

# Shale gas research program

CSIRO is conducting a shale gas program to address research issues and the delivery of services to the Australian industry.

Shale gas production is a major industry in the United States and the success in producing this unconventional resource has led to significant interest in shale gas in Australia.

CSIRO has considerable expertise in shale characterisation and methods to enhance recovery of gas from low permeability formations. Our expertise spans both geological and engineering aspects of shale gas and includes sedimentology, stratigraphy, regional tectonics, structural and seismic interpretation, reservoir characterisation and reservoir engineering, supported by experimental and modelling capability.

CSIRO has a long track record of service in many of these areas and is consulting with industry to develop an appropriately targeted shale gas research program.

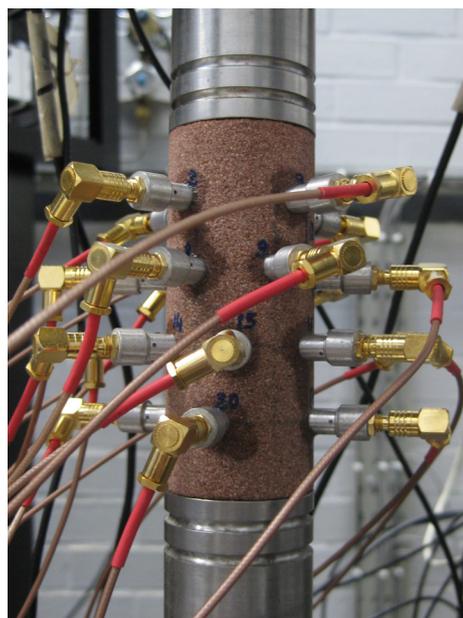
## Activities and capabilities for shale gas

### ORGANIC MATTER CHARACTERISATION

CSIRO's organic geochemistry and petrology teams conduct research into shale gas, source rock quality, thermal maturity evaluation, petroleum geochemistry, and environmental geochemistry. We develop techniques to help reduce exploration risk, aid in appraisal of oil and gas fields, facilitate production and assess the impact of hydrocarbons on the environment.

### GEOMECHANICS

CSIRO has a world class rock mechanics laboratory for determining static and dynamic rock properties, including tests under high pressure, high temperature and with ultrasonic and microseismic (acoustic emission) capability. Anisotropy is also a significant area of study. The experimental facility is supported by significant geomechanical and rock physics modelling capability.



High pressure high temperature rig with active/passive transducers for ultrasonics and acoustic emissions.

### STRUCTURAL GEOLOGY/GEOPHYSICS

We conduct research to help understand the architecture and deformation history of hydrocarbon-bearing sedimentary sequences to predict both the occurrence and distribution of potential reservoirs. Other areas of focus include:

- ♦ providing insight into reservoir fluid and dynamic processes using industry seismic and electromagnetic data, with expertise in quantitative interpretation
- ♦ 3D and 4D seismic
- ♦ stratigraphic forward modelling of organic-rich facies
- ♦ rock physics experiments and theory
- ♦ modelling of coupled processes.



Secondary electron image of a silty clay, showing open pore structure and thin illite bridges between particles.

### UNCONVENTIONAL PETROLEUM RESERVOIR ENGINEERING

CSIRO is integrating laboratory experiments and novel numerical modelling techniques to meet the challenges and improve the management of production from coal seam gas and shale gas reservoirs. We are also investigating adsorption and desorption of gas and modelling of such processes.

### HYDRAULIC FRACTURING

We are developing a comprehensive understanding of hydraulic fracture mechanics of naturally fractured reservoirs

