

Petroleum geoscience: Organic petrology

CSIRO's organic petrology team conducts research and services with an emphasis on petroleum source rock evaluation and coal seam gas reservoir characterisation.

Organic petrology involves the study of organic matter (OM) in rocks including its origin and thermal maturity due to burial within the earth's crust. The organic petrology team develops and applies advanced technologies to increase understandings of sedimentary OM.

Expertise

The organic petrology team and our collaborators use a unique multidisciplinary approach not available in other institutions. The team has extensive experience and expertise in:

- ♦ organic petrology
- ♦ geology (including coal geology)
- ♦ technique development.

The integration of these skills has led to reservoir characterisation studies for coal seam gas (CSG) and the invention of the Fluorescence Alteration of Multiple Macerals (FAMM) technique. The FAMM technique is applied to evaluate thermal maturity of source rocks for petroleum.

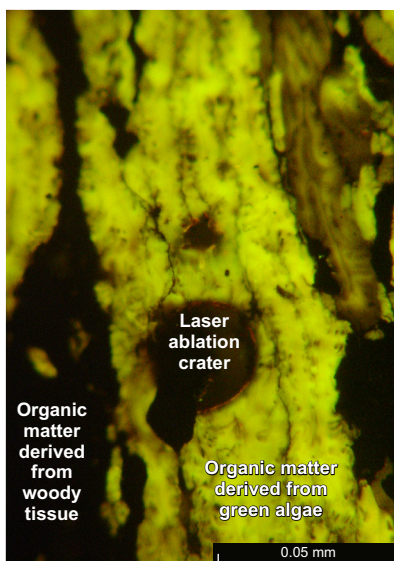
For studies on CSG reservoirs we also integrate skills in:

- ♦ petrophysics
- ♦ gas geochemistry
- ♦ microbiology
- ♦ reservoir engineering.

Facilities

The team uses fluorescence microprobes and reflected white light/fluorescence mode microscopes for petrographic characterisation of OM including 'vitrinite reflectance'. We have access to a laser micropyrolysis system for molecular chemical analyses of single macerals,

as well as geographic information systems and geostatistical capabilities.



Fluorescence mode photomicrograph showing laser ablation crater formed during micropyrolysis experiments to derive molecular information from individual organic entities.

Applying the capability

Organic petrology is a key discipline in assessing petroleum prospectivity of exploration acreage. It involves evaluating the generation potential of source rocks by assessing source quality (OM typing) and thermal flux (maturity). The organic petrological data are used as basic inputs for petroleum generation models to assess the amounts and timing of generation and expulsion.

Organic petrology is combined with other data to identify prospective sites for CSG production and for optimising coal blends as feedstocks for gasification, coking and electricity generation.

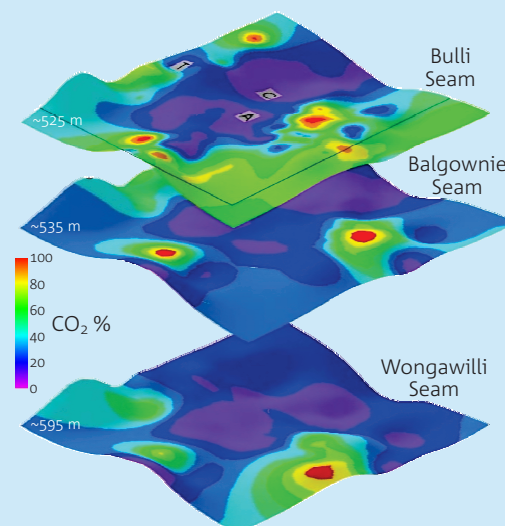
Case study

PAPUA NEW GUINEA FORELAND FOR OIL SEARCH

Petroleum charge models have been constrained for a multi-well, regional study in the Papua New Guinea Foreland for Oil Search by integrating FAMM analyses with conventional organic petrology and organic geochemistry. The work has enabled the identification of previously unknown, potential, lacustrine source rocks and has provided a more accurate evaluation of thermal maturity than previously obtained.

SYDNEY BASIN CSG RESERVOIR CHARACTERISATION

A combination of organic petrology and coal geology, inorganic petrology, gas geochemistry and reservoir engineering has been used to identify a high production CSG fairway near Camden (NSW, Australia), in collaboration with Sydney Gas-AGL. The work was based on analyses of organic matter type, thermal maturity, adsorption isotherms, diffusivity, permeability, gas isotopes and mineralogy of coal samples from numerous gas and coal exploration wells in the southern Sydney Basin. The Sydney Gas-AGL joint venture has subsequently been producing gas from the area identified.



Schematic diagram showing the relationship between %CO₂ and seam structures for three seams in the southern Sydney Basin, NSW, Australia.

The organic petrology team conducts research to:

- ♦ develop innovative techniques for petroleum source rock and coal evaluation, including fluorescence analyses (laser induced fluorescence, spectral fluorescence and combined fluorescence–reflectance) and laser micropyrolysis
- ♦ apply techniques to solve problems in thermal maturity evaluation of source rocks and coals, and in coal utilisation
- ♦ characterise CSG reservoirs through the integration of organic petrology with regional/structural geology, petrophysics, gas geochemistry and microbiology
- ♦ assess the potential for microbially-enhanced CSG production.

The outcomes of this research are offered as services to industry, mainly in the areas of:

- ♦ thermal maturity evaluation of petroleum source rocks, using FMM to assist in prospectivity assessment (this service is unique to CSIRO)
- ♦ integrated CSG reservoir characterisation for delineation of production ‘sweetspots’.

Our collaborators

The organic petrology team collaborates with a number of capability groups within CSIRO, and external organisations including:

- ♦ petroleum exploration and CSG production companies
- ♦ government survey organisations such as Geoscience Australia and the NSW Department of Primary Industries.

Getting involved

The organic petrology team offers FMM and coal seam reservoir analyses on a commercial basis to the petroleum exploration industry, service companies, government survey organisations and research institutions.

Projects can be commissioned as jointly funded collaborations or as fee-for-service contracts, depending upon the nature of the work. Enquiries can be made to Neil Sherwood.

Key contact

Dr Neil Sherwood

Group Leader,

Onshore Gas Program

t +61 2 9490 8976

e neil.sherwood@csiro.au



The organic petrology team conducts research for coal seam gas production and geological storage of carbon dioxide.

CONTACT US

t 1300 363 400

+61 3 9545 2176

e enquiries@csiro.au

w www.csiro.au

YOUR CSIRO

Australia is founding its future on science and innovation. Its national science agency, CSIRO, is a powerhouse of ideas, technologies and skills for building prosperity, growth, health and sustainability. It serves governments, industries, business and communities across the nation.