



Course Outline

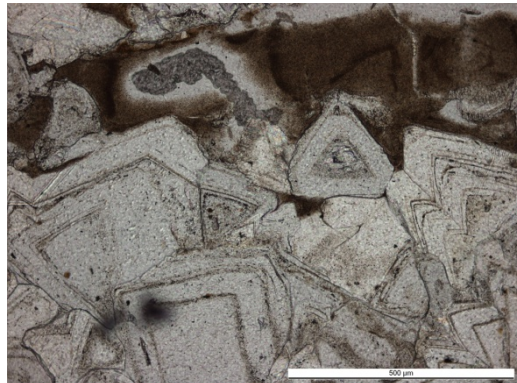
GEOS2181

Earth Materials


SCHOOL OF BIOLOGICAL, EARTH
AND ENVIRONMENTAL SCIENCES

FACULTY OF SCIENCE

T2, 2021



1. Staff

Position	Name	Email	Contact details & Consultation times
Course Convenor	Ian Graham 	i.graham@unsw.edu.au	Room 131, Samuels Building Extension 58720 Consultation by appointment

2. Course information

Units of credit: 6UOC

Pre-requisite(s): GEOS1111 and/or GEOS1211

Teaching times and locations:

Laboratory: Mon 3-5 lab 2 Building D26
 Thu 3-5 lab 2 Building D26

Lectures: All recorded on Moodle

<http://www.timetable.unsw.edu.au/2021/GEOS2181>

2.1 Course summary

Introduction to the identification, classification, formation and analysis of minerals, rocks, meteorites, gems and sediments. Crystal growth, atomic structure, composition, properties and classification of minerals, with special reference to the rock-forming and clay minerals. Mineral analysis techniques including chemical methods and X-ray diffraction; application of geochemical studies including introduction to radiometric dating. Genesis, analysis and classification of igneous, metamorphic and sedimentary rock types. Optical properties of minerals and rocks under the polarising microscope.

2.2 Course aims

Provide a theoretical and practical introduction to the study of minerals (mineralogy) and rocks (petrology), and to the principal techniques for mineralogical, petrological and geochemical analysis. To provide an understanding of the nature and origin of minerals, rocks and sediments, as a basis for further studies in the Earth and Environmental Sciences.

2.3 Course learning outcomes (CLO)

At the successful completion of this course you (the student) should be able to:

1. Identify common rock-forming minerals in both hand-specimen and thin-section.
2. Given an unknown mineral, have the knowledge to know what analyses to use to be able to positively identify it.
3. Identify common igneous and sedimentary rocks in hand-specimen and thin-section.
4. Using field relationships, petrographic analysis and geochemical analyses, be able to determine the broad evolutionary history and environment of formation of igneous and sedimentary rocks and be able to apply this knowledge to the broader regional scale.

3. Strategies and approaches to learning

3.1 Learning and teaching activities

The structure of the course is built around the lectures and associated readings indicated by the staff. This content will be supplemented by the student seminars on diverse mineralogical and petrological topics. The concepts discussed in the lectures are then reinforced through both the laboratory and fieldwork

3.2 Expectations of students

Attendance at lectures, laboratories and the field tutorial is compulsory for this course.

4. Course schedule and structure

This course consists of 7 hours of class contact hours per week. You are expected to take additional hours of non-class contact hours to complete assessments, readings and exam preparation.

