GEOS343

Magmas, Ores and Geochemistry

S1 Day 2014

Earth and Planetary Sciences

Contents

General Information

Unit convenor and teaching staff
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Credit points
3

Prerequisites
GEOS207 and GEOS272

Corequisites

Co-badged status

Unit description
This unit explores the behaviour and evolution of silicate magmas and aqueous fluids in both the crust and mantle. We use examples of mafic/ultramafic and intermediate-silicic magmatic rock associations, and their associated fluids and ore deposits to investigate the geochemistry and petrology of magmatic systems. Such associations are investigated from a deposit to mantle domain scale. Physical attributes of magma-fluid systems and isotopes are considered as exploration and petrogenetic tools. Important ore deposits in sedimentary basins are also considered. Practical work involves integrating geochemical databases with microscopic investigation of key magmatic suites.

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:

an understanding of the genesis and geochemistry of the major igneous rock suites

a process oriented understanding of the genesis and exploration criteria of the major ore

deposit types

an ability to identify the major rock-forming and ore minerals using a petrographic microscope

an ability to recognize and interpret igneous and ore micro-textures

experience in interpreting and modelling geochemical data

understanding scientific methodology

ability to access, research and assess appropriate scientific information

a capacity to communicate the findings of research through scientific writing

Assessment Tasks

Name	Weighting	Due
Assignment 1	15%	28/3/2014
Assignment 2	15%	9/5/2014
Practical assessments	10%	Ongoing
Practical exam	20%	13/06/14
Written Exam	40%	TBC

Assignment 1

Due: **28/3/2014**
Weighting: **15%**

The Bushveld Complex.

You will be assigned one of 5 topics relating to the origin, geochemistry, petrogenesis and mineralisation within the Bushveld Complex.

*This assignment differs from conventional essays in that it is a **true research review style articles**. As such it is anticipated that your primary reference sources will be peer reviewed scientific literature that is appropriately cited and referenced. Some articles of this nature are included in iLearn under each topic to get you started. Note that you will be expected to supplement these with at least four **extra** research articles that you find through your own research. You must use figures to illustrate key concepts.*

These are assignments of at least 1000 words and a ***maximum of 1500 words***, and are designed to give you some grounding in the material to be covered in the week they are due to be handed in.

On successful completion you will be able to:

- an understanding of the genesis and geochemistry of the major igneous rock suites
- a process oriented understanding of the genesis and exploration criteria of the major ore deposit types
- experience in interpreting and modelling geochemical data
- understanding scientific methodology
- ability to access, research and assess appropriate scientific information
- a capacity to communicate the findings of research through scientific writing

Assignment 2

Due: **9/5/2014**
Weighting: **15%**

Geodynamics of Ore Deposits

You will be assigned one of 5 topics relating to the origin, and geodynamics of some Ore Deposits

*This assignment differs from conventional essays in that it is a **true research review style articles**. As such it is anticipated that your primary reference sources will be peer reviewed scientific literature that is appropriately cited and referenced. Some articles of this nature are included in iLearn under each topic to get you started. Note that you will be expected to supplement these with at least four **extra** research articles that you find through your own research. You must use figures to illustrate key concepts.*

These are assignments of at least 1000 words and a ***maximum of 1500 words***, and are designed to give you some grounding in the material to be covered in the week they are due to be handed in.

On successful completion you will be able to:

- an understanding of the genesis and geochemistry of the major igneous rock suites
- a process oriented understanding of the genesis and exploration criteria of the major ore deposit types
- an ability to recognize and interpret igneous and ore micro-textures
- experience in interpreting and modelling geochemical data
- understanding scientific methodology
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- a capacity to communicate the findings of research through scientific writing

Practical assessments

Due: **Ongoing**
Weighting: **10%**

A maximum of four practicals will be submitted for assessment during the semester. You will be notified which at the start of a given weeks practical.

On successful completion you will be able to:

- an understanding of the genesis and geochemistry of the major igneous rock suites
- a process oriented understanding of the genesis and exploration criteria of the major ore deposit types
- an ability to identify the major rock-forming and ore minerals using a petrographic microscope
- an ability to recognize and interpret igneous and ore micro-textures
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- a capacity to communicate the findings of research through scientific writing

Practical exam

Due: **13/06/14**
Weighting: **20%**

1 hour, open book prac exam using the petrographic microscope.

On successful completion you will be able to:

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Written Exam

Due: **TBC**
Weighting: **40%**

2 hour theory exam, covering all aspects of the course, *including* practical work.

