

# Techlog Shale

Evaluate shale reservoirs with more knowledge and less uncertainty

## APPLICATIONS

- Reservoir characterization in shale plays with volume in place computation
- Shale heterogeneity characterization

## BENEFITS

- Extract full value from your acquired measurements
- Reduce the risk of nonperforming wells by locating sweet spots

## FEATURES

- Extensive built-in shale database
- Computation of the total organic content, mineralogy, and volumes in place for gas, condensates, and oil
- Shale classification, based on fundamental attributes
- Concurrent multiple well analysis
- Fully integrated with other Techlog\* modules

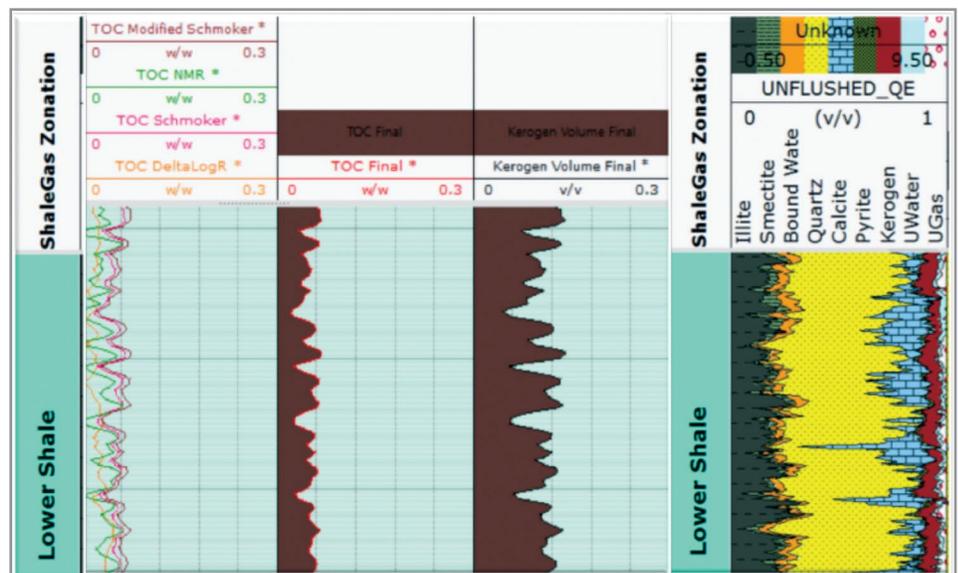
Unconventional resources such as shale plays are structurally simple yet geologically complex. This complexity is due to extreme variability in rock composition and postdeposition diagenetic processes—all shales are not created equal. The Unconventional module in the Techlog wellbore software platform provides unique workflows for the characterization of your shale reservoir and associated hydrocarbons in place, as well as the Shale Advisor tool and Heterogeneous Rock Analysis (HRA) workflow.

### Evaluate total organic carbon

Total organic carbon—the source of hydrocarbon in shales—is derived from conventional logs (density, neutron, sonic, and resistivity) and from advanced log measurements (nuclear magnetic resonance and spectroscopy). It uses this combination of different techniques and calibration to establish the best practice for its estimation in a geographical zone.

### Understand mineralogy and volumes

Understanding lithology is key to evaluating shale plays because it directly influences the porosity distribution in the rock and the geomechanical properties of the formation. Shales have extremely complex mineralogy from multiple clay types. The Shale Advisor tool combines the use of conventional and advanced spectroscopy logs, bringing together core data to build robust models that can successfully explain this complex mineralogy, porosity, and the fluids present in the formation.



Total organic carbon, kerogen, and mineralogy volume computation.



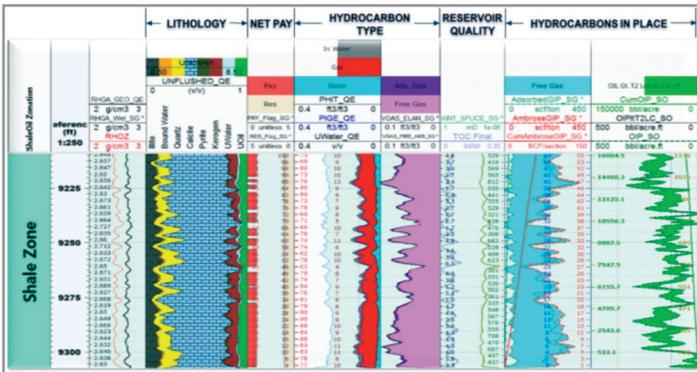
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## Predict hydrocarbons in place

The final step in the unconventional workflow estimates the hydrocarbon volumes in place for gas, condensates or oil at reservoir conditions—both free and adsorbed gas fractions are computed. Core-derived isotherms from many shale plays are integrated into the module for adsorbed gas computation, with the ability to input local data when available.

