



# GEOS776

## Ages, Rates and Timescales of Geological Processes

S1 Day 2017

*Dept of Earth and Planetary Sciences*

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## General Information

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Credit points

4

Prerequisites

Admission to MRes

Corequisites

Co-badged status

GEOS876

Unit description

This unit describes and explores the underpinnings of the tools employed in geochronology and geochemistry in order to unravel the timing and duration of geological phenomena. Primarily focussed on high temperature geochemistry, this course will employ applications spanning from diffusion modelling in magma chambers, through zircon geochronology to model ages in addition to tracing the passage of materials through the solid Earth. A background in the analytical techniques used to attain such data will also be included.

## 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:

1. Understand geochemistry insights and perspectives on the evolution of the Earth system
2. Provides a comprehensive introduction to the basic principles and techniques of modern geochemistry
3. Devise and undertake analytical program using the appropriate techniques to solve complex petrological problems using geochemistry and set-up an analytical protocol for the geochemical analysis of major and trace elements in geological materials
4. develop the knowledge to determine the uncertainty of analytical results and access theirs robustness

## Assessment Tasks

Name	Weighting	Hurdle	Due
<a href="#"><u>Oral presentation</u></a>	50%	No	7/06/2017
<a href="#"><u>Assignment 1</u></a>	20%	No	02/05/2017
<a href="#"><u>Assignement 2</u></a>	20%	No	17/05/2017
<a href="#"><u>Class Participation</u></a>	10%	No	each session

### Oral presentation

Due: **7/06/2017**

Weighting: **50%**

10 min - power point - based on 3 scientific (peer-reviewed) papers.

On successful completion you will be able to:

- 1. Understand geochemistry insights and perspectives on the evolution of the Earth system
- 2. Provides a comprehensive introduction to the basic principles and techniques of modern geochemistry
- 4. develop the knowledge to determine the uncertainty of analytical results and access theirs robustness

## Assignment 1

Due: **02/05/2017**

Weighting: **20%**

Assignment 1 will be based on the concepts and skills covered in days 4, 5 and 6.

This Assessment Task relates to the following Learning Outcomes:

- be able to select an appropriate analytical technique and set-up an analytical protocol for the geochemical analysis of major and trace elements in geological materials
- devise and undertake an analytical program using the appropriate techniques to solve complex petrological problems using geochemistry
- develop the knowledge to determine the uncertainty of analytical results
- critically evaluate the quality of data obtained using different analytical methods

On successful completion you will be able to:

- 3. Devise and undertake analytical program using the appropriate techniques to solve complex petrological problems using geochemistry and set-up an analytical protocol for the geochemical analysis of major and trace elements in geological materials
- 4. develop the knowledge to determine the uncertainty of analytical results and assess their robustness

## Assignment 2

Due: **17/05/2017**

Weighting: **20%**

Assignment 2 is about Trace elements modelling - using the concepts covered in week 7,8 and 9.

On successful completion you will be able to:

- 2. Provides a comprehensive introduction to the basic principles and techniques of modern geochemistry

## Class Participation

Due: **each session**

Weighting: **10%**

The class mark will be awarded on the basis of performance in the laboratory practicals and participation in class discussions.

On successful completion you will be able to:

- 1. Understand geochemistry insights and perspectives on the evolution of the Earth system
- 2. Provides a comprehensive introduction to the basic principles and techniques of modern geochemistry
- 3. Devise and undertake analytical program using the appropriate techniques to solve complex petrological problems using geochemistry and set-up an analytical protocol for the geochemical analysis of major and trace elements in geological materials

## **Delivery and Resources**

There are no prescribed textbooks for this course

The following books are recommended/suggested for additional reading.

1. White, W.M. Geochemistry, Willey-Blackwell
2. White, W.M. Isotope Geochemistry, Willey-Blackwell
3. Potts, P.: A Handbook of Silicate Rock Analysis. Blackie (on reserve)
4. Rollinson, H.: Using Geochemical Data. Longman
5. Allègre, C.J., Isotope Geochemistry, Cambridge U. Press
6. Albarède F., Geochemistry and Introduction, Cambridge U. Press
7. Schaefer, B. Radiogenic isotope Geochemistry, A guide for industry Professionals, Cambridge U. Press
8. Hoefs, J. Stable isotope Geochemistry, Springer
9. Condie, K.C. Earth as an Evolving Planetary System, Elsevier Academic Press
10. Van Kranendonk M.J., Smithies, R.H., Bennett, V.C., Earth's Oldest Rocks, Elsevier

## **Unit Schedule**

W1: Element's properties

W2: Nucleosynthesis

W3: Meteorites - Solar Nebula differentiation - first solid - planetary building blocks.

W4: Analytical methods I

W5: Analytical methods II

W6: Data processing and Handling

W7: Experimental Geochemistry and Petrology

W8: Volatile Elements - Origin, distribution and evolution

W9: Lithophile Elements to decipher high temperature processes

W10: Radiogenic isotopes - long and short lived

W11: U-Pb and Lu-Hf isotopic systematic in Zircon - implication for studying Lithosphere evolution

W12: Siderophile and Chalcophile elements

W13: Student Oral Presentations

## **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

- 1. Understand geochemistry insights and perspectives on the evolution of the Earth system
- 2. Provides a comprehensive introduction to the basic principles and techniques of modern geochemistry
- 3. Devise and undertake analytical program using the appropriate techniques to solve complex petrological problems using geochemistry and set-up an analytical protocol for the geochemical analysis of major and trace elements in geological materials
- 4. develop the knowledge to determine the uncertainty of analytical results and access

theirs robustness

## Assessment tasks

- Oral presentation
- Assignment 1
- Assignment 2

## 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

- 1. Understand geochemistry insights and perspectives on the evolution of the Earth system
- 2. Provides a comprehensive introduction to the basic principles and techniques of modern geochemistry
- 3. Devise and undertake analytical program using the appropriate techniques to solve complex petrological problems using geochemistry and set-up an analytical protocol for the geochemical analysis of major and trace elements in geological materials

## Assessment tasks

- Oral presentation
- Assignment 1
- Assignment 2
- Class Participation

## 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

- 2. Provides a comprehensive introduction to the basic principles and techniques of modern geochemistry



- 3. Devise and undertake analytical program using the appropriate techniques to solve complex petrological problems using geochemistry and set-up an analytical protocol for the geochemical analysis of major and trace elements in geological materials
- 4. develop the knowledge to determine the uncertainty of analytical results and access theirs robustness

### **Assessment tasks**

- Oral presentation
- Assignment 1
- Class Participation

## **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**

- 1. Understand geochemistry insights and perspectives on the evolution of the Earth system
- 2. Provides a comprehensive introduction to the basic principles and techniques of modern geochemistry
- 3. Devise and undertake analytical program using the appropriate techniques to solve complex petrological problems using geochemistry and set-up an analytical protocol for the geochemical analysis of major and trace elements in geological materials
- 4. develop the knowledge to determine the uncertainty of analytical results and access theirs robustness

### **Assessment tasks**

- Assignment 1
- Assignment 2

## **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:

## Assessment tasks

- Oral presentation
- Class Participation

## 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:

### Assessment task

- Class Participation