On successful completion you will be able to:

- an understanding of the genesis and geochemistry of the major igneous rock suites
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Delivery and Resources

2 hours of lectures per week followed by a 3 hour practical session. Attendance is compulsory.

iLearn contains links to electronic resources for the assignments and supplementary material for practicals and lectures.

Technology and Resources: We use iLearn for easy delievery.

We have changed the times for 2014 and added new expertise in volcanic systems.

Unit Schedule

NB This schedule is preliminary only, a final program of lectures and practicals will be available on iLearn at the start of week 1

Week	Lectures	Practical	Presenter
1 7/3	Nomenclature, tectonic associations; chemistry and mineralogy refresher	Petrology refresher, volcanic rocks	BFS
2 14/3	i) Phase equilibria, melting processes; ii) Binary and Ternary systems	Bushveld I: Mineralogy, textures, macroscopic layering	SPT
3 21/3	Geochemistry: i) Major elements ii) Trace elements	Bushveld II: Textural relationships; petrogenetic sequences, liquid line of descent and binary phase diagrams	SPT

4 28/3	i) Origin of basaltic magma ii) Diversification of magmas *1st assignment due (Bushveld)*	Major element modelling; inflections due to modal mineralogy changes	SPT Prac in comp suite
5 4/4	Basaltic magmatism in ocean basins i) MORB ii) OIB iii) LIPs and CFBs	Primary magma compositions (chilled compositions) Forward and inverse melt modelling	SPT Prac in comp suite
6 8/4	Island Arc Magmatism	Bulk mixing, discriminating between mixing vs AFC, isochron	CF Prac in comp suite
Mid semester Break (12/4 – 27/4 2014)			
7 2/5	Volcanology	Volcanic rocks; alkalic systems	MT
8 9/5	Principles of ore petrogenesis; S saturation, differentiation, accumulation, phase equilibria (redox) *2nd assignment due (Geodynamics and ore deposits)*	Bushveld III: Reflected light microscopy; textures, mineralogy, chemical compositions	BFS

9 16/5	Mineralising processes: BIFs, hydrothermal systems, placers, redox (U), regolith	Hand specimens, mineralogy, reflected light of examples	BFS
10 23/5	Granites, I, S, A, crustal growth and evolution, skarns; sedimentary provenance, detrital systems	Crustal mass balance, granite petrogenesis from TS and hand specs	BFS
11 30/5	Isotopes in magmatic and ore forming systems: Stable, cosmogenic, U-series,	Isotope geodynamics prac	BFS
12 6/6	Solar system and planet formation, atmospheric formation and evolution, meteorites	Practical Exam	BFS/ guest lecturers from ANU
13 13/6	**Practical exam, Room E5A210**		

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

Assessment Policy http://mq.edu.au/policy/docs/assessment/policy.html

Grading Policy http://mq.edu.au/policy/docs/grading/policy.html

Grade Appeal Policy http://mq.edu.au/policy/docs/gradeappeal/policy.html

Grievance Management Policy http://mq.edu.au/policy/docs/grievance_management/policy.html

Disruption to Studies Policy http://www.mq.edu.au/policy/docs/disruption_studies/policy.html *The Disruption to Studies Policy is effective from March 3 2014 and replaces the Special Consideration Policy.*

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/

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 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

IT Help

For help with University computer systems and technology, visit http://informatics.mq.edu.au/help/.

When using the University's IT, you must adhere to the Acceptable Use Policy. The policy applies to all who connect to the MQ network including students.

Graduate Capabilities

Capable of Professional and Personal Judgement and Initiative

We want our graduates to have emotional intelligence and sound interpersonal skills and to demonstrate discernment and common sense in their professional and personal judgement. They will exercise initiative as needed. They will be capable of risk assessment, and be able to handle ambiguity and complexity, enabling them to be adaptable in diverse and changing environments.

This graduate capability is supported by:

Learning outcomes

- a process oriented understanding of the genesis and exploration criteria of the major ore deposit types
- an ability to identify the major rock-forming and ore minerals using a petrographic microscope
- an ability to recognize and interpret igneous and ore micro-textures
- experience in interpreting and modelling geochemical data
- understanding scientific methodology
- ability to access, research and assess appropriate scientific information
- a capacity to communicate the findings of research through scientific writing

Assessment tasks

- Assignment 1
- Assignment 2
- Practical assessments
- Practical exam
- Written Exam

Commitment to Continuous Learning

Our graduates will have enquiring minds and a literate curiosity which will lead them to pursue knowledge for its own sake. They will continue to pursue learning in their careers and as they participate in the world. They will be capable of reflecting on their experiences and relationships with others and the environment, learning from them, and growing - personally, professionally and socially.

