

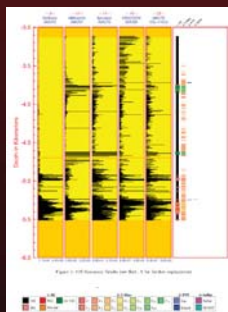
Fluid Inclusion Stratigraphy

Fluid Inclusion Stratigraphy (FIS) is a patented technique that involves the rapid, complete analysis of volatiles trapped as fluid inclusions in cuttings, core or outcrop samples using quadrupole mass analyzers attached to an automated, high-vacuum sample introduction system. The technique documents the presence and relative bulk abundance of geologically important inorganic species as well as organic species with 13 carbon atoms or less. FIS methodology and theoretical framework are the result of a long-standing research and development effort, and the cumulative experience and database of documented case histories are the most extensive in the world. Additionally, the technology represents the most rapid commercial analytical capability of its kind available. Resulting datasets provide nearly continuous depth profiles of present and past pore fluid chemistry, which can be mapped in one, two or three dimensions, depending on sample coverage. FIS also provides an efficient geochemical screening tool for determining the most appropriate samples for more detailed fluid inclusion techniques. Analytical results are unaffected by mud type or fluid balance while drilling.

Fluid Inclusions are microscopic traces of past or present-day subsurface fluids that become entrapped in rocks during burial. They are completely encapsulated within their host minerals, hence are distinctive from adsorbed or residual fluids in open porosity. As such, fluid inclusions are not subject to evaporation during sample storage, loss of light ends during sampling from depth or contamination from the mud system. They persist in the geologic record even after the parent fluids have moved on; thus, a given sample contains the fluid history of the area. Specific tests can be done on fluid inclusions to study processes occurring within the earth, particularly those involving migration and accumulation of oil and gas.

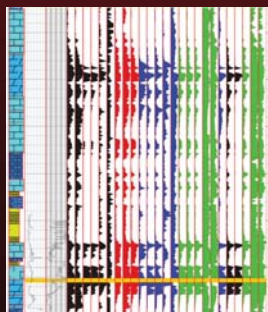


Applications

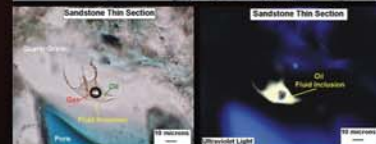
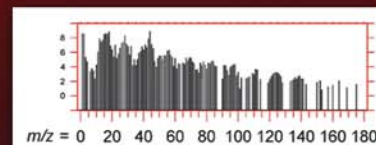


- Migration, charge/paleo-charge, fluid contacts
- Petroleum type; quality; multiple charges
- Inferring nearby undrilled accumulations
- Microseepage, deeper potential
- Seals, compartmentalization
- Source rock richness and maturity
- Fractures/sweet spots in horizontal wells
- Identifying samples for GCMS and CSIA

Analysis



- Surface contamination removed
- Crushed in vacuum; analyzed via mass spectrometry
- C1-C13 petroleum species
- BTEX compounds and organic acids
- Sulfur bearing compounds including H₂S, SO₂, COS, and CS₂
- Depth plots of species and relevant gas ratios
- Individual mass spectrum for each sample
- Thin section follow up included as part of service



When Should I Use FIS?

Fluid Inclusion Stratigraphy is one of the most broadly applicable geochemical techniques available. Virtually any question that involves the present or past distribution of petroleum, its chemical characteristics, and relationship to the rock/pore system can be addressed using FIS.

FIS has been used to provide evidence for:

- Petroleum migration or paleocharge in a section that did not have significant drilling shows
- Characteristics of migration or charge such as oil vs. gas; sour vs. sweet; thermal/bacterial alteration
- Earlier liquid petroleum charge in a gas reservoir
- Updip or lateral charge and hydrocarbon type in a wet reservoir section
- Deeper potential (microseepage) in an area with shallow well control
- Effectiveness of a seal system over geologic time
- Delineation of petroleum-water contacts when log calculations of pay are equivocal
- Porosity/permeability sweet spots in tight reservoirs where log calculations of porosity are unclear
- Lateral or vertical reservoir compartmentalization; location of potential barriers or baffles to production
- Unswept oil for EOR

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

