

EMSC2017

Rocks and Minerals

Common crustal and upper mantle rock types will be studied, with emphasis on their formation and mineralogy, leading to rock-type classification. Study of the important rock types in the Earth is combined with the investigation of the common rock-forming minerals, with particular emphasis on those minerals that comprise the bulk of the Earth's crust and upper mantle. The influence of changing pressure, temperature and chemical environment on the origin and occurrence of different classes of minerals and rocks will be discussed. Rocks and minerals are investigated in hand specimens and in thin sections under the microscope. Simple phase relations and phase diagrams relevant to important mineral groups will be examined, in the context of explaining formation and properties of minerals and rocks. Other aspects that may be explored will include the characteristics and economic significance of the most important ore and gem minerals, and the properties of minerals that may cause health problems.

Mode of Delivery	On campus
Prerequisites	EMSC1008 Earth
Incompatible Courses	
Course Convener:	 <p>Professor Greg Yaxley Petrology, Geochemistry</p>
Phone:	6125 8334
Email:	greg.yaxley@anu.edu.au
Office hours for student consultation:	Please make an appointment via email.
Research Interests	High pressure experimental petrology, mineralogy and geochemistry of the earth's mantle, earth's deep carbon cycle.
Relevant administrator if any (optional)	Mrs Joy McDermid
Phone:	6125 8321
Email:	joy.mcdermid@anu.edu.au

Lecturers	
 <p>Dr Guil Mallmann Petrology guil.mallmann@anu.edu.au</p>	 <p>Dr Janania Avila Geochemistry janaina.avila@anu.edu.au</p>
 <p>Dr Brendan Hanger Petrology brendan.hanger@anu.edu.au</p>	 <p>Louise Schoneveld Demonstrator</p>
Office hours for student consultation:	Please make an appointment via email.

<http://programsandcourses.anu.edu.au/course/EMSC2017>

COURSE OVERVIEW

Lectures, workshops and practicals

Students will attend 5 hours per week in Semester 1, comprised of a 1 hour lecture session (Tuesday 12:00-1:00pm), a 2-hour practical session (Tuesday 2:00pm-4:00pm) and a 2-hour workshop session (Friday 10:00am-12:00pm). All sessions will take place in the DA Brown Teaching Lab in building J8, at the Research School of Earth Sciences, ANU.

Resources and other documentation for all sessions will be made available on the Wattle site in advance of the session.

Learning Outcomes

On satisfying the requirements of this course, students will have the knowledge and skills to:

1. Give examples of different mineral assemblages and host rocks, including igneous, metamorphic and sedimentary rocks and some ores.
2. Explain that minerals are crystalline materials; that macroscopic symmetry arises from a repeated arrangement of atoms and how this is used for mineral classification.
3. Balance chemical formulas of relevant reactions and determine simple structural formulas from chemical analyses of common minerals.

4. Describe the physical properties of hand specimens of rocks and minerals, with clear sketches and at least provisional identification of mineral species, with explanation of reasoning.
5. Recognise and describe different minerals and rocks using the petrographic microscope and identify minerals and hence classify host rocks.
6. Relate mineralogical and textural observations in a simple way to host rock petrogenesis and tectonic processes.
7. Understand basic phase diagrams and how they relate to mineral solid solutions, partial melting and other deep Earth processes.

Assessment Summary (indicative only)

Assessment Task	Date assignment available	Value	Due Date	Date for Return of Assessment	Linked Learning Outcomes (optional)
1. Assignment on ultramafic and mafic rocks	10 March 2017	10%	3 April 2017	≈ 14 days after due date	2,3,6,7
2. Assignment on intermediate to felsic rocks	31 March 2017	10%	8 May 2017	≈ 14 days after due date	2,3,6,7
3. Optical petrography test on igneous rocks	5 May 2017	20%	5 May 2017	≈ 14 days after due date	1,2,4,5,6
4. Assignment on metamorphic rocks	2 May 2017	10%	26 May 2017	≈ 14 days after due date	2,3,6,7
5. Optical petrography test on metamorphic rocks	26 May 2017	10%	26 May 2017	≈ 14 days after due date	1,2,4,5,6
6. Final Exam	tba	40%	tba	na	1,2,3,5,6,7

Research-Led Teaching

This course will introduce you to some aspects of the dynamic earth for which our understanding is currently incomplete or controversial and therefore the topic of active research at RSES and elsewhere. With the skills and learning outcomes you acquire from this course, you will be able to critically evaluate competing hypotheses to explain these problems and research strategies to investigate them.

