GEOS710
Records of Palaeoenvironments: Life and Geochemistry
S2 Day 2019
Dept of Earth and Planetary Sciences

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General Information

Unit convenor and teaching staff
Unit Convenor, lecturer
Simon George
simon.george@mq.edu.au
Contact via simon.george@mq.edu.au; 02 9850 4424; 0418 428217
Level 3, Room 329, 12 Wally's Walk (old E7A)
Send email to book time

Lecturer
April Abbott
april.abbott@mq.edu.au
Contact via april.abbott@mq.edu.au
Level 3, Room 338, 12 Wally's Walk (old E7A)
Send email to book time

Lecturer
Martin Kennedy
martin.j.kennedy@mq.edu.au
Contact via martin.j.kennedy@mq.edu.au
Level 3, Room 330, 12 Wally's Walk (old E7A)
Send email to book time

Lecturer
Stefan Löhr
stefan.loehr@mq.edu.au
Contact via stefan.loehr@mq.edu.au
Level 3, Room 334, 12 Wally's Walk (old E7A)
Send email to book time

Credit points
4

Prerequisites
Admission to MRes

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, 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, 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 high level research skills in these areas.

Important Academic Dates
Information about important academic dates including deadlines for withdrawing from units are available at https://students.mq.edu.au/important-dates

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

Assessment Tasks

<table>
<thead>
<tr>
<th>Name</th>
<th>Weighting</th>
<th>Hurdle</th>
<th>Due</th>
</tr>
</thead>
<tbody>
<tr>
<td>Tutorial summaries/questions</td>
<td>20%</td>
<td>No</td>
<td>1/8/19; 8/8/19; 15/8/19</td>
</tr>
<tr>
<td>Assignment 1</td>
<td>30%</td>
<td>No</td>
<td>26th August 2019</td>
</tr>
<tr>
<td>Assignment 2</td>
<td>30%</td>
<td>No</td>
<td>30th September 2019</td>
</tr>
<tr>
<td>Oral presentation</td>
<td>20%</td>
<td>No</td>
<td>7th November 2019</td>
</tr>
</tbody>
</table>
Tutorial summaries/questions
Due: 1/8/19; 8/8/19; 15/8/19
Weighting: 20%

Tutorial summaries/questions: in weeks 1, 2 and 3, there will be 3 x 15 minute "last 15 tests", to be completed during the class in the last 15 mins, or shortly thereafter. Week 1, 5%. Week 2, 2 x 5%. Week 3, 5%.

This Assessment Task relates to the following 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

Assignment 1
Due: 26th August 2019
Weighting: 30%

Assignment 1: The Eocene–Oligocene cooling event

This Assessment Task relates to the following 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
- Demonstrated ability to communicate about biogeochemistry and palaeo-environments to a wider audience through masters level writing and oral presentation

Assignment 2
Due: 30th September 2019
Weighting: 30%

Paper review: Understanding past Earth events

This Assessment Task relates to the following Learning Outcomes:
- An advanced knowledge of the principles and concepts of biogeochemistry, basic modelling and element cycles
**Oral presentation**

**Due:** *7th November 2019*
**Weighting:** 20%

Oral Presentations by everyone in the class on individually allocated topics

This Assessment Task relates to the following 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

**Delivery and Resources**

**GEOS710 Records of palaeoenvironments: life and geochemistry (session 2, 2019)**

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.

**Web pages and electronic resources**

The main unit web page will be on iLearn: [https://ilearn.mq.edu.au/login/MQ/](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 be in 11 Wally's Walk 240, Thursday 14:00-16:00 (or 15:00-17:00).

