

# Fluid Inclusion Technologies

Rapid analysis of trapped fluids and mineralogy



Distribution, abundance, and attributes of encapsulated fluids



Minimal rock material samples



Quick, automated analysis of up to 575 cuttings samples in as little as 5 days

## Applications

- Any lithology, reservoir, and sample type: cuttings, whole or sidewall cores, and outcrop samples
- Evaluation of abundance, distribution, and composition of hydrocarbon and aqueous fluids trapped in inclusions
- Petroleum systems insight: causal relationships between rocks and fluids, migration, local generation, multiple charges, and diagenesis
- Identification of migration and paleo accumulations in the absence of conventional shows

## How it improves wells

Identification of the most productive intervals for guiding prospectivity mapping, well placement, and staged fracturing

## Custom fluid databases

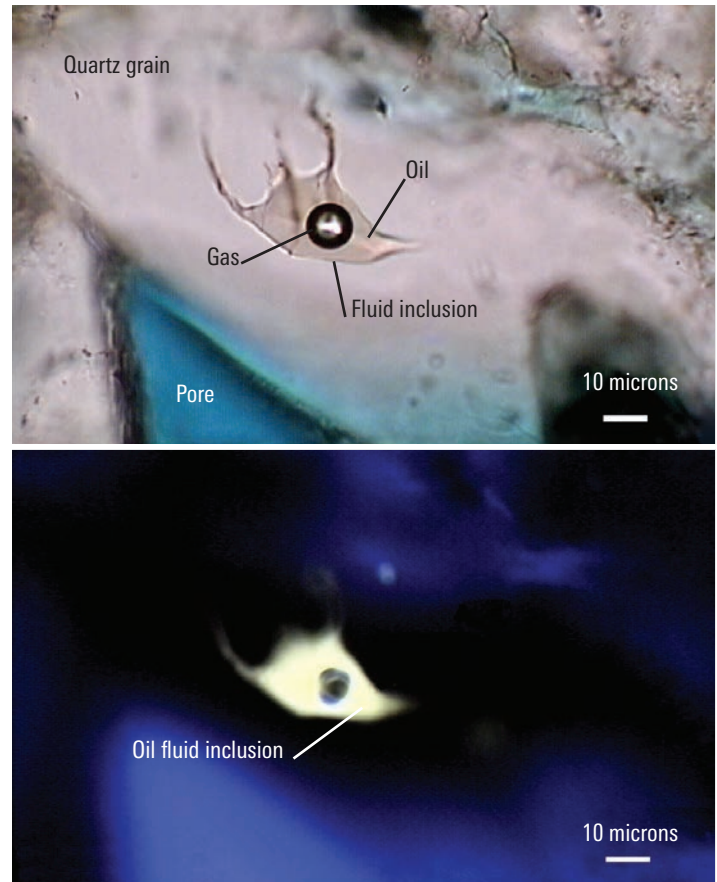
Fluid inclusion petrography and microthermometry are applicable to any lithology and any age reservoir, provided that suitable fluid inclusion populations can be found. Drilling fluids do not affect the analysis, and there is no shelf life for samples.

## PetroFecta automated trapped fluid and elemental composition analysis

PetroFecta\* analysis employs a unique workflow to efficiently evaluate the entire wellbore by sequencing

- high-resolution photographic images in both visible light and UV fluorescence
- FIS\* fluid inclusion stratigraphy analysis for rapid and complete analysis of volatiles trapped in rock material
- automated X-ray fluorescence elemental analysis
- diffuse reflectance infrared Fourier transform spectroscopy (DRIFTS) for direct mineralogy measurement.

This efficient geochemical screening readily integrates with mud and wireline logs and basin modeling. It also enables identifying the most appropriate samples for more detailed investigation, including microthermometry, biomarkers, gas isotopes, and source rock richness.



*Oil and gas fluid inclusion in a sandstone thin section in visible light (top) and under UV light (bottom).*

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## Fluid inclusion petrography

Performed on thick, polished sections of rock material under transmitted plane-polarized light and episcopic illumination with a high-intensity UV source, fluid inclusion petrographic analysis provides

- microscopic examination of rock material for trapped hydrocarbons and aqueous fluids
- characterization of the distribution, abundance, and attributes of encapsulated fluids, such as fluorescence color
- partitioning of petroleum migration paths from paleo accumulations in conventional reservoirs
- maturity and effectiveness of local organic matter for petroleum generation in self-sourced unconventional reservoirs.

