



# GEOS920

## Palaeoenvironments and Biogeochemistry

S2 Day 2017

*Dept of Earth and Planetary Sciences*

### Contents

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<a href="#"><u>General Information</u></a>	2
<a href="#"><u>Learning Outcomes</u></a>	3
<a href="#"><u>Assessment Tasks</u></a>	3
<a href="#"><u>Delivery and Resources</u></a>	5
<a href="#"><u>Unit Schedule</u></a>	6
<a href="#"><u>Policies and Procedures</u></a>	7
<a href="#"><u>Graduate Capabilities</u></a>	8
<a href="#"><u>Changes from Previous Offering</u></a>	11

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## General Information

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Credit points

4

Prerequisites

Admission to MGeoSc and GEOS309

Corequisites

Co-badged status

### Unit description

This unit will provide masters students with the foundations of palaeoenvironmental analysis as applied to some key geoscience problems. The unit will have a problem-based approach that focuses on understanding important processes, especially with examples from the Neoproterozoic, Cretaceous and the modern day. We will introduce the fundamentals of ocean circulation, nutrient supply and the carbon cycle. Students will assess the veracity of biogeochemical oceanographic signals, especially with respect to diagenetic overprinting. Box models will be introduced as a means for understanding geochemical and isotopic signals. The unit will cover co-evolution of life and its environment, the effect of bioturbation on sediments, especially across the Precambrian-Cambrian boundary, and the geochemical record of life as expressed through biomarkers. The pros and cons of various proxies used for the reconstruction of palaeoenvironments will be evaluated. The unit will build knowledge about important techniques and methods such as stable and radiogenic isotopes, organic geochemistry and microscopic techniques for assessing sediments and sedimentary rocks. Assignments will build skills in practical and industry applications of this area, including in the energy industry.

## Important Academic Dates

Information about important academic dates including deadlines for withdrawing from units are available at <https://www.mq.edu.au/study/calendar-of-dates>

## Learning Outcomes

On successful completion of this unit, you will be able to:

An advanced knowledge of the principles and concepts of biogeochemistry, basic modelling and element cycles

The ability to select and critically evaluate appropriate proxies to obtain information on past environments

A knowledge of oceanic anoxic events, and the impact of life on element cycles, with a focus on the Cretaceous and Neoproterozoic

An advanced knowledge of the principles and concepts of organic geochemistry

Demonstrated ability to communicate about biogeochemistry and palaeo-environments to a wider audience through masters level writing and oral presentation

## Assessment Tasks

Name	Weighting	Hurdle	Due
<a href="#">Tutorial summaries/questions</a>	20%	No	4/8, 15/9, 6/10 2017
<a href="#">Assignment 1</a>	30%	No	8th September 2017

Name	Weighting	Hurdle	Due
<a href="#">Assignment 2</a>	30%	No	13th October 2017
<a href="#">Oral presentation</a>	20%	No	10th November 2017

## Tutorial summaries/questions

Due: **4/8, 15/9, 6/10 2017**

Weighting: **20%**

Tutorial summaries/questions: in weeks 1, 7 and 8, there will be 3 x 15 minute "last 15 tests", to be completed before leaving the room. Week 1, 5%. Week 7, 2 x 5%. Week 8, 5%.

On successful completion you will be able to:

- An advanced knowledge of the principles and concepts of biogeochemistry, basic modelling and element cycles
- The ability to select and critically evaluate appropriate proxies to obtain information on past environments

## Assignment 1

Due: **8th September 2017**

Weighting: **30%**

Assignment 1: The Paleocene–Eocene Thermal Maxima (PETM)

On successful completion you will be able to:

- An advanced knowledge of the principles and concepts of biogeochemistry, basic modelling and element cycles
- The ability to select and critically evaluate appropriate proxies to obtain information on past environments
- A knowledge of oceanic anoxic events, and the impact of life on element cycles, with a focus on the Cretaceous and Neoproterozoic
- Demonstrated ability to communicate about biogeochemistry and palaeo-environments to a wider audience through masters level writing and oral presentation

## Assignment 2

Due: **13th October 2017**

Weighting: **30%**

Paper review: Understanding past Earth events

On successful completion you will be able to:

- An advanced knowledge of the principles and concepts of biogeochemistry, basic modelling and element cycles
- An advanced knowledge of the principles and concepts of organic geochemistry
- Demonstrated ability to communicate about biogeochemistry and palaeo-environments to a wider audience through masters level writing and oral presentation

## Oral presentation

Due: **10th November 2017**

Weighting: **20%**

Oral Presentations by everyone in the class on individually allocated topics

On successful completion you will be able to:

- An advanced knowledge of the principles and concepts of biogeochemistry, basic modelling and element cycles
- The ability to select and critically evaluate appropriate proxies to obtain information on past environments
- A knowledge of oceanic anoxic events, and the impact of life on element cycles, with a focus on the Cretaceous and Neoproterozoic
- An advanced knowledge of the principles and concepts of organic geochemistry
- Demonstrated ability to communicate about biogeochemistry and palaeo-environments to a wider audience through masters level writing and oral presentation

## Delivery and Resources

### **GEOS920 Palaeoenvironments and biogeochemistry (session 2, 2017)**

This unit will provide masters students with the foundations of palaeoenvironmental analysis as applied to some key geoscience problems. The unit will have a problem-based approach and will focus on understanding important processes, especially with examples from the Neoproterozoic, Cretaceous and the modern day. Fundamentals of ocean circulation, nutrient supply and the carbon cycle will be introduced. The veracity of biogeochemical oceanographic signals will be assessed, especially with respect to diagenetic overprinting. Box models will be introduced as a means for understanding geochemical and isotopic signals. The unit will cover co-evolution of life and its environment, the effect of bioturbation on sediments, especially across the Precambrian-Cambrian boundary, and the geochemical record of life as expressed through biomarkers. The pros and cons of various proxies used for the reconstruction of palaeotemperatures will be assessed. The unit will build knowledge about important techniques and methods such as stable and radiogenic isotopes, organic geochemistry and microscopic techniques for assessing sediments and sedimentary rocks. Assignments will be designed to build high level research skills in this area.

This unit is co-taught with GEOS710 Records of palaeoenvironments: life and geochemistry (Master of Research). The lectures are the same, but the assignments differ slightly due to different learning outcomes. There is only one iLearn site for both units.

**Web pages and electronic resources**

The main unit web page will be on iLearn: <https://ilearn.mq.edu.au/login/MQ/>

iLearn is Macquarie's learning management system. Assignments, hand-outs, and reading material will be available here.

**Classes:** There will be 13 compulsory lectures/tutorials to introduce the unit and give you a grounding in the theory behind some of the techniques. It is important that you attend these sessions every week, as they include discussion sections, and also problem solving on hard copy handouts. These sessions will not be audio recorded. and will be in 12 Wally's Walk (E7A) 324, Friday 14:00-16:00.

**Unit Schedule**

GEOS920 Palaeoenvironments and biogeochemistry (session 2, 2017)					
Week	Dates	What	Who	Classroom: 12 Wally's Walk (E7A) 324 Friday 14:00-16:00	"Last 15"
1	04-Aug-17	Introduction	SG	Snowball Earth from the sediment record: processes & Earth systems	Daisy World
2	11-Aug-17	Organic Geochemistry & Biomarkers	SG	Introduction to biomarkers; diagenesis of OM; inference of palaeoenvironments	
3	18-Aug-17			Palaeotemperatures: alkenones and TEX86; environmental biomarkers/oil spills	
4	23-Aug-16			Chemical record of life; microorganisms and the deep biosphere	
5	01-Sep-17	Stable Isotopes	MK	Determining palaeotemperatures and palaeoenvironments using stable isotopes	
6	08-Sep-17			Monitoring the global carbon cycle, the isotope and sedimentary record	
7	15-Sep-17	Global Circulation	AA	Physical processes: box models and introduction to circulation	Box modelling exercise
Break	22-Sep-17				
Break	29-Sep-17				
8	06-Oct-17	Global cycles; Radiogenic Isotopes; box models	AA	Physical processes: circulation of the atmosphere and oceans, salty ocean	Jolly's age of ocean
9	13-Oct-17			Chemical processes: elemental cycling and nutrients	