Week (Date mon)	Lecture 1 (1h)	Staff	Lecture 2 (1h)	Staff	Lecture 3 (1h)	Staff	Lab 1 (2h) Lab 02 D26 Ground Floor/3-5	Lab 2 (2h) Lab 02 D26 Ground Floor/3-5	Assessments due
1 May 31	Getting to know each other and Course overview	ITG	Mineral properties in hand specimen	ITG	Intro to Geochemistry	ITG	Minerals I	Minerals II	
2 June 7	Intro to Mineralogy	ITG	Mineral Groups	ITG	Optical Mineralogy	ITG	Intro to Petrography	Thin sections I	Quiz 1
3 June 14	Igneous Processes	ITG	Magma formation and evolution I	ITG	Magma formation and evolution II	ITG	Public Holiday	Thin sections II	Quiz 2
4 June 21	Classification and naming of igneous rocks	ITG	Volcanoes and their products I	ITG	Volcanoes and their products II	ITG	Thin sections III	Igneous rocks I	Quiz 3
5 June 29	Cenozoic intraplate volcanism in eastern Australia	ITG	Analytical Techniques	ITG	Geochronology	ITG	Igneous rocks II	Igneous rocks III	Quiz 4
6 July 5	Mid term break								
7 July 12	X-ray diffraction analysis	ITG	Clays and clay minerals	ITG	Gem Materials	ITG	Igneous rocks IV	XRD techniques	Quiz 5
8 July 19	Sedimentary processes and materials	ITG	Clastic non-carbonate sedimentary rocks I	ITG	Carbonate rocks	ITG	Using geochemical data	Clastic non-carbonate sedimentary rocks	Quiz 6
9 July 26	Sedimentary rocks of the Sydney Basin	ITG	Metamorphism	ITG	Regional metamorphism	ITG	Carbonate rocks	Metamorphic minerals	Quiz 7
10 Aug 2	Extra Terrestrial Materials	ITG	Course overview and final exam		No class		Metamorphic rocks I	Metamorphic rocks II	Quiz 8

ITG, Ian Graham

LIST OF LECTURES, LABS AND QUIZZES

WEEK 1

LECTURES

L1 Getting to know each other and course overview

L2 Mineral properties in hand-specimen

L3 Introduction to Geochemistry (parts I and II)

LABS

Mon 31 May 3-5

Lab 1 Minerals 1

Thu 3 June 3-5

Lab 2 Minerals II

WEEK 2

LECTURES

L4 Introduction to Mineralogy

L5 Mineral Groups

L6 Optical Mineralogy

LABS

Mon 7 June 3-5

Lab 3 Introduction to Petrography

Thu 10 June 3-5

Lab 4 Thin sections I

Quiz 1: Properties of minerals in hand-specimen

WEEK 3

LECTURES

L7 Igneous Processes (parts I and II)

L8 Magma formation and evolution (parts I, II, III and IV)

LABS

Mon 14 June NO CLASS DUE TO PUBLIC HOLIDAY

Thu 17 June 3-5

Lab 5 Thin sections II

Quiz 2: Introduction to Geochemistry/Introduction to Mineralogy

WEEK 4

LECTURES

L9 Classification and naming igneous rocks (parts I, II and III)

L10 Volcanoes and their products (parts I, II, III and IV)

LABS

Mon, 21 June 3-5

Lab 6 Thin sections III

Thu, 24 June 3-5

Lab 7 Igneous rocks I

Quiz 3: Mineral Groups/Optical Mineralogy

WEEK 5

LECTURES

L11 Cenozoic intraplate volcanism in eastern Australia

L12 Analytical techniques

L13 Geochronology

LABS

Mon, 28 June 3-5

Lab 8 Igneous rocks II

Thu 1 July 3-5

Lab 9 Igneous rocks III

Quiz 4: Properties of minerals in thin-section

WEEK 6: BREAK (5-9 July)

WEEK 7

LECTURES

L14 X-ray diffraction analysis (parts I and II)

L15 Clays and clay minerals

L16 Gem materials

LABS

Mon 12 July 3-5

Lab 10 Igneous rocks IV

Thu 15 July 3-5

Lab 11 XRD techniques

Quiz 5: Igneous processes/Classification and naming of igneous rocks/Volcanoes and their hazards

WEEK 8

LECTURES

L17 Sedimentary processes and materials (parts I and II)

L18 Clastic non-carbonate sedimentary rocks (parts I and II)

L19 Carbonate rocks

LABS

Mon, 19 July 3-5

Lab 12 Using geochemical data

Thu, 22 July 3-5

Lab 13 Clastic non-carbonate sedimentary rocks

Quiz 6: Analytical techniques/geochronology/Gem materials

WEEK 9

LECTURES

L20 Sedimentary rocks of the Sydney Basin

L21 Introduction to metamorphism (parts I and II)

L22 Regional metamorphism (parts I and II)

LABS

Mon, 26 July 3-5

LAB 14 Carbonate rocks

Thu 29 July 3-5

Lab 15 Metamorphic minerals

Quiz 7: Sedimentary and metamorphic processes and rocks

WEEK 10

LECTURES

L23 Extra-terrestrial Materials (parts I and II)

