11918

Geology 316
Crustal Evolution

UNIT OUTLINE
Semester 2 2008
# Table of Contents

INTRODUCTION ......................................................................................................................... 3

ESSENTIAL ADMINISTRATIVE INFORMATION ................................................................. 3

TEACHING STAFF ....................................................................................................................... 4

UNIT COORDINATOR ............................................................................................................... 4

UNIT SYLLABUS ......................................................................................................................... 5

LEARNING OUTCOMES ........................................................................................................... 5

LEARNING ACTIVITIES .......................................................................................................... 5

STUDENT FEEDBACK ............................................................................................................. 5

LEARNING RESOURCES ......................................................................................................... 6

TEXT BOOKS .......................................................................................................................... 6

  Essential Texts: .................................................................................................................... 6

  Recommended Texts: .......................................................................................................... 6

ASSESSMENT DETAILS .......................................................................................................... 6

  Assessment Summary ........................................................................................................ 6

  Assessment 1 – Essay ....................................................................................................... 6

  Assessment 2 – Practical Exam ....................................................................................... 7

  Assessment 3 – Theory Exam ........................................................................................ 7

  Referencing Style ............................................................................................................. 7

  Guidelines for Submission: ............................................................................................. 8

  Assignment Marking ......................................................................................................... 8

STUDENTS’ RIGHTS AND RESPONSIBILITIES ................................................................. 8

ADDITIONAL INFORMATION .............................................................................................. 8

  Deferred and Supplementary Assessment .................................................................... 8

  Enrolment and HECS .................................................................................................... 8

UNIT STUDY CALENDAR ....................................................................................................... 9
INTRODUCTION

Welcome to Geology 316 – Crustal Evolution. The aim of this unit is to provide students with an understanding of the evolution of metamorphic belts in terms of regional tectonic processes.

An emphasis is placed on the regional-scale evolution of continental crust during metamorphism, how styles of modern metamorphism vary with tectonic setting, and how patterns in metamorphic belts and changed through Earth history. The metamorphic focus provides an understanding of how the deeper levels of the crust respond during regional tectonic events, and complements the igneous and structural perspectives taken in Geology 301 and 307.

ESSENTIAL ADMINISTRATIVE INFORMATION

<table>
<thead>
<tr>
<th>Unit Title</th>
<th>Geology 316 – Crustal Evolution</th>
</tr>
</thead>
<tbody>
<tr>
<td>Unit Study Package Number</td>
<td>11918</td>
</tr>
<tr>
<td>Unit Coordinator</td>
<td>Ian Fitzsimons</td>
</tr>
<tr>
<td>Teaching Area</td>
<td>Department of Applied Geology</td>
</tr>
<tr>
<td>Credit Value</td>
<td>12.5</td>
</tr>
<tr>
<td>Mode(s) of study</td>
<td>Internal</td>
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</tbody>
</table>
| Co-, Pre- and Anti-requisites | The following are pre-requisites for this unit:  
|                           | 9778 Geology 301 – Petrogenesis AND  
|                           | 302451 Geology 307 - Geodynamics |
| Additional requirements  | None                            |
| Core Unit status         | This is a core unit in the BSc (Applied Geology) and you may be terminated from this course of study if you fail it twice. |
| Result Type              | Grade/Mark                      |
| Ancillary Fees and Charges | This unit has no ancillary fees or charges. |
| Unit Website             | Unit materials can be accessed from the associated WebCT site via [http://oasis.curtin.edu.au](http://oasis.curtin.edu.au) |
| Faculty or School Website| www.geology.curtin.edu.au       |
| Tuition Pattern          | Lecture (1 hour): Wednesday 16.00–17.00 Rm. 314.216  
|                           | Practical (2 hours): Friday 14.00–16.00 Rm. 312.202 |
| Study Load               | Students are expected to spend an average of three hours per week on background reading and completing practical exercises in addition to the three hours of contact teaching. |
TEACHING STAFF

The lecturers for this unit and their contact details are below:

<table>
<thead>
<tr>
<th>Lecturer</th>
<th>Email</th>
<th>Phone</th>
<th>Fax</th>
<th>Building &amp; Room</th>
<th>Contact Hours</th>
</tr>
</thead>
<tbody>
<tr>
<td>Ian Fitzsimons</td>
<td><a href="mailto:I.Fitzsimons@curtin.edu.au">I.Fitzsimons@curtin.edu.au</a></td>
<td>(08) 9266 7968</td>
<td>(08) 9266 3153</td>
<td>312 - 214</td>
<td>Ian is often busy as Head of Geology. Please make an appointment with the Geology Office if you need to see him.</td>
</tr>
<tr>
<td>Chris Clark</td>
<td><a href="mailto:C.Clark@curtin.edu.au">C.Clark@curtin.edu.au</a></td>
<td>(08) 9266 2446</td>
<td>(08) 9266 3153</td>
<td>312 – 208A</td>
<td>Chris will be overseas for much of semester but will be helping with some classes.</td>
</tr>
</tbody>
</table>

The teaching staff will assist you with your learning and any problems or difficulties you may be experiencing while undertaking this unit. They will also mark your assignments and provide feedback in relation to your progress in this unit.

If you leave a message for a lecturer on email or telephone they will try to respond as soon as possible, but please allow for a response time of up to 5 working days.

UNIT COORDINATOR

Every unit also has a person who is responsible for the overall administration of that unit. This person is the Unit Coordinator. If you cannot contact the person who is teaching you at the time or if you have general administrative queries about this unit, you may wish to contact the Unit Coordinator for this unit.

<table>
<thead>
<tr>
<th>Lecturer</th>
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<th>Phone</th>
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<tr>
<td>Ian Fitzsimons</td>
<td><a href="mailto:I.Fitzsimons@curtin.edu.au">I.Fitzsimons@curtin.edu.au</a></td>
<td>(08) 9266 7968</td>
<td>(08) 9266 3153</td>
<td>312 - 214</td>
<td>Please make an appointment with the Geology Office if you need to see Ian</td>
</tr>
</tbody>
</table>

Please make an appointment with the Geology Office if you need to see him.
UNIT SYLLABUS


LEARNING OUTCOMES

On successful completion of this unit you will be able to:

1. Predict the effects that tectonic processes have on temperature variations within the crust and on the pressure-temperature-time paths followed by metamorphic rocks
2. Infer ages of geological events from common graphical plots of isotopic data
3. Differentiate high, medium and low pressure metamorphic rocks using their mineral assemblages and assess their likely origins using common tectonic models
4. Evaluate the evidence for plate tectonics and the supercontinent cycle in the Precambrian

LEARNING ACTIVITIES

This unit involves the following learning activities

The one-hour lecture each week provides the background information for each topic covered in this unit.

The two-hour practical classes comprise a number of exercises that complement and reinforce material presented in lectures. Some of the exercises are based on rock description and interpretation while others are based on calculation and graphical analysis of other forms of geological data.

STUDENT FEEDBACK

We welcome your feedback as one way to keep improving this unit. Later this semester, you will be encouraged to give unit feedback through eVALUate, Curtin's online student feedback system (see http://evaluate.curtin.edu.au). Recent changes to this unit in response to student feedback through eVALUate include:

1. A higher proportion of marks has been allocated to the essay assignment to match the time and effort required to complete it.
2. A mock practical examination has been introduced so that students are familiar with the exam format and expectations.
3. The microscope laboratory has been refurbished with 24 new petrographic teaching microscopes.

For Semester 1 and Semester 2 eVALUate is open for student feedback in weeks 12-17.

For other study periods see http://evaluate.curtin.edu.au/info/dates.cfm
LEARNING RESOURCES

The following resources will be posted on the WebCT site for this unit:

1. Copy of this unit outline
2. Summaries of all lectures
3. On-line quizzes for each lecture topic to test your understanding of the material

TEXT BOOKS

Essential Texts:
There are no textbooks that you need to purchase in order to complete this unit.

Recommended Texts:
You may like to refer to the final chapter of the following textbook which discusses the regional tectonic settings of metamorphic belts and pressure-temperature time paths, although you are not required to purchase it, and it has recently gone out of print:

ASSESSMENT DETAILS

Assessment Summary
The assessment for this unit consists of the following items.