10	20-Oct-17			Nd isotopes in the Cretaceous... what else do we need to know			
11	27-Oct-17	Life & Biogeochemistry	SL	OAEs continued, changes in carbonate compensation depth			
12	03-Nov-17			Bioturbation across Neoproterozoic-Cambrian, impact of life on cycles			
13	10-Nov-17	Wrap up	all	Student Presentations			
SG = Prof. Simon George; MK = Prof. Martin Kennedy; AA = Dr April Abbott; SL = Dr Stefan Löhner							

## Policies and Procedures

Macquarie University policies and procedures are accessible from [Policy Central](#). Students should be aware of the following policies in particular with regard to Learning and Teaching:

Academic Honesty Policy [http://mq.edu.au/policy/docs/academic\\_honesty/policy.html](http://mq.edu.au/policy/docs/academic_honesty/policy.html)

Assessment Policy [http://mq.edu.au/policy/docs/assessment/policy\\_2016.html](http://mq.edu.au/policy/docs/assessment/policy_2016.html)

Grade Appeal Policy <http://mq.edu.au/policy/docs/gradeappeal/policy.html>

Complaint Management Procedure for Students and Members of the Public [http://www.mq.edu.au/policy/docs/complaint\\_management/procedure.html](http://www.mq.edu.au/policy/docs/complaint_management/procedure.html)

Disruption to Studies Policy (in effect until Dec 4th, 2017): [http://www.mq.edu.au/policy/docs/disruption\\_studies/policy.html](http://www.mq.edu.au/policy/docs/disruption_studies/policy.html)

Special Consideration Policy (in effect from Dec 4th, 2017): <https://staff.mq.edu.au/work/strategy-planning-and-governance/university-policies-and-procedures/policies/special-consideration>

In addition, a number of other policies can be found in the [Learning and Teaching Category](#) of Policy Central.

## Student Code of Conduct

Macquarie University students have a responsibility to be familiar with the Student Code of Conduct: [https://students.mq.edu.au/support/student\\_conduct/](https://students.mq.edu.au/support/student_conduct/)

## Results

Results shown in *iLearn*, or released directly by your Unit Convenor, are not confirmed as they are subject to final approval by the University. Once approved, final results will be sent to your student email address and will be made available in [eStudent](#). For more information visit [ask.mq.edu.au](http://ask.mq.edu.au).

## Student Support

Macquarie University provides a range of support services for students. For details, visit <http://students.mq.edu.au/support/>

### Learning Skills

Learning Skills ([mq.edu.au/learningskills](http://mq.edu.au/learningskills)) provides academic writing resources and study strategies to improve your marks and take control of your study.

- [Workshops](#)
- [StudyWise](#)
- [Academic Integrity Module for Students](#)
- [Ask a Learning Adviser](#)

## Student Services and Support

Students with a disability are encouraged to contact the [Disability Service](#) who can provide appropriate help with any issues that arise during their studies.

## Student Enquiries

For all student enquiries, visit Student Connect at [ask.mq.edu.au](http://ask.mq.edu.au)

## IT Help

For help with University computer systems and technology, visit [http://www.mq.edu.au/about\\_us/offices\\_and\\_units/information\\_technology/help/](http://www.mq.edu.au/about_us/offices_and_units/information_technology/help/).

When using the University's IT, you must adhere to the [Acceptable Use of IT Resources Policy](#). The policy applies to all who connect to the MQ network including students.

## Graduate Capabilities

### PG - Capable of Professional and Personal Judgment and Initiative

Our postgraduates will demonstrate a high standard of discernment and common sense in their professional and personal judgment. They will have the ability to make informed choices and decisions that reflect both the nature of their professional work and their personal perspectives.

This graduate capability is supported by:

### Learning outcomes

- The ability to select and critically evaluate appropriate proxies to obtain information on past environments
- A knowledge of oceanic anoxic events, and the impact of life on element cycles, with a focus on the Cretaceous and Neoproterozoic



- An advanced knowledge of the principles and concepts of organic geochemistry
- Demonstrated ability to communicate about biogeochemistry and palaeo-environments to a wider audience through masters level writing and oral presentation

## **Assessment tasks**

- Tutorial summaries/questions
- Assignment 1
- Assignment 2
- Oral presentation

## **PG - Discipline Knowledge and Skills**

Our postgraduates will be able to demonstrate a significantly enhanced depth and breadth of knowledge, scholarly understanding, and specific subject content knowledge in their chosen fields.