## Fluid inclusion microthermometry

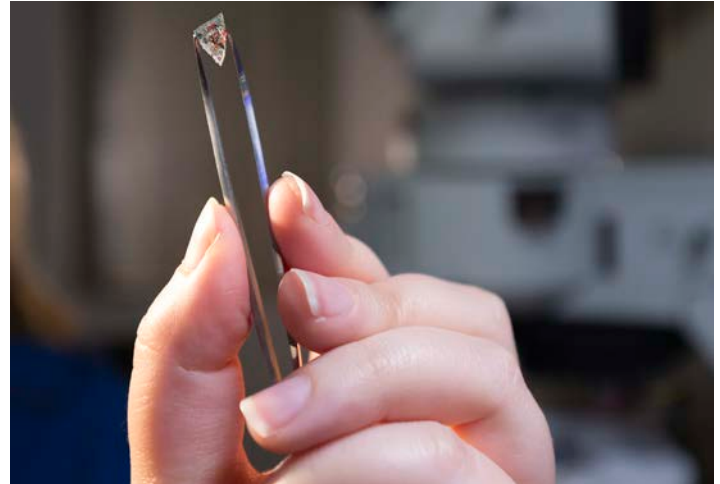
This advanced quantification of aqueous and petroleum fluid inclusions uses a specially designed temperature-controlled chamber attached to a petrographic microscope. Phase changes and other observations within individual fluid inclusions are recorded and compared with appropriate phase diagrams or calibration curves to determine

- homogenization temperature of aqueous and petroleum inclusions
- proximity to bubblepoint or dewpoint at trapping
- determination of API gravity to within 2 API
- salinity of aqueous inclusions to infer fluid sources and evaluate the composition of irreducible water within reservoirs for calculating the water saturation.

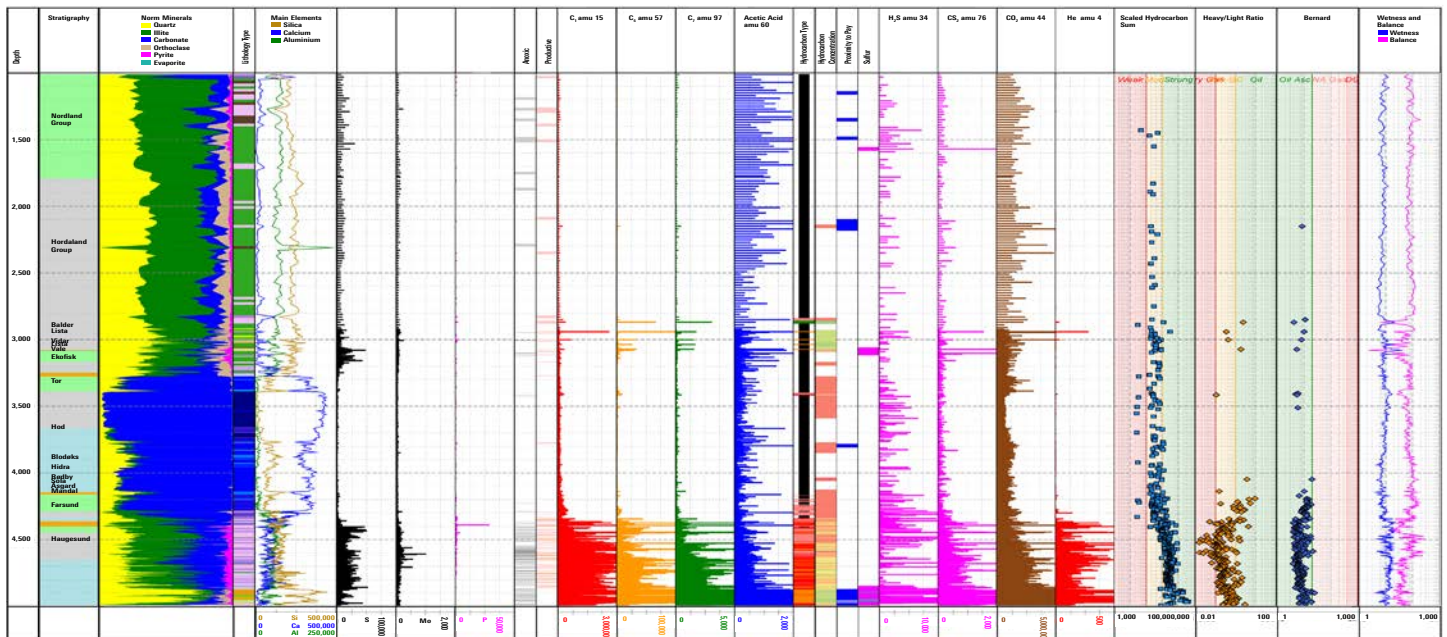
## Biomarker and gas isotope analysis

Compositional analysis is performed by gas chromatography (GC) and by GC and mass spectrometry (GC-MS) and the  $\delta^{13}\text{C}$  of fluid inclusions is determined by isotope ratio MS (IRMS) for correlating data from rock material, hydrocarbon samples, and fluid inclusions. Applications include

- correlation of shows and paleo accumulations to source rock
- maturity comparison
- biodegradation and thermal alteration assessment
- identification of potential end members for pay allocation.



Polished sandstone rock fragment for fluid inclusion microthermometry.



Summary log from PetroFecta analysis for North Sea well.

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