Penilaian Formasi Lanjutan

# Clean Formation Interpretation

## Multimineral Identification

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## Agenda

1. Multimineral Identification
2. The M-N Plot
3. The MID Plot
4. The Litho-Density-Neutron Method
5. Trends in Multimineral Identification

## Multimineral Identification

Identification of matrix makeup is particularly important in tight formations, reasons:

1. Porosities may hover near cutoff values, about 5%
2. Tight formations often require acidizing or acid fracturing to stimulate production
3. Geologic in nature

Three methods:

1. The M-N Plot
2. The MID Plot
3. The Litho-Density-Neutron Method



## The M-N Plot

M-N plot is a means of combining data from the three porosity devices in such manner that effects due to porosity variation are almost eliminated and those due to matrix changes are maximized.

## M-N Plot for Mineral Identification

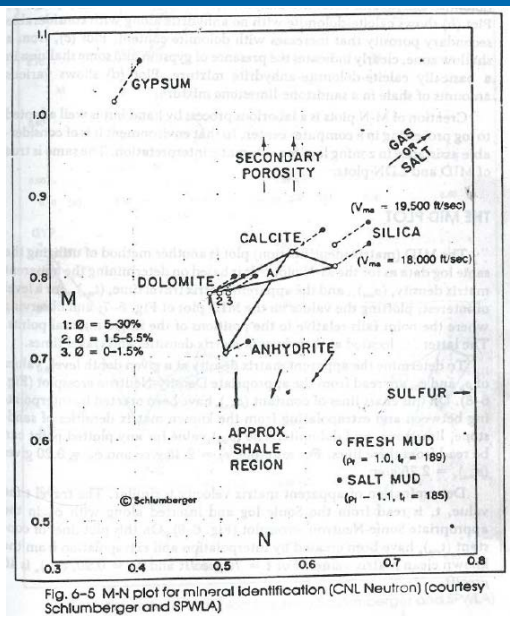


Fig. 6–5 M-N plot for mineral identification (CNL Neutron) (courtesy Schlumberger and SPWLA)

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## Example of M-N Plots

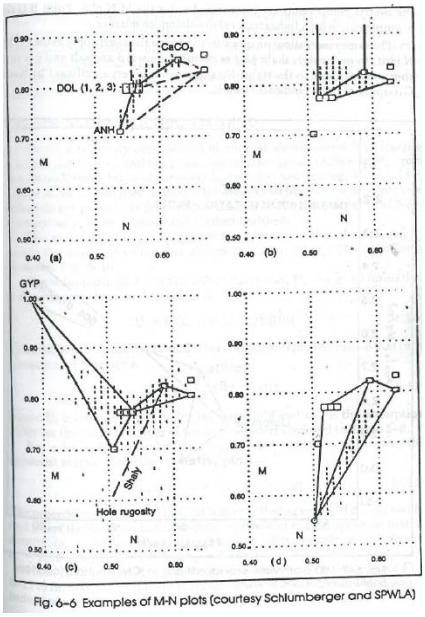


Fig. 6–6 Examples of M-N plots (courtesy Schlumberger and SPWLA)

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## The MID Plot

- MID (matrix identification) plot is another method of utilizing the same log data as for the M-N plot

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## MID Plot for Mineral Identification

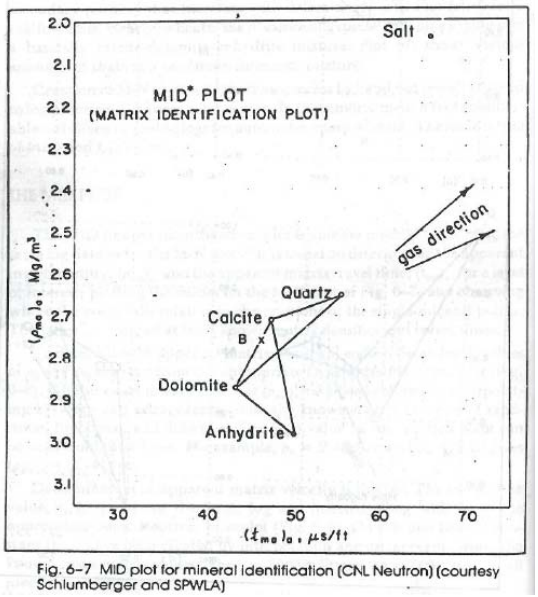


Fig. 6-7 MID plot for mineral identification (CNL Neutron) (courtesy Schlumberger and SPWLA)

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## The Litho-Density-Neutron Method

- Input is the bulk density (rhob) and the photoelectric absorption coefficient (Pe) from the Litho-Density log, and porosity from Neutron log