This graduate capability is supported by:

## **Learning outcomes**

- An advanced knowledge of the principles and concepts of biogeochemistry, basic modelling and element cycles
- The ability to select and critically evaluate appropriate proxies to obtain information on past environments
- A knowledge of oceanic anoxic events, and the impact of life on element cycles, with a focus on the Cretaceous and Neoproterozoic
- An advanced knowledge of the principles and concepts of organic geochemistry
- Demonstrated ability to communicate about biogeochemistry and palaeo-environments to a wider audience through masters level writing and oral presentation

## **Assessment tasks**

- Tutorial summaries/questions
- Assignment 1
- Assignment 2
- Oral presentation

## **PG - Critical, Analytical and Integrative Thinking**

Our postgraduates will be capable of utilising and reflecting on prior knowledge and experience, of applying higher level critical thinking skills, and of integrating and synthesising learning and knowledge from a range of sources and environments. A characteristic of this form of thinking is the generation of new, professionally oriented knowledge through personal or group-based critique of practice and theory.

This graduate capability is supported by:

## **Learning outcomes**

- An advanced knowledge of the principles and concepts of biogeochemistry, basic modelling and element cycles
- The ability to select and critically evaluate appropriate proxies to obtain information on past environments
- A knowledge of oceanic anoxic events, and the impact of life on element cycles, with a focus on the Cretaceous and Neoproterozoic
- An advanced knowledge of the principles and concepts of organic geochemistry

## **Assessment tasks**

- Tutorial summaries/questions
- Assignment 1
- Assignment 2
- Oral presentation

## **PG - Research and Problem Solving Capability**

Our postgraduates will be capable of systematic enquiry; able to use research skills to create new knowledge that can be applied to real world issues, or contribute to a field of study or practice to enhance society. They will be capable of creative questioning, problem finding and problem solving.

This graduate capability is supported by:

## **Learning outcomes**

- The ability to select and critically evaluate appropriate proxies to obtain information on past environments
- A knowledge of oceanic anoxic events, and the impact of life on element cycles, with a focus on the Cretaceous and Neoproterozoic
- An advanced knowledge of the principles and concepts of organic geochemistry

## **Assessment tasks**

- Tutorial summaries/questions
- Assignment 1
- Assignment 2
- Oral presentation

## **PG - Effective Communication**

Our postgraduates will be able to communicate effectively and convey their views to different

social, cultural, and professional audiences. They will be able to use a variety of technologically supported media to communicate with empathy using a range of written, spoken or visual formats.

This graduate capability is supported by:

## **Learning outcomes**

- The ability to select and critically evaluate appropriate proxies to obtain information on past environments
- A knowledge of oceanic anoxic events, and the impact of life on element cycles, with a focus on the Cretaceous and Neoproterozoic
- An advanced knowledge of the principles and concepts of organic geochemistry
- Demonstrated ability to communicate about biogeochemistry and palaeo-environments to a wider audience through masters level writing and oral presentation

## **Assessment tasks**

- Tutorial summaries/questions
- Assignment 1
- Assignment 2
- Oral presentation

## **PG - Engaged and Responsible, Active and Ethical Citizens**

Our postgraduates will be ethically aware and capable of confident transformative action in relation to their professional responsibilities and the wider community. They will have a sense of connectedness with others and country and have a sense of mutual obligation. They will be able to appreciate the impact of their professional roles for social justice and inclusion related to national and global issues

This graduate capability is supported by:

## **Learning outcome**

- An advanced knowledge of the principles and concepts of biogeochemistry, basic modelling and element cycles

## **Assessment tasks**

- Assignment 1
- Assignment 2
- Oral presentation

## **Changes from Previous Offering**

The unit has been rescheduled since 2016, with lectures/tutorials in a different order, and one new assessment task.