Unit Schedule

<table>
<thead>
<tr>
<th>Week</th>
<th>Dates</th>
<th>Module</th>
<th>Who</th>
<th>Workshop topic</th>
<th>&quot;Last 15&quot;</th>
</tr>
</thead>
<tbody>
<tr>
<td>1, Thurs</td>
<td>01-Aug-19</td>
<td>Introduction</td>
<td>MK</td>
<td>Snowball Earth from the sediment record: processes &amp; Earth systems</td>
<td>Daisy World</td>
</tr>
<tr>
<td>2, Thurs</td>
<td>08-Aug-19</td>
<td>Global Circulation</td>
<td>AA</td>
<td>Physical processes: box models and introduction to circulation</td>
<td>Box modelling exercise</td>
</tr>
<tr>
<td>3, Thurs</td>
<td>15-Aug-19</td>
<td>Global cycles; Radiogenic Isotopes; box models</td>
<td>AA</td>
<td>Physical processes: circulation of the atmosphere and oceans, salty ocean</td>
<td>Jolly's age of ocean</td>
</tr>
<tr>
<td>4, Thurs</td>
<td>22-Aug-19</td>
<td>Global cycles; Radiogenic Isotopes; box models</td>
<td>SG</td>
<td>Chemical processes: elemental cycling and nutrients</td>
<td></td>
</tr>
<tr>
<td>5, Thurs</td>
<td>29-Aug-19</td>
<td>Global cycles; Radiogenic Isotopes; box models</td>
<td>AA</td>
<td>Nd isotopes in the Cretaceous... what else do we need to know</td>
<td></td>
</tr>
<tr>
<td>6, Thurs</td>
<td>05-Sep-19</td>
<td>Life &amp; Biogeochemistry</td>
<td>SL</td>
<td>OAEs continued, changes in carbonate compensation depth</td>
<td>Teaching in week 6 may be shifted to week 7 as an extra 2 hr block to avoid ICP</td>
</tr>
<tr>
<td>7, Thurs</td>
<td>12-Sep-19</td>
<td>Life &amp; Biogeochemistry</td>
<td>SL</td>
<td>Bioturbation across Neoproterozoic-Cambrian, impact of life on cycles</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>Break</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>8, Thurs</td>
<td>03-Oct-19</td>
<td>Stable Isotopes</td>
<td>MK</td>
<td>Determining palaeotemperatures and palaeoenvironments using stable isotopes</td>
<td></td>
</tr>
<tr>
<td>9, Thurs</td>
<td>10-Oct-19</td>
<td>Stable Isotopes</td>
<td>MK</td>
<td>Monitoring the global carbon cycle, the isotope and sedimentary record</td>
<td></td>
</tr>
<tr>
<td>10, Thurs</td>
<td>17-Oct-19</td>
<td>Organic Geochemistry &amp; Biomarkers</td>
<td>SG</td>
<td>Introduction to biomarkers; diagenesis of OM; inference of palaeoenvironments</td>
<td></td>
</tr>
</tbody>
</table>

https://unitguides.mq.edu.au/unit_offerings/95408/unit_guide/print 6
Policies and Procedures

Macquarie University policies and procedures are accessible from Policy Central (https://staff.mq.edu.au/work/strategy-planning-and-governance/university-policies-and-procedures/policy-central). Students should be aware of the following policies in particular with regard to Learning and Teaching:

- Academic Appeals Policy
- Academic Integrity Policy
- Academic Progression Policy
- Assessment Policy
- Fitness to Practice Procedure
- Grade Appeal Policy
- Complaint Management Procedure for Students and Members of the Public
- Special Consideration Policy (Note: The Special Consideration Policy is effective from 4 December 2017 and replaces the Disruption to Studies Policy.)

Undergraduate students seeking more policy resources can visit the Student Policy Gateway (https://students.mq.edu.au/support/study/student-policy-gateway). It is your one-stop-shop for the key policies you need to know about throughout your undergraduate student journey.

If you would like to see all the policies relevant to Learning and Teaching visit Policy Central (https://staff.mq.edu.au/work/strategy-planning-and-governance/university-policies-and-procedures/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/study/getting-started/student-conduct

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<table>
<thead>
<tr>
<th>Date</th>
<th>Topic</th>
<th>Instructor(s)</th>
</tr>
</thead>
<tbody>
<tr>
<td>11, Thurs</td>
<td>Organic Geochemistry &amp; Biomarkers</td>
<td>SG</td>
</tr>
<tr>
<td>12, Thurs</td>
<td>Organic Geochemistry &amp; Biomarkers</td>
<td>SG</td>
</tr>
<tr>
<td>13, Thurs</td>
<td>Wrap up</td>
<td>SG, AA, SL, MK</td>
</tr>
</tbody>
</table>

SG = Prof. Simon George; MK = Prof. Martin Kennedy; AA = Dr April Abbott; SL = Dr Stefan Löhr

Classroom: 11Wally’s Walk (E5A) 240 Thursday 14:00-16:00 (hoping to change to 15-17 to avoid geos309 clash)
Results

Results published on platform other than eStudent, (eg. iLearn, Coursera etc.) 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 or if you are a Global MBA student contact globalmba.support@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) 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 Enquiry Service

For all student enquiries, visit Student Connect at ask.mq.edu.au

If you are a Global MBA student contact globalmba.support@mq.edu.au

Equity 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.

IT Help

For help with University computer systems and technology, visit 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 - 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 - 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 - 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 2018, with lectures/tutorials in a different order.