## Determining Apparent Matrix Density

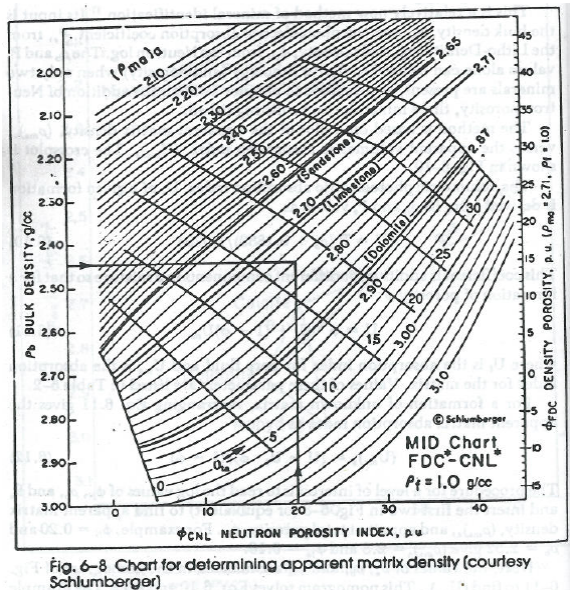


Fig. 6–8 Chart for determining apparent matrix density (courtesy Schlumberger)

## Determining Apparent Matrix Travel Time

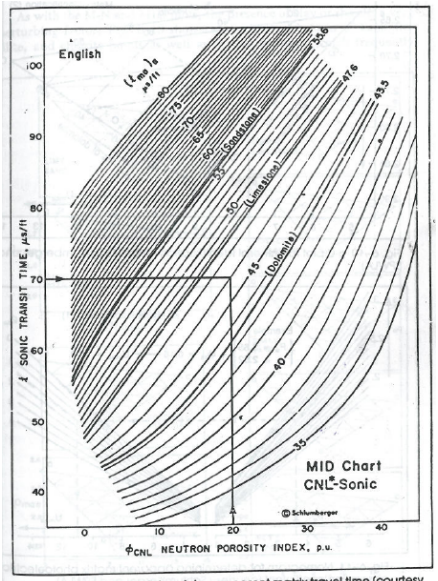


Fig. 6–9 Chart for determining apparent matrix travel time (courtesy Schlumberger)



## p-U Plot for Mineral Identification

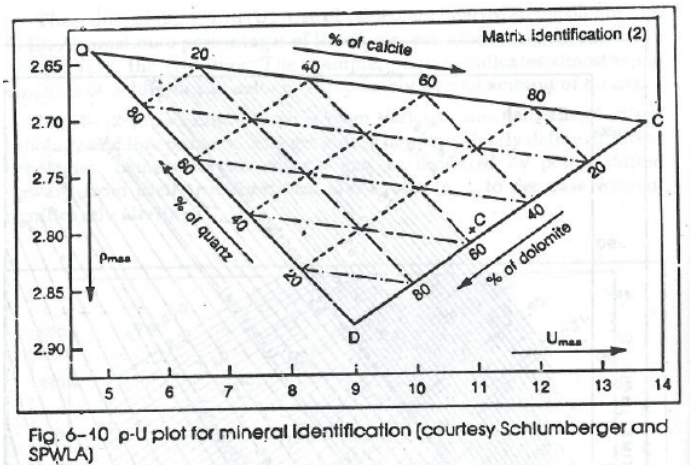


Fig. 6–10 p-U plot for mineral identification (courtesy Schlumberger and SPWLA)

## Determining Apparent Matrix Photoelectric

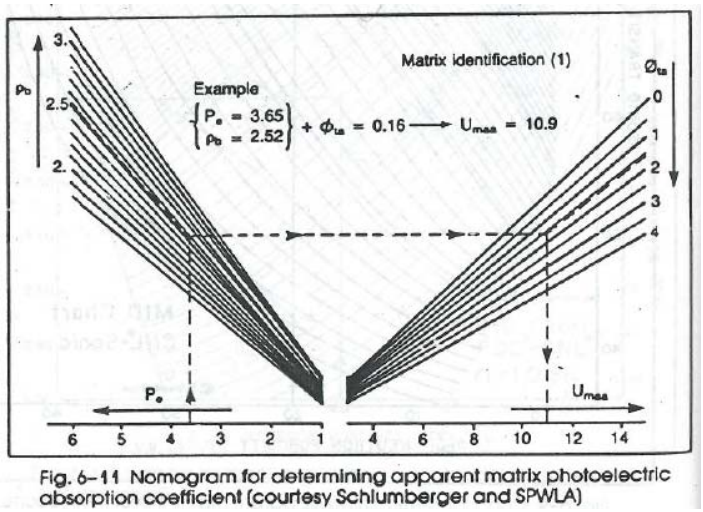


Fig. 6–11 Nomogram for determining apparent matrix photoelectric absorption coefficient (courtesy Schlumberger and SPWLA)

