Course Outline

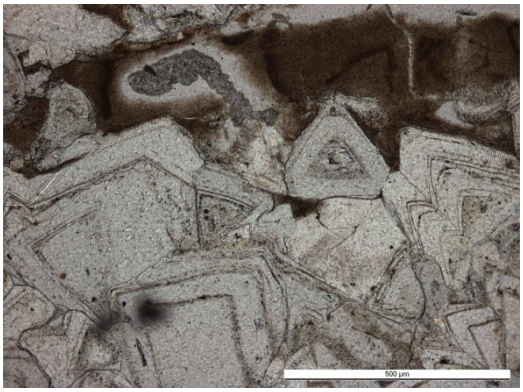
GEOS2181

Earth Materials

SCHOOL OF BIOLOGICAL, EARTH
AND ENVIRONMENTAL SCIENCES

FACULTY OF SCIENCE

T2, 2022



1. **Staff**

Position	Name	Email	Contact details & Consultation times
Course Convenor	Ian Graham 	i.graham@unsw.edu.au	Room 131, Samuels Building Phone 9385 8720 Consultation by appointment
Lab Manager	Mira van der Ley 	m.vanderley@unsw.edu.au	

2. Course information

Units of credit: 6UOC

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

Teaching times and locations:

Laboratory: **Tue 1-3** **Teaching Lab 2 Building D26**

Wed 1-3 **Teaching Lab 2 Building D26**

Lectures: **Mon 2-3, CLB3. In person**

All others recorded on Moodle

http://www.timetable.unsw.edu.au/2022/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, know what analyses to use to be able to positively identify it.
3. Identify common igneous, sedimentary and metamorphic rocks in hand-specimen and thin-section.
4. Using field relationships, petrographic analysis and geochemical analyses, be able to determine the broad evolution and environment of formation of igneous, sedimentary and metamorphic rocks and 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 and laboratories is compulsory for this course while fieldtrips are optional.

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) CLB3/GO4/2-3	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 30	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 6	Intro to Mineralogy	ITG	Mineral Groups	ITG	Optical Mineralogy	ITG	Intro to Petrography	Thin sections I	Quiz 1
3 June 13	PUBLIC HOLIDAY		Igneous Processes	ITG	Magma formation and evolution	ITG	Thin sections II	Thin sections III	Quiz 2
4 June 20	Classification and naming of igneous rocks	ITG	Volcanoes and their products I	ITG	Volcanoes and their products II	ITG	Igneous rock I	Igneous rocks II	Quiz 3
5 June 27	Cenozoic intraplate volcanism in eastern Australia	ITG	Analytical Techniques	ITG	Geochronology	ITG	Igneous rocks III	Igneous rocks IV	Quiz 4
6 July 4	Mid term break: Gerringong Fieldtrip Thursday 7 July								
7 July 11	Gem Materials	ITG	X-ray diffraction analysis	ITG	Clays and Clay Minerals	ITG	Using geochemical data	XRD techniques	Quiz 5
8 July 18	Sedimentary processes and materials	ITG	Clastic non-carbonate sedimentary rocks	ITG	Carbonate sedimentary rocks	ITG	Clastic non-carbonate sedimentary rocks	Clastic non-carbonate sedimentary rocks	Quiz 6
9 July 25	Sedimentary rocks of the Sydney Basin	ITG	Introduction to Metamorphism	ITG	Regional metamorphism	ITG	Carbonate sedimentary rocks	Metamorphic minerals	Quiz 7
10 Aug 1	Course revision and final exam	ITG	Extraterrestrial Materials	ITG			Metamorphic rocks I	Metamorphic rocks II	Quiz 8

ITG, Ian Graham

LIST OF LECTURES, LABS AND QUIZZES

WEEK 1

LECTURES
Mon 30 May: L1 Getting to know each other and course overview, CLB3/G04 2-3pm
L2 Mineral properties in hand-specimen (recorded online)
L3 Introduction to Geochemistry (parts I and II) (recorded online)

LABS
Tue 31 May 1-3
Lab 1 Minerals 1

Wed 1 June 1-3
Lab 2 Minerals II

WEEK 2

LECTURES
Mon 6 June: L4 Introduction to Mineralogy, CLB3/G04 2-3 pm
L5 Mineral Groups (recorded online)
L6 Optical Mineralogy (recorded online)

LABS
Tue 7 June 1-3
Lab 3 Introduction to Petrography

Wed 8 June 1-3
Lab 4 Thin sections I
Quiz 1: Properties of minerals in hand-specimen

WEEK 3

LECTURES
Mon 13 June: PUBLIC HOLIDAY, no classes
L7 Igneous Processes (recorded online)
L8 Magma formation and evolution (parts I, II, III and IV) (recorded online)

LABS
Tue 14 June 1-3
Lab 5 Thin sections II

Wed 15 June 1-3
Lab 6 Thin sections III
Quiz 2: Introduction to Geochemistry/Introduction to Mineralogy

Saturday 18th June, fieldtrip to North Maroubra 1:30-5 pm

WEEK 4

LECTURES
Mon 20 June: L9 Classification and naming igneous rocks (parts I and II), CLB3/G04 2-3 pm
L10: Classification and naming of igneous rocks (parts III and IV) (recorded online)
L11 Volcanoes and their products (parts I, II, III and IV) (recorded online)