For oil and condensate reservoirs, computations of fluids in place are corrected from the presence of bitumen that often exists in such plays.

All volumes are expressed at surface condition. Cumulative volumes per zone are delivered in a summation table and expressed in both volumes per ton and per area.



Lithology and hydrocarbons in place for shale oil.

## Anisotropic geomechanics

When completing the well and planning stimulation stages, it is imperative to factor in the far field stresses to ensure the stages are placed in low stress areas. The Anisotropic Geomechanics tool helps calculate the mechanical properties and horizontal stresses from the static VTI elastic properties, pore pressure, Biot coefficient, and overburden stress.

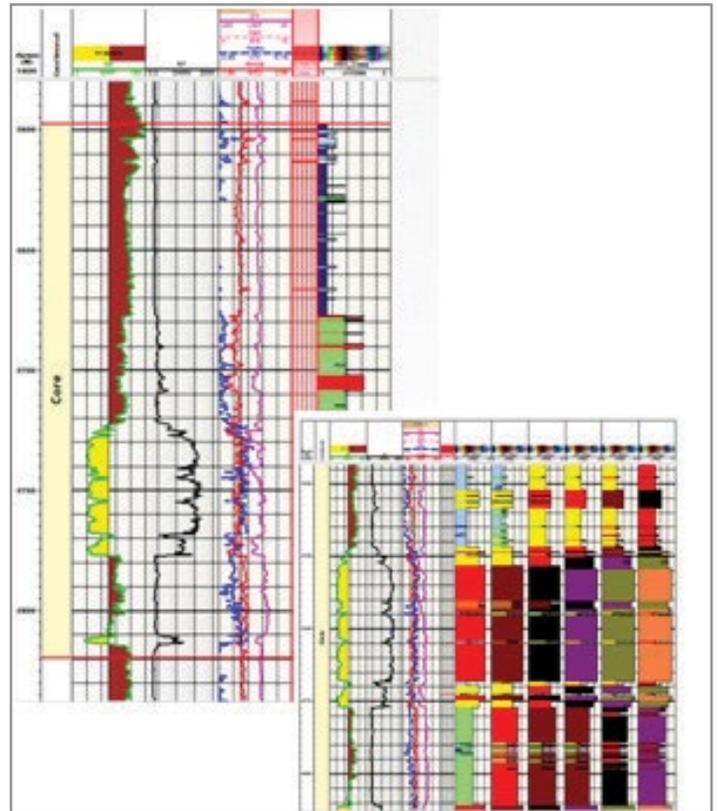
Typical input data for this workflow consists of borehole sonic compressional, dipole fast and slow shear, and Stoneley shear slownesses. Sonic Scanner\* acoustic scanning platform measurements provide the best quality input for this workflow as they provide directional shear. The results can be used in conjunction with reservoir quality for optimum completion planning.

## Perform heterogeneous rock analysis

The HRA workflow was developed for the heterogeneous rocks often encountered in unconventional shale reservoirs. It is a well-defined workflow for distinguishing material property facies (rock classes) in a heterogeneous system. It also provides an integration platform for propagating measured properties throughout a reservoir.

HRA clustering is an unsupervised classification algorithm used to group rocks with similar log responses into rock classes, which are assigned colors for visualization purposes. These rock classes represent intervals of similar bulk composition and texture and form the fundamental building blocks of the reservoir.

HRA tagging is a supervised classification method for identifying where rock classes defined from a reference model appear in new wells. It also allows for the propagation of measured properties (e.g., core analysis or field measurements) throughout a field and for the identification of new rock classes.



HRA clustering: Quickly define the correct number of classes through multiple realizations and customized quality control plots.



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