<table>
<thead>
<tr>
<th>Assessment Tasks</th>
<th>Worth</th>
<th>Due</th>
<th>Unit Learning Outcome Assessed</th>
</tr>
</thead>
<tbody>
<tr>
<td>Essay</td>
<td>30%</td>
<td>Week 13</td>
<td>4</td>
</tr>
<tr>
<td>Practical Exam</td>
<td>35%</td>
<td>Week 14</td>
<td>2, 3</td>
</tr>
<tr>
<td>Theory Exam</td>
<td>35%</td>
<td>Exam Period</td>
<td>1, 2, 3, 4</td>
</tr>
<tr>
<td><strong>TOTAL</strong></td>
<td><strong>100%</strong></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Assessment 1 – Essay

**Worth: 30%**

**Due: 5pm Friday of Week 13**

*Describe the lithologies and structure of the Yilgarn Craton of Western Australia and summarize its crustal evolution, making sure that you include the most recent work and pay particular attention to whether this evolution might reflect modern plate tectonics.*

The essay should be around 10-15 pages in length.
Assessment 1 Marking Criteria
To be graded highly the essay will need to:
1. Provide an accurate, logical, and concise description of the geology of the Yilgarn Craton
2. Discuss evidence for plate tectonics in the development of the Yilgarn Craton
3. Illustrate relationships with maps and diagrams where appropriate
4. Cite several relevant and up-to-date scientific articles

Assessment 2 – Practical Exam
Worth: 35%
Held: Practical Class in Week 14
The duration of the practical exam will be 2.5 hours, and comprise one long thin section description (1 hour), four short thin section descriptions (15 minutes each), and a 30 minute discussion of the likely tectonic setting of the rocks, based on the descriptions and additional information provided (geological map and geochronological data).

Assignment 2 Marking Criteria
To score highly in the practical exam you will need to:
1. Identify the major minerals present in each rock sample
2. Correctly infer the facies series of each sample (low, medium or high pressure)
3. Extract geologically meaningful age information from graphical plots of isotopic data
4. Explain the origins of the samples with an appropriate tectonic model

Assessment 3 – Theory Exam
Worth: 35%
Held: Examination period (time and date to be published in the Examination timetable)
The duration of the theory exam is 2 hours, and it comprises three sections of equal value. In each section you will be asked to answer one question from a choice of two.

Section A is concerned with temperature variations in the crust and thermal modeling of P-T paths in metamorphic rocks.

Section B is concerned with the tectonic setting of low, medium and high pressure metamorphism.

Section C is concerned with Precambrian crustal evolution and how it might relate to plate tectonics and supercontinent evolution.

Previous theory exam papers for this unit and others taught by Applied Geology are available online at http://library.curtin.edu.au/exampapers/Sci_Eng/Department_of_Applied_Geology/

Assignment 3 Marking Criteria
To score highly in the theory exam you will need to:
1. Provide factually correct answers to the questions
2. Present arguments in a logical fashion
3. Provide illustrations where appropriate

Referencing Style
Students should use the Chicago author-date referencing style when preparing assignments. More information can be found on this style from the Library web site: http://library.curtin.edu.au/referencing/index.html.
Guidelines for Submission:
All assignments must be accompanied by an Assignment Cover Sheet.
All assignments must be received by 5 pm on the Friday of the week due.
Marks will be lost for late submission of assignments at a rate of 5% per day, except where an extension is negotiated prior to the assessment due date or where unforeseen medical, family or other issues prevent timely submission. Extensions will usually require supporting documentation.

Assignment Marking
Students should allow a 2 week marking turnaround for written assignments.

STUDENTS’ RIGHTS AND RESPONSIBILITIES
It is the responsibility of every student to be aware of all relevant legislation, policies and procedures relating to their rights and responsibilities as a student. These include:

- the Student Charter,
- the University’s Guiding Ethical Principles,
- the University’s policy and statements on plagiarism and academic integrity,
- copyright principles and responsibilities,
- the University’s policies on appropriate use of software and computer facilities,
- students’ responsibility to check enrolment,
- deadlines, appeals, and grievance resolution,
- student feedback,
- other policies and procedures
- electronic communication with students

See www.students.curtin.edu.au/administration/responsibilities.cfm for comprehensive information on all of the above.

ADDITIONAL INFORMATION

Deferred and Supplementary Assessment
You might be granted a deferred assessment for this unit if you are unable to complete an assessment task due to documented circumstances outside of your control, or a supplementary assessment when your final grade from the unit is between 45 and 50 and your academic record and personal circumstance warrant a second chance to pass the unit.

Deferred and supplementary exams will be held in Orientation Week of Semester One 2009 to accommodate the high number of student with vacation work. Students expecting to complete their degree this semester will have the opportunity to take any supplementary or deferred exams earlier to allow them to meet deadlines for graduation.