This graduate capability is supported by:

Learning outcomes

- an understanding of the genesis and geochemistry of the major igneous rock suites
- a process oriented understanding of the genesis and exploration criteria of the major ore deposit types
- an ability to identify the major rock-forming and ore minerals using a petrographic microscope
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Discipline Specific Knowledge and Skills

Our graduates will take with them the intellectual development, depth and breadth of knowledge, scholarly understanding, and specific subject content in their chosen fields to make them competent and confident in their subject or profession. They will be able to demonstrate, where relevant, professional technical competence and meet professional standards. They will be able to articulate the structure of knowledge of their discipline, be able to adapt discipline-specific knowledge to novel situations, and be able to contribute from their discipline to inter-disciplinary solutions to problems.

This graduate capability is supported by:

Learning outcomes

- an understanding of the genesis and geochemistry of the major igneous rock suites
- a process oriented understanding of the genesis and exploration criteria of the major ore deposit types
- an ability to identify the major rock-forming and ore minerals using a petrographic microscope
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Critical, Analytical and Integrative Thinking

We want our graduates to be capable of reasoning, questioning and analysing, and to integrate

and synthesise learning and knowledge from a range of sources and environments; to be able to critique constraints, assumptions and limitations; to be able to think independently and systemically in relation to scholarly activity, in the workplace, and in the world. We want them to have a level of scientific and information technology literacy.

This graduate capability is supported by:

Learning outcomes

- an understanding of the genesis and geochemistry of the major igneous rock suites
- a process oriented understanding of the genesis and exploration criteria of the major ore deposit types
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- Written Exam

Problem Solving and Research Capability

Our graduates should be capable of researching; of analysing, and interpreting and assessing data and information in various forms; of drawing connections across fields of knowledge; and they should be able to relate their knowledge to complex situations at work or in the world, in order to diagnose and solve problems. We want them to have the confidence to take the initiative in doing so, within an awareness of their own limitations.

This graduate capability is supported by:

Learning outcomes

- an understanding of the genesis and geochemistry of the major igneous rock suites
- a process oriented understanding of the genesis and exploration criteria of the major ore deposit types
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- Assignment 2
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- Practical exam
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Creative and Innovative

Our graduates will also be capable of creative thinking and of creating knowledge. They will be imaginative and open to experience and capable of innovation at work and in the community. We want them to be engaged in applying their critical, creative thinking.

This graduate capability is supported by:

Learning outcomes

- an ability to identify the major rock-forming and ore minerals using a petrographic microscope
- an ability to recognize and interpret igneous and ore micro-textures
- understanding scientific methodology
- ability to access, research and assess appropriate scientific information
- a capacity to communicate the findings of research through scientific writing

Assessment tasks

- Practical assessments
- Practical exam
- Written Exam

Effective Communication

We want to develop in our students the ability to communicate and convey their views in forms effective with different audiences. We want our graduates to take with them the capability to read, listen, question, gather and evaluate information resources in a variety of formats, assess, write clearly, speak effectively, and to use visual communication and communication technologies as appropriate.

This graduate capability is supported by:

Learning outcomes

- an ability to identify the major rock-forming and ore minerals using a petrographic microscope
- an ability to recognize and interpret igneous and ore micro-textures
- experience in interpreting and modelling geochemical data
- understanding scientific methodology
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Engaged and Ethical Local and Global citizens

As local citizens our graduates will be aware of indigenous perspectives and of the nation's historical context. They will be engaged with the challenges of contemporary society and with knowledge and ideas. We want our graduates to have respect for diversity, to be open-minded, sensitive to others and inclusive, and to be open to other cultures and perspectives: they should have a level of cultural literacy. Our graduates should be aware of disadvantage and social justice, and be willing to participate to help create a wiser and better society.

This graduate capability is supported by:

Learning outcomes

- ability to access, research and assess appropriate scientific information
- a capacity to communicate the findings of research through scientific writing

Socially and Environmentally Active and Responsible

We want our graduates to be aware of and have respect for self and others; to be able to work with others as a leader and a team player; to have a sense of connectedness with others and country; and to have a sense of mutual obligation. Our graduates should be informed and active participants in moving society towards sustainability.

This graduate capability is supported by:

Learning outcomes

- understanding scientific methodology
- ability to access, research and assess appropriate scientific information
- a capacity to communicate the findings of research through scientific writing

Assessment tasks

- Assignment 1
- Assignment 2