LABS
Tue, 21 June 1-3
Lab 7 Igneous rocks I

Wed, 22 June 1-3
Lab 8 Igneous rocks II
Quiz 3: Mineral Groups/Optical Mineralogy

WEEK 5

LECTURES
Mon 27 June: L12 Cenozoic intraplate volcanism in eastern Australia, CLB3/G04 2-3 pm
L13 Analytical techniques (recorded online)
L14 Geochronology (recorded online)

LABS
Tue, 28 June 1-3
Lab 9 Igneous rocks III

Wed 29 June 1-3
Lab 10 Igneous rocks IV
Quiz 4: Properties of minerals in thin-section

WEEK 6: BREAK (4-10 July), optional fieldtrip to Gerringong on Thursday 7th

WEEK 7

LECTURES
Mon 11 July: L15 Gem Materials, CLB3/G04 2-3 pm
L16 X-ray diffraction analysis (recorded online)
L17 Clays and Clay Minerals (recorded online)

LABS
Mon 12 July 3-5
Lab 11 Using geochemical data

Thu 15 July 3-5
Lab 12 XRD techniques

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

WEEK 8

LECTURES
Mon 18 June: L18 Sedimentary processes and materials (parts I and II), CLB3/G04 2-3 pm
L19 Clastic non-carbonate sedimentary rocks (parts I and II) (recorded online)
L20 Carbonate rocks (recorded online)

LABS

Tue, 19 July 1-3
Lab 13 Clastic non-carbonate sedimentary rocks I

Wed, 20 July 1-3
Lab 14 Clastic non-carbonate sedimentary rocks II
Quiz 6: Analytical techniques/geochronology/Gem materials

WEEK 9

LECTURES
Mon 25 July: L21 Sedimentary rocks of the Sydney Basin, CLB3/G04 2-3 pm
L22 Introduction to metamorphism (parts I and II) (recorded online)
L23 Regional metamorphism (parts I and II) (recorded online)

LABS
Tue, 26 July 1-3
LAB 15 Carbonate sedimentary rocks

Wed 27 July 1-3
Lab 16 Metamorphic minerals
Quiz 7: Sedimentary and metamorphic processes and rocks

WEEK 10

LECTURES
Mon 1 August: L24 Course revision and final exam, CLB3/G04 2-3 pm
L25 Extraterrestrial Materials

LABS
Tue, 2 August 1-3
Lab 17 Metamorphic rocks I

Wed 3 August 1-3
Lab 18 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%	Tuesday 12th 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	7 Jun
2	Intro to Geochem/Intro to Mineralogy	14 Jun
3	Mineral Groups/Optical Mineralogy	21 Jun
4	Properties of minerals in thin-section	28 Jun
5	Igneous processes, classification and volcanoes	12 Jul
6	Analytical techniques, geochronology, gem materials	19 Jul
7	Sedimentary and metamorphic processes and rocks	26 Jul
8	Revision of whole course	3 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	**Klein, C., and Dutrow, B., 2008.** *The Manual of Mineral Science* (23rd Edition). John Wiley and Sons. **Klein, C., 2008.** *Minerals and Rocks* (3rd Edition). John Wiley and Sons. **Deer, W.A, Howie, R.A. and Zussman, J., 1992**. *Introduction to the Rock Forming Minerals*. Longman. **Wenk, H-R., and Bulakh, A., 2004.** *Minerals: their constitution and origin.* Cambridge University Press.
Optical Mineralogy	**Nesse, W.D., 2004.** *Introduction to Optical Mineralogy* (3rd Edition). Oxford University Press. **Gribble, C.D., and Hall, A.J., 1985**. *A Practical Introduction to Optical Mineralogy*. George Allen and Unwin. **MacKenzie, W.S. and Guildford, C., 1980**. *Atlas of Rock-forming Minerals in Thin Section,* Longman **MacKenzie, W.S. and Adams, A.E., 2000**. *A Colour Atlas of Rocks and Minerals in Thin Section*. Manson Publishing. **Perkins, D. and Henke, K.R., 2004.** *Minerals in Thin Section* (Second Edition). Pearson Education Inc.
Crystals	**Sunagawa, I., 2005.** *Crystals: growth, morphology and perfection*. Cambridge University Press.
Clay Mineralogy	**Velde, B., 1992**. *Introduction to Clay Minerals*. Chapman and Hall.
Earth Materials	**Klein, C., and Philpotts, A., 2013**. Earth materials: Introduction to Mineralogy and Petrology. Cambridge University Press.
Sediment. Petrology	**Tucker, M.E., 1981.** *Sedimentary Petrology: an introduction.* Blackwells Scientific. **Boggs, S., 1992**. *Petrology of sedimentary rocks*. Macmillan Press.

[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	School website: http://www.bees.unsw.edu.au/ **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
Occupational Health and Safety	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 UNSW OHS Home page: http://safety.unsw.edu.au/
Equity and Diversity	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/). 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.
Student complaint procedure	http://student.unsw.edu.au/complaints **Designated/Grievance Officer** A/Prof Scott Mooney; s.mooney@unsw.edu.au Tel: 9385 8036 **School Student Ethics Officer** A/Prof Stephen Bonser; s.bonser@unsw.edu.au; Tel: 9385 3863 **University contact** University Contact University Counselling Services Tel: 9385 5418

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/