

# TerraStation II - Petrophysics

## Technical Specifications

These are the optional modules that are not part of the Base TerraStation

### KOBRA1 – Deterministic Analysis

- Quick look modeling – provides rapid evaluation of Vshale, Porosity, water saturation and netpay. Uses several different models – Dual water, Simandoux, Archie, Total Shale, Indonesian, Nigerian, Juhasz, Hanai-Bruggeman, Laminar Shale. Monte Carlo option if desired to vary input parameters randomly. Tornado plot to evaluate variables after Monte Carlo run. Includes logic to deal with coal and salt presence. Has a Shale Gas model option also for computing free, adsorbed and total gas.
- Vshale models – individual modeling of Vshale using several models simultaneously – Linear, Larionov, Tertiary, Clavier, Steiber, Neutron, Neutron/Density, Resistivity, Density/Sonic, Neutron/Sonic. Allows merging of selected models by averaging, taking minimum, or maximum.
- Porosity models - individual modeling of porosity using several models simultaneously – Density, Raymer-Hunt, Wyllie, Porter, Neutron/Density, Neutron/Sonic. Allows merging of selected models by averaging, taking minimum, or maximum.
- Water Saturation models - individual modeling of Sw using several models simultaneously – Archie, Total Shale, Fertl, Dispersed Shale, Laminar Shale, Simandoux, Indonesian, Dual Water, Waxman-Smit, Juhasz, Woodhouse (tar sand), Nigerian, Hanai-Bruggeman. Allows merging of selected models by averaging, taking minimum or maximum.
- Permeability models – three linear models plus Jennings-Lucia, Tixier, Timur and Coates equations. Allows merging of selected models by averaging, taking minimum or maximum.
- Netpay Analysis – a comprehensive netpay reporting module. Inputs can be Vsh, Porosity, Sw, Permeability and up to five other curves. Full cutoff control. Reports can be zoned. User control over the statistical summations that are output. TVD and MD based thicknesses. Probabilistic capability available. Graphs of how thicknesses vary with changing cutoff parameters. There is a simple Volumetrics calculator included within this option.

### KOBRA2 – Additional miscellaneous petrophysical options

- Hydrocarbon correction of neutron and density – Gaynard-Poupon or “two-thirds rule” method.
- Moveable Hydrocarbon display – computes and display moveable hydrocarbon within porosity.
- CMR T2 Interpretation – computes water saturation, permeability BVirr and other outputs from T2 spectrum from CMR/NMR tools.
- EPT Analysis – computation of Sw and porosity from a variety of dielectric tools.
- Pulsed Neutron Analysis – provides a generic equation or a specific TMD tool solution. Outputs Sw and effective porosity from either a laminar or structural shale model. Optionally outputs Sigma wet, sigma water apparent and sigma hydrocarbon.
- Leverett-J Water Saturation – computes a water saturation, BVW and capillary pressure using FOIL values derived by fitting to a crossplot, and permeability.
- Hingle Plot – crossplot of resistivity vs porosity to obtain Rw. An alternative approach to Pickett.
- Free Water Level – graphical approach to defining free water level from BVW curves.
- Computation of Rw from SP curve.
- Computation of Rw from salinity.
- Water filled porosity computation using resistivity and Vshale information.
- Computation of apparent water resistivity.
- Computation of wet resistivity from resistivity, porosity and Vshale data using the Indonesian Sw equation. Also outputs a water saturation, effective porosity and Ro curve.

- Temperature gradient analysis – includes a Horner plot capability.
- Computation of Hodges-Lehmann Index from up to five shale indicators.
- Computation of pore geometry information from resistivity and porosity log. Outputs include a tortuosity factor and a path length ratio, as well as estimates of Archie 'a' and 'm'.
- Coal Bed Methane Analysis capability – using gamma ray and porosity logs as well as user definable quality of coal. Outputs include estimates of gas content using a variety of methods, gas in place, coal rank, ash, volatiles, moisture and fixed carbon estimates.

#### **PETRA – lithology component modeling**

- A lithological computation methodology using a simultaneous linear equation methodology.

#### **STATLITH – complex mineralogy and fluid modeling**

- Uses a linear/non-linear approximation methodology to predict proportions of components and fluids.
- Can use a water saturation model – Dual Water, Waxman-Smits, Total Shale, Archie, or Indonesian.
- Define uncertainty of log responses for specific depth zones.
- Compute model error at each depth. Provides summary report of result of model.

#### **Merlin – Statistics**

- Polynomial Regression.
- Multiple Linear Regression.
- Reduced Major Axis Regression.
- Principal Components Analysis – of up to 10 input variables.
- Discriminant Function Analysis – simple or multi group discriminant analysis.
- Fourier Analysis – analyze the frequency spectrum of any curve.
- Cospectral Analysis.
- Transition Probability – define up to 20 groups and compute the likelihood of transitioning from one to another within a well. Can also use the user defined facies data available within TerraStation.
- Cluster Analysis – create a model then apply to other wells. Uses K means clustering.

#### **EQUUS – user definable equations**

- Provides arithmetic operators – addition, subtraction, division, multiplication, raise to the power.
- Allows the functions for logarithm, natural log, square root, absolute value, sine, cosine, tangent, arccosine, arcsine, arctangent.
- Allow up to 10 input curves.
- Conditional operation available – IF –THEN – ELSE type operation.

#### **ROCKMOD – a suite of deterministic models**

- ENVIRON – performs environmental corrections on input logs.
- CALC – a general lithology model used mostly for tighter sands and Paleozoic sandstones.
- WAXMAN – designed for Tertiary sandstones, particularly with low volumes of cementation (5% or less).
- Water saturation model is user selectable from a variety of models.
- VELOCITY – used to compute a theoretical in-situ compressional sonic and in-situ shear sonic taking into account fluids present.

