

## Fluid Inclusion Technologies

# Rapid XRF, High Resolution Photography & Cuttings Analysis of Entire Wellbore

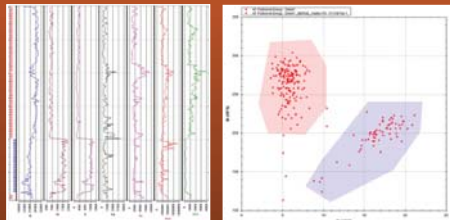
A unique approach using recently drilled and/or archived cuttings that involves 1) elemental analysis of rock material via x-ray fluorescence, 2) high resolution photography in both white light and under UV excitation, and 3) cuttings volatile analysis for hydrocarbons and non-hydrocarbons. The strength of this process is that all analyses are conducted on the same sample (up to 575 samples) with a complete analytical cycle of four days from preparation (washing, loading, etc.). This approach provides basic rock, fluid and petroleum system data that can be used as feedstock for log and rock properties calculations to more completely evaluate controls on fluid distribution, fluid type and porosity within problematic stratigraphic sections.

**X-ray Fluorescence (PDQ-XRF®)** provides a continuous elemental analysis of cuttings to be compared with FIS, petrography and photography in order to evaluate rock and cement types, interpolate spot trends defined by petrography to other portions of the data set, and used as a stratigraphic tool for well-to-well correlation and for retrospective horizontal wellbore mapping. Sweet spots defined by FIS may have specific XRF chemical attributes that reflect some property of the rock that can be monitored and exploited in future wells.

**Full Wellbore Photography (RockEye®)** provides a catalog of images of every sample taken at well site in plane light and under UV excitation. Grain-scale details of porosity distribution, rock types, etc. can be identified and correlated with the other data sets to provide a more integrated understanding of what is controlling hydrocarbon and porosity distribution in the system. These archived images are much easier to manage than the samples themselves, and allow the geologists to look at the rocks at their desks without relying on samples descriptions or lower quality images from well site. A viewer is available for these specific data sets so that interrelationships can be easily seen.

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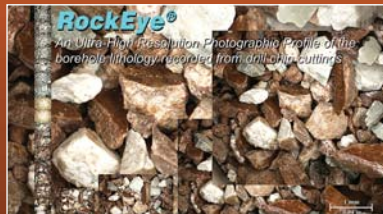
**Fluid Inclusion Stratigraphy (FIS®)** is a cuttings volatile analysis that provides a full wellbore profile of trapped fluids that can be related to migration, present and past accumulations of oil and gas, proximity to nearby charge, seals, maturity, fluid composition, and sweet spots. Follow-up petrographic and microthermometric data can help identify specific hydrocarbon change events, quantitative API gravities, saturation state of the hydrocarbon fluid, and salinities for log calculations of water saturation.



### PDQ-XRF®

High speed elemental profile of the entire well bore

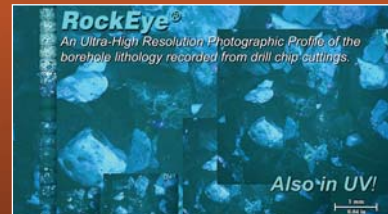
- Provides the lithologic/stratigraphic framework into which formation fluid chemistry can be placed
- Designed to be used in conjunction with FIS
- XRF Evaluates more than 30 major, minor, and trace elements
- Estimating mineralogical components & chemical marker horizons that can be correlated from well to well
- Data contains information relevant to depositional environment, diagenesis, facies and provenance
- Applicable to rocks of any age and type, allowing it to be effectively integrated with biostratigraphic information to be used where such information is not available



### RockEye®

High resolution photographic images of the entire well bore lithology in both visible light & UV fluorescence from cuttings and cores

- Visual record of the exact sample aliquot that was analyzed via FIS and/or PDQ-XRF®
- Photo resolution great enough to allow information to be obtained at the individual grain level
- Photos allow volatile chemistry and chemical stratigraphy trends to be placed into lithostratigraphic context without resorting to calculated rock types or well site sample descriptions
- Add-on module allows FIS data to be related to optically recognizable lithologic and textural features including characteristic mineral fluorescence
- Critical elements to the data package, photo records are more transportable and survive when sample has been depleted, destroyed or misplaced



## **FIT Geochemical Data Previewer**

A unique approach placing entire well bore history on one viewer that includes:

- Fluid Inclusion Stratigraphy (FIS) analysis of trapped fluid in cuttings, core or outcrop samples
- X-ray Fluorescence (PDQ-XRF®) provides a continuous elemental analysis
- High Resolution Photography (RockEye®) in both UV & white light
- Mass Spectrometry Well Gas Analyzer (Dq1000®) log done at the time of drilling

### **Benefits of FIT one viewer approach are:**

- The same sample of rock is analyzed at each step, preserving the interrelationships among rock type, rock chemistry and fluid type.
- The analysis is conducted on the entire bore hole from first returns to TD
- Lithology profiles in the absence of, or in place of, well site lithology descriptions
- Distribution and relative abundance of cements
- Cuttings volatile analysis for hydrocarbons and non-hydrocarbons
- Chemical stratigraphy for correlation in monotonous vertical or horizontal sections
- Depositional environment, facies, provenance
- High resolution photography in both White Light and under UV excitation
- Elemental analysis of rock material via X-ray Fluorescence
- Rock behavior relevant to completion (e.g., siliceous vs. clay rich)

### **Key strengths of this process are:**

- Process is automated
- Small sample requirements 2-5 gms washed
- All analyses are conducted on the same sample with up to 575 samples per well
- Fast response — analytical cycle of four days from preparation (washing, loading, etc.)

### **Sample Requirements**

Cuttings, core and/or outcrop  
2-5 gms washed / 10-15 gms unwashed  
Spacing: 10-30 ft (3-10 m) for cuttings; 1 ft (0.5 m) for core.

### **Where to Send Samples:**

Fluid Inclusion Technologies  
Attn: FIS Analysis  
2217 N. Yellowood Ave.  
Broken Arrow, OK 74012 USA

### **Suggested Supporting Information:**

FIT service request form  
Logs  
Geochemistry

### **Where to Send Support Information:**

Fluid Inclusion Technologies  
2217 N. Yellowood Ave.  
Broken Arrow, OK 74012 USA

### **Deliverable:**

A high speed XRF elemental profile, high resolution photographic lithology (in white light and UV), and FIS report of entire well bore delivered on FIT Data Previewer. FIS includes sample analysis by mass spectrometry of each sample, thin section prep of samples of interest derived from the analysis, photo documentation of the sections, electronic data in .las and .pdf format, annotated track plot, executive summary and one final report in electronic format.