Feedback

Staff Feedback

Students will be given feedback in the following forms in this course:

- written and verbal comments on individuals' assessment tasks
- feedback to the entire class by going through the assignment solutions and posting them on the course Wattle site
- verbal comments during class sessions
- written comments posted on Wattle

Student Feedback

ANU is committed to the demonstration of educational excellence and regularly seeks feedback from students. One of the key formal ways students have to provide feedback is through Student Experience of Learning Support (SELS) surveys. The feedback given in these surveys is anonymous and provides the Colleges, University Education Committee and Academic Board with opportunities to recognise excellent teaching, and opportunities for improvement.

For more information on student surveys at ANU and reports on the feedback provided on ANU courses, go to

<http://unistats.anu.edu.au/surveys/self/students/> and
<http://unistats.anu.edu.au/surveys/self/results/learning/>

Policies

ANU has educational policies, procedures and guidelines, which are designed to ensure that staff and students are aware of the University's academic standards, and implement them. You can find the University's education policies and an explanatory glossary at: <http://policies.anu.edu.au/>

Students are expected to have read the [Academic Misconduct Rules 2014](#) before the commencement of their course.

Other key policies include:

- Student Assessment (Coursework)
- Student Surveys and Evaluations

Required Resources

Commonwealth supported students and domestic full-fee paying students generally must be able to complete the requirements of their program of study without the imposition of fees that are additional to the student contribution amount or tuition fees.

Provided that its payment is in accordance with the *Act*, a fee is of a kind that is into any one or more of the following categories:

- (a) It is a charge for a good or service that is not essential to the course of study.
- (b) It is a charge for an alternative form, or alternative forms, of access to a good or service that is an essential component of the course of study but is otherwise made readily available at no additional fee by the higher education provider.
- (c) It is a charge for an essential good or service that the student has the choice of acquiring from a supplier other than the higher education provider and is for:
 - (i) equipment or items which become the physical property of the student and are not consumed during the course of study; or
 - (ii) food, transport and accommodation costs associated with the provision of field trips that form part of the course of study.
- (d) It is a fine or a penalty provided it is imposed principally as a disincentive and not in order to raise revenue or cover administrative costs.

Examination material or equipment

The final exam and the optical petrography tests are open-book. Any resources may be used during the exam and tests with the exception of all on-line resources.

Recommended Resources

There is no prescribed text book, but the following publications between them cover nearly all aspects of this course and more.

- Klein and Philpotts (2013) **Earth materials – Introduction to mineralogy and petrology** Cambridge University Press (ANU call number [QE363.2 .K529 2013](#))

- Gill (2010) **Igneous rocks and processes – a practical guide** Wiley-Blackwell
- Best (2008) **Igneous and metamorphic petrology** Blackwell Publishing (ANU call number [QE461.B53](#))

On-line resources will be highlighted as required throughout the course and other useful documents will be available on the Wattle site.

The following web-sites are also useful resources

<https://www.mindat.org/>

<http://www.webmineral.com/>

COURSE SCHEDULE

Week/ Session	Summary of Activities	Assessment
1	Introduction to EMSC2017 and ultramafic rocks & minerals (Prof Greg Yaxley)	
2	Ultramafic rocks & minerals (Dr Brendan Hanger)	
3	Ultramafic rocks & minerals (Dr Brendan Hanger)	
4	Mafic volcanic rocks and minerals (Dr Brendan Hanger)	
5	Mafic volcanic rocks and minerals (Dr Brendan Hanger)	
6	Mafic plutonic rocks and minerals (Dr Guil Mallmann)	Out of class assignment (10%)
7	Feldspars (Dr Guil Mallmann)	
8	Intermediate to felsic volcanic rocks and minerals (Dr Guil Mallmann)	
9	Intermediate to felsic plutonic rocks and minerals (Dr Guil Mallmann)	Out of class assignment (10%) Optical test on igneous rocks (20%)
10	Metamorphic rocks and minerals (Dr Janaina Avila)	
11	Metamorphic rocks and minerals (Dr Janaina Avila)	
12	Metamorphic rocks and minerals (Dr Janaina Avila)	Out of class assignment (10%) Optical test on metamorphic rocks (10%)
	Examination period	(40%)

