Pyrolysis of Permian sediments from the Sydney Basin

Prerequisites / Requirements:

GEOS710/920

Supervisors / Research Group / Project Partners:

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Organic Geochemistry group.

Project Description:

Over the last few years several masters students have worked on organic geochemical studies of Permian sedimentary rocks from the southern part of the Sydney Basin. The objectives of the projects have been to determine the depositional environment, organic matter inputs, thermal maturity and petroleum generation potential of these formations, which were deposited when Australia was close to the South Pole. We have utilised outcrop samples from the coastline S of Ulladulla (GEOS206 area), and core from boreholes held by NSW Resources and Energy at the core library at Londonderry, and have carried out biomarker studies on the extractable organic matter.

Alternative methods of analysing the organic matter in mudstones and coals are pyrolysis based. In mid-2017 we installed new flash pyrolysis and microscale sealed vessel (MSSV) pyrolysis equipment, which for the first time enable the characterisation of the kerogen (insoluble organic matter) preserved in organic-rich rocks. It is proposed that an MRes student will work on characterising the already-sampled Wandrawandian Siltstone, Snapper Point Formation and Pebbley Beach Formation, in order to assess variations in kerogen type and the correlation with the biomarker interpretations of depositional environment and organic matter input.

Additionally, a multi-institution 2018 ARC LIEF project led by Simon George is building a new femtosecond laser micropyrolysis gas chromatograph-mass spectrometry (la-py-GC-MS) system at Macquarie University. This world-leading facility will be able to analyse small (<20μm) petrographically-selectable areas of organic-rich rocks in order to understand the organic geochemistry at the microscopic scale (instead of the usual bulk powder methods). There is an opportunity for the MRes student working on pyrolysis to be involved with the initial instrument developments on this facility during 2019, using the same Permian samples. This would include petrographic assessment of the samples using scanning electron microscopy and Nanomin, in order to select specific organic matter for pyrolysis, followed by laser micropyrolysis of those entities so as to establish its chemistry.

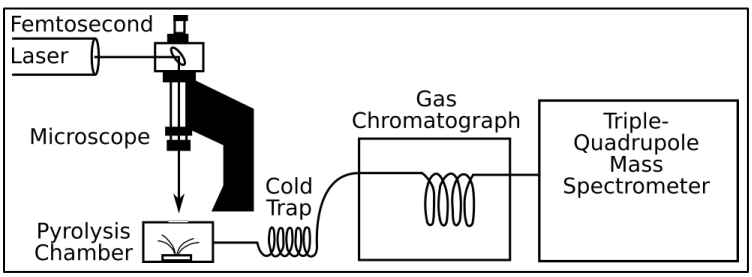

Figure: The la-py-GC-MS will be constructed by interfacing four separate instrument modules: (1) a femtosecond laser; (2) a reflected light microscope; (3) a sample chamber and associated GC carrier gas inlet system for trapping and transfer of pyrolysates to the GC-MS; and (4) a triple quadrupole GC-MS. From George *et al.*, ARC LIEF grant application.