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## Example of p-U Plots

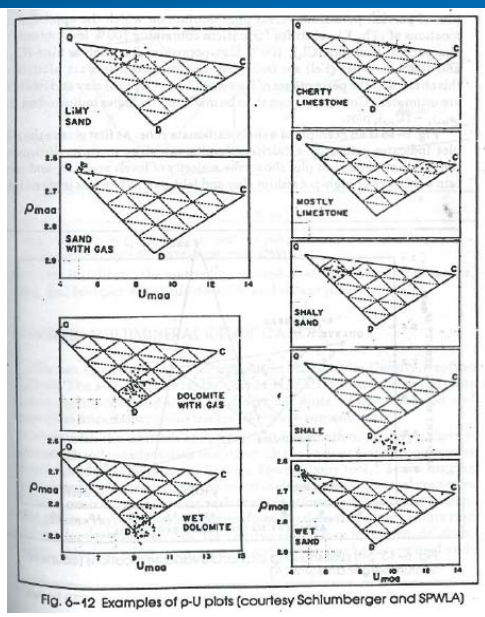


Fig. 6–12 Examples of p-U plots (courtesy Schlumberger and SPWLA)

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## p-U Plot Shows Clay and Evaporite

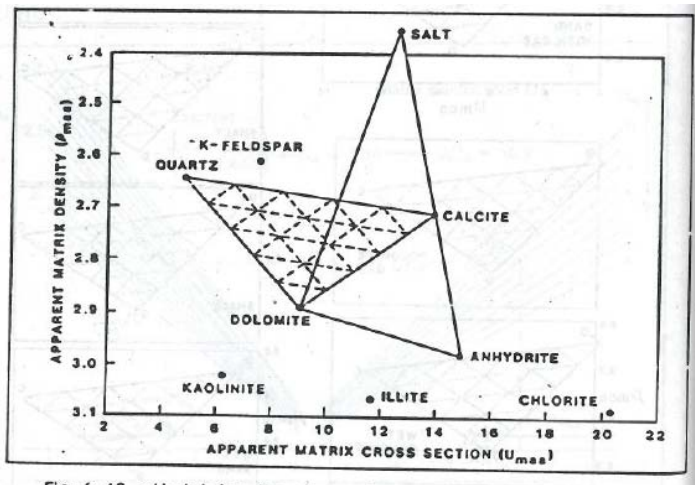


Fig. 6-13 p-U plot showing clay and evaporite locations (courtesy Schlumberger and SPWLA)



## Thorium-potassium Plot

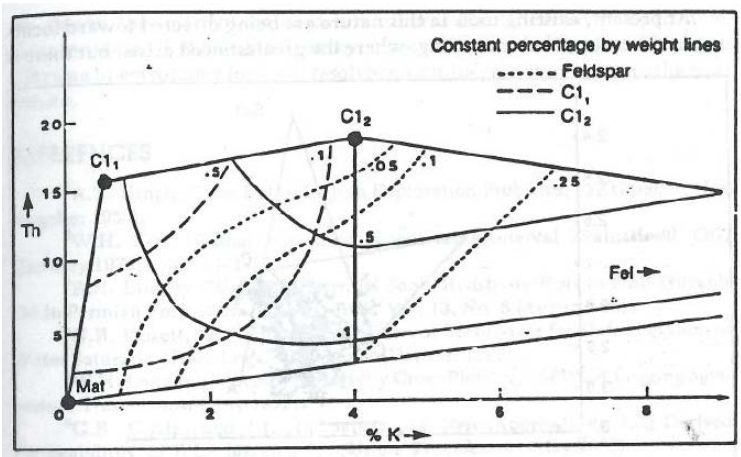


Fig. 6-14 Thorium-potassium plot for determining clay and feldspar content (courtesy Schlumberger and SPWLA)

## Trends in Multimineral Identification

- The p-U plot is better than the M-N or MID plots because the basic quartz-calcite-dolomite-anhydrite points are more widely separated and there is no uncertainty in matrix travel time to contend with.



## Mineral Identification using p-U and Th-K Plots

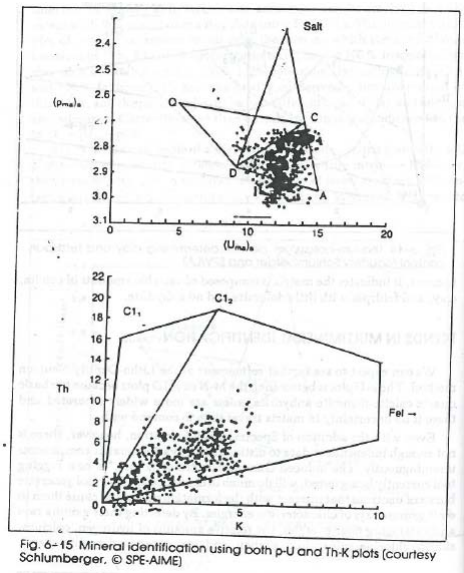


Fig. 6-15 Mineral identification using both p-U and Th-K plots (courtesy Schlumberger, © SPE-AIME)

## 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