L24 Course revision and final exam

LABS

Mon, 2 August 3-5

Lab 16 Metamorphic rocks I

Thu 5 August 3-5

Lab 17 Metamorphic rocks II and Final Quiz

Quiz 8: Revision of whole course

5.1 Assessment tasks

			Feedback	
Assessment task	Weight	Due date (normally midnight on due date)	When	How
Assessment 1: Weekly quizzes [Answer 15-20 multiple choice questions]	20%	Beginning of every Thursday lab class	1 week after submission	Grades
Assessment 2: Volcano report [Write in less than 1500 words a properly formatted and well-illustrated report outlining the key geological relationships and features for your selected terrestrial volcano.]	20%	Thursday 22 nd July	2 weeks after submission	Grades and comments
Assessment 3: Final Exam [Answer all of Sections A and B and any three questions From Sections C and D]	60%	TBC		

LIST OF QUIZZES

Quiz	Topic	Day
1	Properties of minerals in hand-specimen	10 Jun
2	Intro to Geochem/Intro to Mineralogy	17 Jun
3	Mineral Groups/Optical Mineralogy	24 Jun
4	Properties of minerals in thin-section	1 Jul
5	Igneous processes, classification and volcanoes	15 Jul
6	Analytical techniques, geochronology, gem materials	22 Jul
7	Sedimentary and metamorphic processes and rocks	29 Jul
8	Revision of whole course	5 Aug

NOTE: Quizzes 1-7 are worth 2% each while Quiz 8 is worth 6%

Further information

UNSW grading system: <https://student.unsw.edu.au/grades>

UNSW assessment policy: <https://student.unsw.edu.au/assessment>

5.2 Submission of assessment tasks

Submission of assignments will be via email to Ian @ i.graham@unsw.edu.au

Late assignments will receive a penalty of 5% per day overdue.

5.3. Feedback on assessment

See Assessment tasks section 5.1 for information on feedback for each assessment

6. Academic integrity, referencing and plagiarism

Referencing is a way of acknowledging the sources of information that you use to research your assignments. You need to provide a reference whenever you draw on someone else's words, ideas or research. Not referencing other people's work can constitute plagiarism.

Further information about referencing styles can be located at <https://student.unsw.edu.au/referencing>

Academic integrity is fundamental to success at university. Academic integrity can be defined as a commitment to six fundamental values in academic pursuits: honesty, trust, fairness, respect,

responsibility and courage.¹ At UNSW, this means that your work must be your own, and others' ideas should be appropriately acknowledged. If you don't follow these rules, plagiarism may be detected in your work.

Further information about academic integrity and **plagiarism** can be located at:

- The *Current Students* site <https://student.unsw.edu.au/plagiarism>, and
- The *ELISE* training site <http://subjectguides.library.unsw.edu.au/elise/presenting>

The *Conduct and Integrity Unit* provides further resources to assist you to understand your conduct obligations as a student: <https://student.unsw.edu.au/conduct>.

7. Readings and resources

Mineralogy	<p>Klein, C., and Dutrow, B., 2008. <i>The Manual of Mineral Science</i> (23rd Edition). John Wiley and Sons.</p> <p>Klein, C., 2008. <i>Minerals and Rocks</i> (3rd Edition). John Wiley and Sons.</p> <p>Deer, W.A, Howie, R.A. and Zussman, J., 1992. <i>Introduction to the Rock Forming Minerals</i>. Longman.</p> <p>Wenk, H-R., and Bulakh, A., 2004. <i>Minerals: their constitution and origin</i>. Cambridge University Press.</p>
Optical Mineralogy	<p>Nesse, W.D., 2004. <i>Introduction to Optical Mineralogy</i> (3rd Edition). Oxford University Press.</p> <p>Gribble, C.D., and Hall, A.J., 1985. <i>A Practical Introduction to Optical Mineralogy</i>. George Allen and Unwin.</p> <p>MacKenzie, W.S. and Guildford, C., 1980. <i>Atlas of Rock-forming Minerals in Thin Section</i>, Longman</p> <p>MacKenzie, W.S. and Adams, A.E., 2000. <i>A Colour Atlas of Rocks and Minerals in Thin Section</i>. Manson Publishing.</p> <p>Perkins, D. and Henke, K.R., 2004. <i>Minerals in Thin Section</i> (Second Edition). Pearson Education Inc.</p>
Crystals	<p>Sunagawa, I., 2005. <i>Crystals: growth, morphology and perfection</i>. Cambridge University Press.</p>
Clay Mineralogy	<p>Velde, B., 1992. <i>Introduction to Clay Minerals</i>. Chapman and Hall.</p>
Earth Materials	<p>Klein, C., and Philpotts, A., 2013. <i>Earth materials: Introduction to Mineralogy and Petrology</i>. Cambridge University Press.</p>
Sediment. Petrology	<p>Tucker, M.E., 1981. <i>Sedimentary Petrology: an introduction</i>. Blackwells Scientific.</p> <p>Boggs, S., 1992. <i>Petrology of sedimentary rocks</i>. Macmillan Press.</p>

