Shale Formation Analysis for Fracturing Treatment Design Optimization (ShaleLog® Service)

Standard Log and Core Analysis Inputs Can Be Used to Answer Critical Completion Design Questions

The Halliburton shale formation analysis and fracturing treatment design optimization process (ShaleLog® service) provides information critical to developing a shale asset:

- Helps identify targets to complete.
- Reduces risk of unnecessary fracture treatments.
- Provides data to design an optimized fracture treatment.

**ShaleLog Analysis Service Can Use Available Formation Information**

ShaleLog analysis service integrates available wireline or LWD log data and laboratory core analysis to help define the characteristics of potential shale reservoirs:

- Total organic carbon (TOC) and gas content.
- Shale volumetric gas in place.
- Highest kerogen content zones.
- Organic-rich zones.
- Porosity, permeability and natural fractures.
- Mineralogy.
- Geomechanical considerations including the following:
  - Brittleness index (aids in frac fluid choice).
  - Shale reservoir type (aids in frac fluid choice).
  - Unconfined compressive strength (aids in drilling decisions).
  - Closure pressure (aids in proppant selection).
  - Frac barriers (helps determine fluid and proppant volume).
  - Hydraulic fracture initiation points (helps determine pump rate).

To provide the answers, ShaleLog analysis service uses logging inputs of the spectral density, dual spaced neutron, and resistivity. The service can be further enhanced by including the spectral gamma ray and sonic measurements.

**Brittleness is a Key Factor**

The heart of the ShaleLog analysis service model is the calculation of the brittleness index. Calibration of the model can be done from cores as well as local area experience.

Understanding the brittleness of a shale can guide the placement of perforations, isolation points and fracture stages.

The concept of rock brittleness reflects the ability of the rock to fail under stress and maintain a fracture. Brittle shale is more likely to be naturally fractured and also more likely to respond well to hydraulic fracturing treatments.

Ductile shale, on the other hand, is not a good producer because the formation will tend to heal any natural or hydraulic fractures. Ductile shale, however, makes a good seal, trapping the hydrocarbons and preventing migration out of the more brittle shale.

*ShaleLog analysis service can assist in the decision about where to perforate for an optimized fracture network system. The decisions can be based on the brittleness and ductility determination in both vertical and horizontal wellbores.*
Halliburton has been providing ShaleLog analysis service for over a decade and has provided the analysis for Operators in every shale play in North America. Map source: Energy Information Administration based on data from various published studies, May 2009.

**Area-Specific Results**

The processed ShaleLog service output is area specific. It is built upon the shale properties collected in the basin of interest. These properties come from many sources such as core and cuttings lab analysis (ShaleEval® service) or wellsite drilling cuttings analysis (LaserStrat® service). Data from advanced logging tools including mechanical rock properties (WaveSonic® service) and elemental analysis (GEM™ tool) enhance the quantitative results obtained from ShaleLog service. As the wells in shale plays shift to horizontals, more LWD data is available and can also be used as input for ShaleLog analysis service.

For more information about how ShaleLog® analysis service can help make your shale assets more profitable, contact your local Halliburton representative or email stimulation@Halliburton.com.