The *R_{xo}/R_t quick look* evaluation at *4,810* indicates the zone is wet
- *Exhibit following*

Figure 4

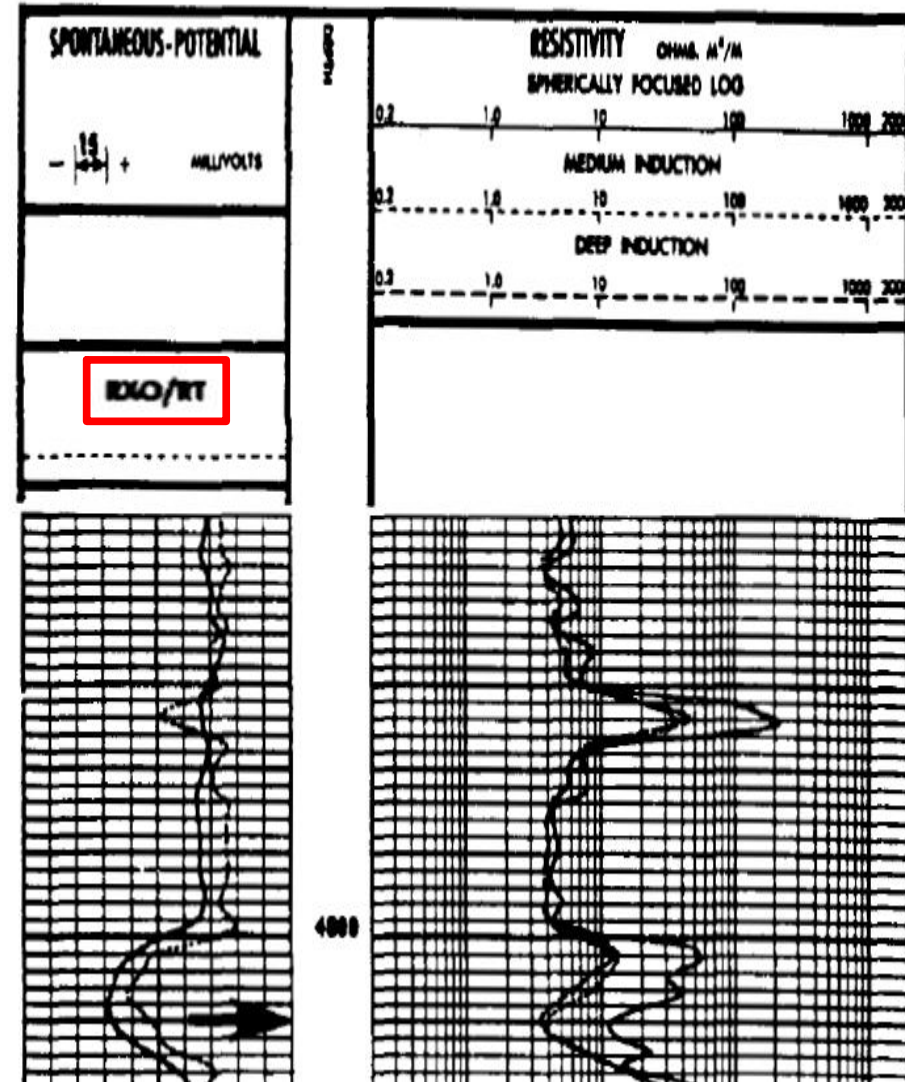


Figure 5

Quick Look S_w Evaluation of the Kansas City - Lansing, Anadarko Basin

Depth (ft)	ϕ	R_t	R_{xo}	S_{wa}	S_w/S_{xo}	S_{wr}	BVW
4,810 (ft)	0.25	3.5	12	38%	0.61	53%	0.095
4,900 (ft)	0.15	9	25	40%	0.54	47%	0.060
4,920 (ft)	0.11	19	32	37%	0.42	34%	0.041
4,924 (ft)	0.13	14	30	37%	0.48	40%	0.048
4,932 (ft)	0.17	22	45	22%	0.47	39%	0.037
4,936 (ft)	0.09	30	60	36%	0.46	38%	0.032

Where:

$R_w = 0.032$

$R_{mf} = 0.30$

 S_{wa} = Archie water saturation S_{wr} = Ratio water saturation

From Density-Neutron.