¹ International Center for Academic Integrity, 'The Fundamental Values of Academic Integrity', T. Fishman (ed), Clemson University, 2013.

Igneous Petrology **McBirney, A.R., 2007.** *Igneous Petrology* (3rd Edition). Jones and Bartlett.

General Petrology **Blatt, H., Tracey, R.J. and Owens, B.E., 2006.** *Petrology: Igneous, Sedimentary and Metamorphic* (Third Edition). W.H. Freeman

Geochemistry **Dickin, A.P., 2000.** *Radiogenic Isotope Geology*. Cambridge University Press.
Faure, G., 2001. *Origin of Igneous Rocks: the isotopic evidence*. Springer.
Faure, G., 2003. *Principles and Applications of Isotope Geochemistry*. Macmillan.
Rollinson, H., 1993. *Using Geochemical Data: evaluation, presentation and interpretation*. Longman Scientific.

Useful Web Sites:

Links for Mineralogists, University of Wurzburg:

<http://www.uni-wuerzburg.de/mineralogie/links.html>

University of Oxford (Dave Waters), Mineralogy Links:

<http://www.earth.ox.ac.uk/~davewa/minerals.html>

Mineralogical data base:

<http://www.mindat.org>

Interested in Minerals? Join the **Mineralogical Society of New South Wales**. It's an amateur society for people interested in collecting and learning more about minerals. Meetings are held the first Friday of every month at the Parramatta Campus of the University of Western Sydney. Details can be found at <http://www.minsocnsw.org.au>.

8. Administrative matters

School information	<p>School website: http://www.bees.unsw.edu.au/</p> <p>Student Enquiries (Undergraduate, Honours and 8271 Master of Marine Science Coursework) Ms Faye Mo Telephone: +61 2 9385 2961 (current BEES students) Current Students: Web Form</p>
Occupational Health and Safety	<p>Information on relevant Occupational Health and Safety policies and can be found on the following website: http://www.bees.unsw.edu.au/health-and-safety</p> <p>UNSW OHS Home page: http://safety.unsw.edu.au/</p>
Equity and Diversity	<p>Those students who have a disability that requires some adjustment in their teaching or learning environment are encouraged to discuss their study needs with the course Convenor prior to, or at the commencement of, their course, or with the Equity Officer (Disability) in the Equity and Diversity Unit (9385 4734 or http://www.studentequity.unsw.edu.au/).</p> <p>Issues to be discussed may include access to materials, signers or note-takers, the provision of services and additional exam and assessment arrangements. Early notification is essential to enable any necessary adjustments to be made.</p>
Student complaint procedure	<p>http://student.unsw.edu.au/complaints</p> <p>Designated/Grievance Officer A/Prof Scott Mooney; s.mooney@unsw.edu.au Tel: 9385 8036</p> <p>School Student Ethics Officer A/Prof Stephen Bonser; s.bonser@unsw.edu.au; Tel: 9385 3863</p> <p>University contact University Contact University Counselling Services Tel: 9385 5418</p>

9. Additional support for students

- The Current Students Gateway: <https://student.unsw.edu.au/>
- Academic Skills and Support: <https://student.unsw.edu.au/academic-skills>
- Student Wellbeing, Health and Safety: <https://student.unsw.edu.au/wellbeing>
- Equitable Learning Services: <https://student.unsw.edu.au/els>
- UNSW IT Service Centre: <https://www.myit.unsw.edu.au/>