ASSESSMENT REQUIREMENTS

Out of class assessment tasks (Assessment Tasks 1, 2 and 4) should be submitted online through Wattle. There is a penalty for late submission of these items at the rate of 5% per working day. Late submission of assessment tasks is not accepted after 10 working days after the due date. Extensions can be negotiated by emailing the course convenor

(greg.yaxley@anu.edu.au) or the appropriate lecturer prior to the submission date. If you have documented and appropriate medical evidence that demonstrates you were not able to request an extension on or before the due date, you may be able to request it after the due date. Extensions and late submission of assessment pieces are covered by the Student Assessment (Coursework) Policy and Procedure.

You will be required to electronically sign a declaration as part of the submission of your assignment. Please keep a copy of the assignment for your records.

We will endeavour to provide feedback on your assessment items within 7 days of the submission date.

Please note that assessment tasks of students undertaking the Honours Pathway Option, or graduates students (EMSC6017) will be assessed at a higher level on all assessment tasks.

Assessment Tasks

Assessment Task 1: Ultramafic and mafic rocks and minerals

Details of task: An assignment involving simple mineralogical calculations and questions relating to the classification of ultramafic and mafic rocks, mineral structures and interpretation of simple phase diagrams, to be completed in your own time.

Value: 10%

Presentation requirements: Answers to be written on the assignment document provided.

Assessment Task 2: Intermediate to felsic rocks and minerals

Details of task: An assignment involving simple mineralogical calculations and questions relating to the classification of intermediate to felsic, volcanic and plutonic rocks, mineral structures and interpretation of simple phase diagrams, to be completed in your own time.

Value: 10%

Presentation requirements: Answers to be written on the assignment document provided.

Assessment Task 3: Optical mineralogy text on igneous rocks

Details of task: A two hour, open book exam in which you will be given thin-sections of 6 igneous rocks and required to identify their constituent minerals, classify the rocks and write a brief petrographic description.

Value: 20%

Presentation requirements: Answers to be written on the exam paper provided.

Assessment Task 4: Metamorphic rocks

Details of task: An assignment involving simple mineralogical calculations and questions relating to the classification of metamorphic rocks and facies, mineral structures and interpretation of simple phase diagrams, to be completed in your own time.

Value: 10%

Presentation requirements: Answers to be written on the assignment document provided.

Assessment Task 3: Optical mineralogy text on metamorphic rocks

Details of task: A two hour, open book exam in which you will be given thin-sections of 3 or 4 metamorphic rocks and required to identify their constituent minerals, classify the rocks and write a brief petrographic description.

Value: 10%

Presentation requirements: Answers to be written on the exam paper provided.

Examination(s)

A 2-hour, written, open-book examination on the entire content of the course. Any relevant resources can be used during the exam, except for on-line resources. The final exam will take place in during the Semester 1 examination period, in the same lab as the other sessions in the course.

Extensions and penalties

Extensions and late submission of assessment pieces are covered by the Student Assessment (Coursework) Policy and Procedure.

The Course Convener or relevant lecturer may grant extensions for assessment pieces that are not examinations or take-home examinations. If you need an extension, you must request it by email to the course convener (greg.yaxley@anu.edu.au) or the relevant lecturer, on or before the due date. If you have documented and appropriate medical evidence that demonstrates you were not able to request an extension on or before the due date, you may be able to request it after the due date.

No submission of assessment tasks without an extension after the due date will be permitted. If an assessment task is not submitted by the due date, a mark of 0 will be awarded.

Late submission of assessment tasks without an extension are penalized at the rate of 5% of the possible marks available per working day or part thereof. Late submission of assessment tasks is not accepted after 10 working days after the due date, or on or after the date specified in the course outline for the return of the assessment item.

SUPPORT FOR STUDENTS

The University offers a number of support services for students. Information on these is available online from <http://students.anu.edu.au/studentlife/>