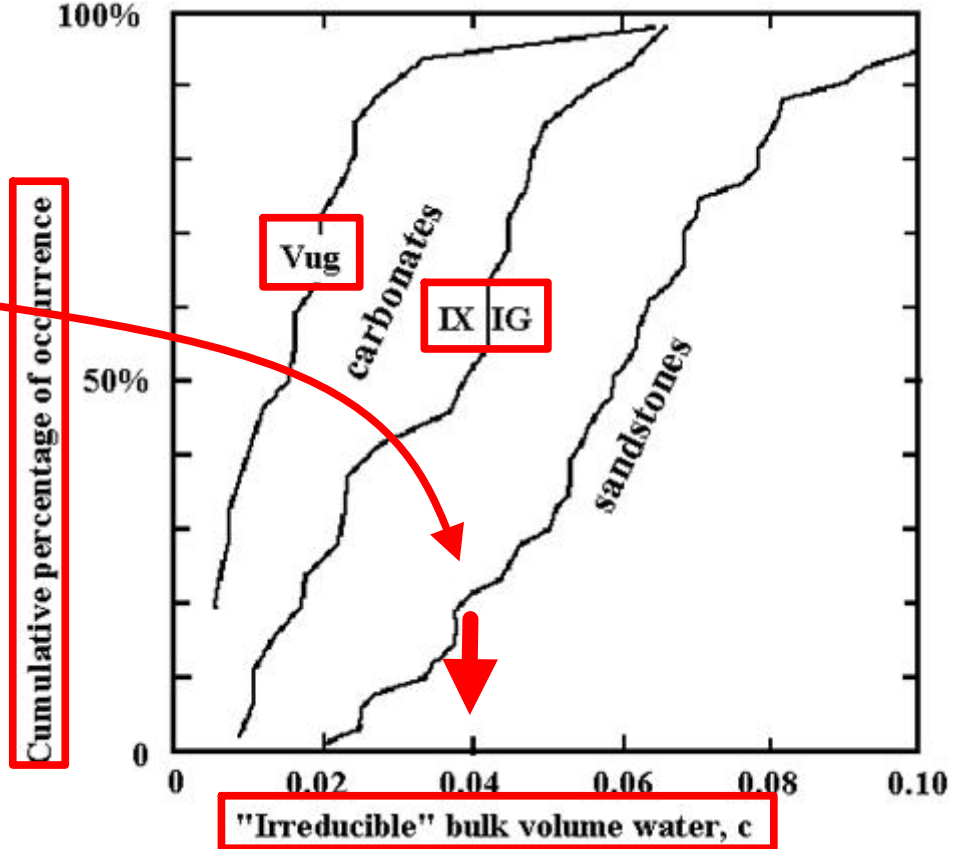
- The zone at 4810' has *good porosity* and *low Archie water saturation*.
- The *Moveable Hydrocarbon Index* ($S_w/S_{xo} = 0.61$) is *greater than 0.60* and the *Ratio Method water saturation is high* (53 percent). These *calculations indicate that the zone may be wet*.
- The *calculation which further indicates the zone is wet is the very high bulk volume water value (0.095)*
 - *Exhibit following*
 - This *BVW* is based upon $\Phi * S_w$ (Archie), with “m” = 2.0, and *will increase if S_w (Ratio) is used for the calculation* (ie the zone will look even “wetter”)

Critical BVW

- Carbonate reservoirs with a bulk volume water value greater than 0.04 are usually wet
- The zone at 4,810 feet is oomoldic with high porosity (and high "m")

Figure 6

http://www.kgs.ku.edu/Gemini/Help/PfeFFER/Pfeffer-theory4.html#bv_w_pickett



Cumulative frequency plots of irreducible bulk volume water for reservoirs by pore type.

Depth (ft)	ϕ	R_t	R_{x0}	S_{wb}	S_w/S_{x0}	S_{wr}	BVW
4,810 (ft) (oomoldic)	0.25	3.5	12	38%	0.61	53%	0.095
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From petrography