Enrolment and HECS
It is your responsibility to ensure that your enrolment is correct - you can check your enrolment through the eStudent option on OASIS, www.oasis.curtin.edu.au, and you can also print off an Enrolment Advice.

You can make requests to have corrections made to your Semester One enrolment up to 31 August. The University will not change records after 31 August. HECS liabilities (where they apply) and your results depend on your 31 August enrolment. Withdrawals made after that date will not reduce your HECS liability.
<table>
<thead>
<tr>
<th>WEEK</th>
<th>DATES</th>
<th>TOPIC (L = lecture, P = practical):</th>
<th>STAFF</th>
<th>ASSESSMENT</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.</td>
<td>Wed 30 Jul</td>
<td>L: Pressure, temperature and heat production in the Earth</td>
<td>ICWF</td>
<td>ICWF</td>
</tr>
<tr>
<td></td>
<td>Fri 1 Aug</td>
<td>P: Heat Flow and geothermal gradients</td>
<td></td>
<td></td>
</tr>
<tr>
<td>2.</td>
<td>Wed 6 Aug</td>
<td>L: Transient geotherms and P-T-t paths</td>
<td>ICWF</td>
<td>ICWF</td>
</tr>
<tr>
<td></td>
<td>Fri 8 Aug</td>
<td>P: Heat Flow and geothermal gradients (continued)</td>
<td></td>
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<td>3.</td>
<td>Wed 13 Aug</td>
<td>L: P-T estimates in metamorphic rocks</td>
<td>ICWF</td>
<td>ICWF</td>
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<tr>
<td></td>
<td>Fri 15 Aug</td>
<td>P: P-T estimates for the Fanad contact aureole, Ireland</td>
<td></td>
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</tr>
<tr>
<td>4.</td>
<td>Wed 20 Aug</td>
<td>L: Using radioactivity to date metamorphic rocks</td>
<td>CC</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Fri 22 Aug</td>
<td>P: Geochronology, isochrons, and Concordia diagrams</td>
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<td>5.</td>
<td>25-29 Aug</td>
<td>Tuition Free Week</td>
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<td>6.</td>
<td>1-5 Sep</td>
<td>No class - Geology 392/394 Field Trip</td>
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<td>7.</td>
<td>Wed 10 Sep</td>
<td>L: High pressure metamorphism</td>
<td>ICWF</td>
<td>ICWF</td>
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<tr>
<td></td>
<td>Fri 12 Sep</td>
<td>P: High-P metamorphism in the New England Fold Belt</td>
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<tr>
<td>8.</td>
<td>Wed 17 Sep</td>
<td>L: Medium and low pressure metamorphism</td>
<td>ICWF</td>
<td>ICWF</td>
</tr>
<tr>
<td></td>
<td>Fri 19 Sep</td>
<td>P: Low-P metamorphism in the Adelaide Fold Belt</td>
<td></td>
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<tr>
<td></td>
<td>Fri 26 Sep</td>
<td>P: Mock Practical Exam</td>
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<tr>
<td>10.</td>
<td>29 Sep to</td>
<td>Tuition Free Week</td>
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<td></td>
<td>3 Oct</td>
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<tr>
<td>11.</td>
<td>Wed 8 Oct</td>
<td>L: Crustal development of the Yilgarn Craton</td>
<td>ICWF</td>
<td>ICWF</td>
</tr>
<tr>
<td></td>
<td>Fri 10 Oct</td>
<td>P: Mock Practical Exam (continued)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>12.</td>
<td>Wed 15 Oct</td>
<td>L: Archaean cratons</td>
<td>ICWF</td>
<td>ICWF</td>
</tr>
<tr>
<td></td>
<td>Fri 17 Oct</td>
<td>P: Archaean crustal evolution</td>
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<td></td>
<td>Fri 24 Oct</td>
<td>P: Proterozoic crustal evolution</td>
<td></td>
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<td></td>
<td>Fri 31 Oct</td>
<td>P: Practical Exam</td>
<td></td>
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<tr>
<td>15.</td>
<td>3-7 Nov</td>
<td>Study Week</td>
<td></td>
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</tr>
<tr>
<td>16.</td>
<td>10-14 Nov</td>
<td>Examinations</td>
<td>Theory Exam</td>
<td></td>
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<tr>
<td>17.</td>
<td>17-21 Nov</td>
<td>Examinations</td>
<td>Theory Exam</td>
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Semester 2 2008