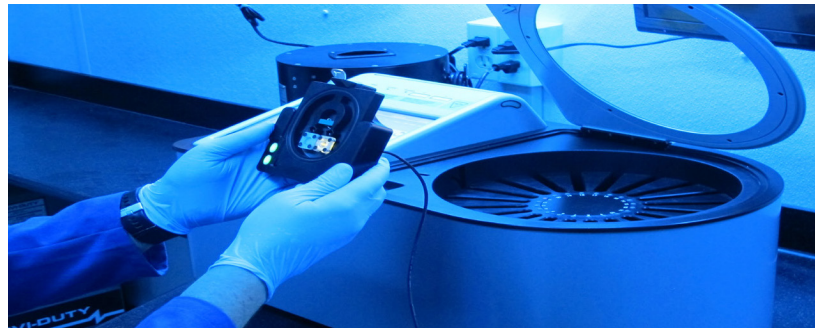


## X-Ray Diffraction or Bulk Mineralog



### Why XRD

RELIABLE acquisition of key properties such as bulk clay quantification, carbonate composition and silicate trends require accurate and non-subjective measurements.

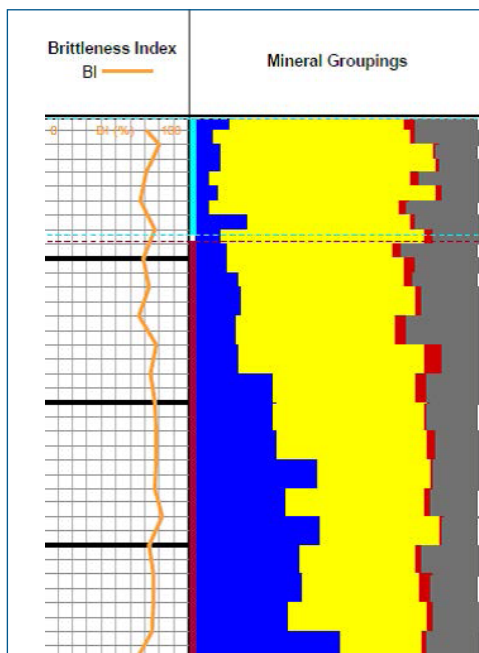
- The most advanced and accurate technology on the market along with interpretation by dedicated data analysts in the remote operations center provide the highest quality, rapid turnaround mineralogy available for immediate drilling and completions decisions.
- Even the most modern models and algorithms for “calculating” mineralogy are challenged by the heterogeneity of the unconventional formations. High levels of heterogeneity would require algorithm changes almost on a sample by sample basis through mudstones and shales.
- XRD can be used blindly and requires no historical data or algorithms to produce reliable and repeatable results.

### Overview

Unconventional reservoirs typically contain a significant amount of mineralogical heterogeneity which requires accurate and detailed lithology for immediate drilling and completions decisions. Traditional wellsite lithologic descriptions are very subjective and lack repeatable procedures for generating quantitative mineralogy.

X-Ray Diffraction has long been the industry standard for accurate mineralogy and is still a preferred method to calculation of mineralogy from downhole elemental capture tools. However, traditional laboratory XRD is very costly and typically comes with slow turnaround times.

Reservoir Group Surface Logging uses state-of-the-art technology and industry leading interpretive protocols to provide accurate, quantified, laboratory quality bulk XRD mineralogy at a fraction of traditional costs either at wellsite or in a Rapid Answer Lab setting.



Features	Benefits
Our innovative and portable instrument allows for rapid analysis (less than 30 minutes) either on location or in the Mobile Rock Lab for fast turnaround and the ability to utilize results in immediate time sensitive decisions.	Monitoring trends in the mineralogy and calculated relative brittleness to recognize key stratigraphic indicators
Provides a quantified phase breakdown (in wt %) of all major minerals (Quartz, Feldspar, Plagioclase, Calcite, Dolomite, Pyrite, etc.) along with bulk clay.	Avoid potentially problematic intervals such as high clay content, close proximity to potential frac barriers and any other lithotypes with historical (and costly) drilling or completions issues.
Can be done on cuttings or small rock samples at a fraction of what it would cost in the lab. This allows for larger intervals to be evaluated and/or tighter intervals on a well by well basis.	Integration with the organic data sets (pyrolysis and mass spec) for a complete characterization sample by sample through a well and across multiple wells. Combination of the most attractive organic and inorganic qualities drive decisions such as where to land a lateral and how to design customized completions.
Calculation of relative brittleness for comparing and mapping stratigraphic intervals in a given well or across acreage.	