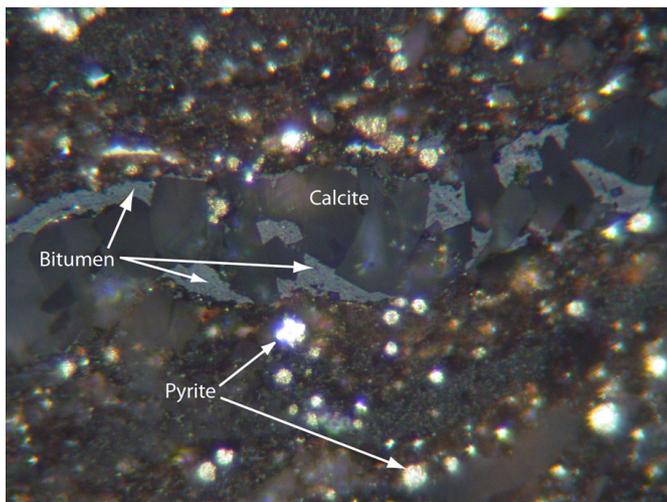
through theoretical development, numerical modelling, and laboratory and field experimentation. For example, one numerical model considers the effect of fracture–fracture interaction, fracture branching and offsetting on pressure, growth rate and ultimate extent.

#### PETROPHYSICS

Our petrophysics activity includes laboratory and wireline log determination of the petrophysical response of rocks, including electrical and dielectric properties, nuclear magnetic resonance and rock physics. We also conduct computed tomography (CT) and MicroCT scanning, digital rock properties and other specialist visualisation techniques.

### Shale Research Centre

The Shale Research Centre is an association of CSIRO laboratories and researchers combining experimental and theoretical research expertise aimed at understanding clay and shale behaviour applied to wellbore stability, pore pressure prediction, seal integrity, shale gas, CO<sub>2</sub> storage and seismic imaging. A strong focus area is the links between geomechanics, rock physics and petrophysics in shales as overburden or reservoir rocks.



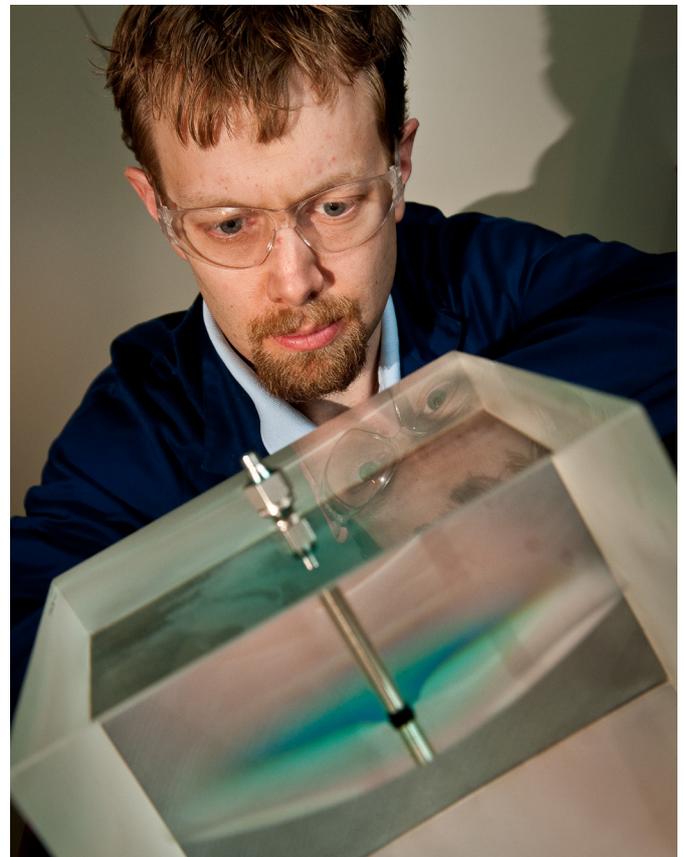
Bitumen associated with carbonate porosity in Posidonia Shale. Reflected white light illumination, oil immersion.

### Program duration and structure

CSIRO is currently developing a shale gas program to cover research issues and the delivery of services to the Australian industry. CSIRO's shale gas research program will have a flexible structure that will accommodate:

- ♦ investment in CSIRO-funded strategic research

- ♦ co-funded research and development programs sponsored by CSIRO, government and industry
- ♦ industry-funded asset-specific applied research
- ♦ provision of specialised services.



Our hydraulic fracturing facilities are equipped with specialised instrumentation and equipment to develop and provide innovative technical capabilities closely aligned with industry needs.

### Key contacts

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