Petroleum geoscience: Fluid history analysis

CSIRO develops and applies innovative techniques to investigate the movement of hydrocarbons in petroleum reservoirs and sedimentary basins at geological and production time scales, by analysing rocks and associated fluids at the micro-scale.

Expertise

The team has multi-disciplinary skills in the following areas:

- petroleum geoscience, particularly fluid inclusion microscopy
- spectroscopy
- petrography
- laboratory characterisation of fluids and sedimentary rocks.

The research team works closely with both CSIRO's organic geochemistry team, that analyses the molecular composition of oil inclusions (MCI), and structural team, that investigates trap integrity, to provide a complete fluid history analysis capability.

Preparing a sample for analysis in the fluid history analysis laboratory.

Facilities

We have access to unique facilities to conduct research and provide analytical services. CSIRO owns and operates:

- patented and exclusive technologies with data acquisition and interpretation work flows:
  - –GOI™ (Grains with Oil Inclusions)
  - –QGF and QGF-E (Quantitative Grain Fluorescence)
  - –TSF (Total Scanning Fluorescence)
  - –ROI (Resistivity from Oil–water Inclusions)
- an extensive database of GOI™ and QGF data in Australia
- a fully equipped fluid inclusion laboratory with CSIRO-assembled GOI™-spectroscopy work stations and thermometric equipment
- a dedicated quantitative fluorescence laboratory
- a laser Raman microscope (LabRAM HR).

Applying the capability

These technologies have direct application to the oil and gas industry in the fields of:

- petroleum systems analysis
- detection of palaeo-oil zones and potential for nearby oil prospects
- detection of oil migration in out-of-closure wells
- regional oil charge prediction
- reserve estimation.

Crude oil from the Barrow oilfield, Western Australia.

Our collaborators

Our team has established extensive partnerships with other research groups within CSIRO to deliver a multi-disciplinary approach to our work. We also collaborate with other Australian and international research organisations and major national petroleum companies in the region including:

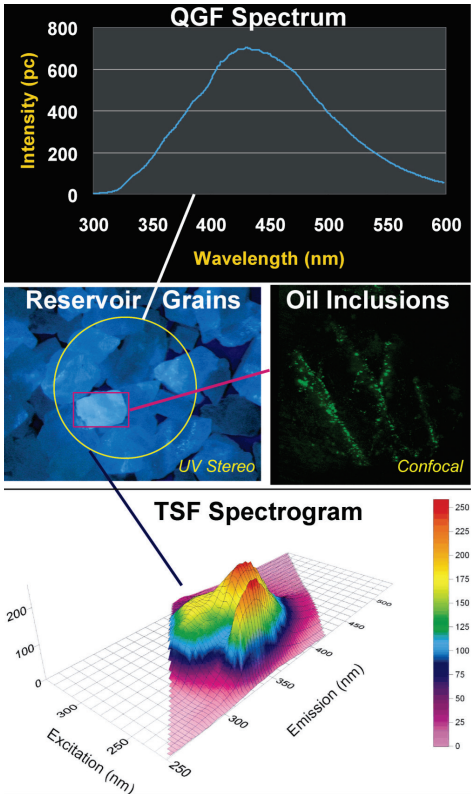
- Geoscience Australia
- Australian National Low Emissions Coal Research & Development (ANLEC R&D)
- the Western Australian Energy Research Alliance (WA:ERA)
- China University of Petroleum
- Petrobras, PetroChina and SINOPEC.

We deliver commercial services to the petroleum industry and have over 140 clients worldwide.

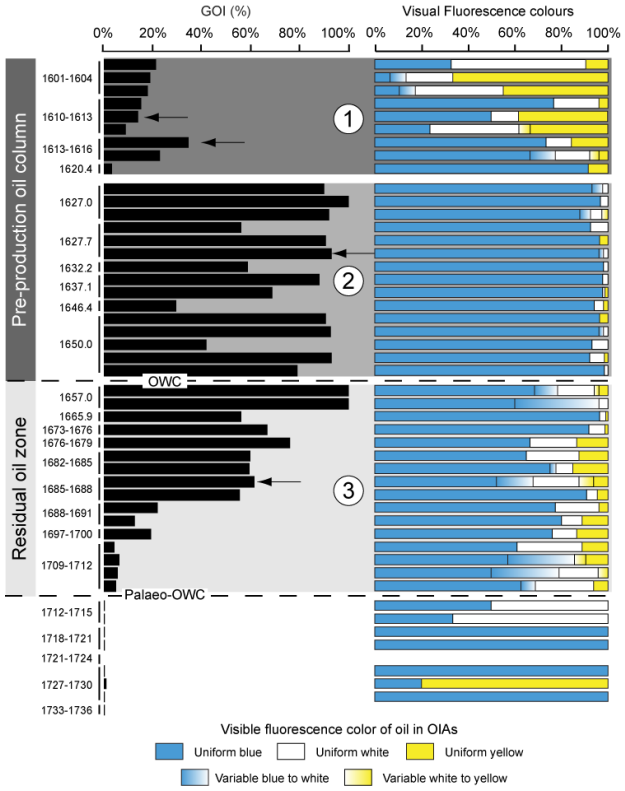
Case study

NORTHERN OFFSHORE PERTH BASIN

GOI™ and QGF have been applied to successfully delineate current residual oil and palaeo-oil zones in geographically diverse wells in the northern offshore Perth Basin. These techniques, in conjunction with MCI, indicate a widespread oil charge from Early Triassic source rocks that was not evident in early exploration outcomes. Early Cretaceous fault reactivation exerts the primary control on trap integrity, with fault orientation being the first-order factor for evaluating oil-preservation potential.



Schematic illustration of microscopic and spectroscopic investigation of reservoir grains containing oil inclusions.



Fluid inclusion abundance (GOI) profile of Jabiru-1A, Timor Sea.

Getting involved

The expertise and technologies of the fluid history analysis team can be accessed through:

- commercial consulting services and technical support
- collaborative research
- technology and laboratory system licensing and training.

Key contacts

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