Faculty of Science  
School of Geography, Environment and Earth Sciences  
ESCI 303 Petrology and Geochemistry  
20 points.  
Trimester 2, 2013  

Important dates  
Trimester dates: 15 July to 18 October 2013  
Teaching dates: 15 July to 18 October 2013  
Mid-trimester break: 26 August to 8 September 2013  
Study period: 21 October to 16 November, 2013  
Examination/Assessment Period: 25 October to 16 November 2013  

Note: students who enrol in courses with examinations must be able to attend an examination at the University at any time during the scheduled examination period.  
Withdrawal dates: Refer to www.victoria.ac.nz/home/admisenrol/payments/withdrawalsrefunds  
If you cannot complete an assignment or sit a test or examination (aegrotats), refer to www.victoria.ac.nz/home/study/exams-and-assessments/aegrotat  

Class times and locations  
LECTURES  Mon 11:00 – 11:50 am; Weds, Fri 13:10 – 14:00 pm CO 124  
LABS  Mon 12:00 – 13:50 pm; Weds 14:10 – 16:00 pm CO 124  

Names and contact details  
Course lecturers:  
Monica Handler (course Coordinator), Room CO407, 463-5391  
Julie Vry, Room CO409, 463-6432  
John Gamble, Room CO419  
Terry Seward, Room CO416  
Diane Seward, Room CO416  
Dan J Sinclair, Room CO408  
Kevin Norton, Room CO202  

Office hours: Within reason, the teaching staff for this course maintain an open-door policy, but note that many of the lecturers for this course have part- or half-time hours at the University, which may vary. Please try to ask your questions during the laboratory time period.  

Communication of additional information  
If required, additional information will be announced verbally in lecture. Written notices may also be handed out or posted on the bulletin boards in the laboratories.
### Prescription

The course introduces fundamental concepts, principles and methods in geochemistry and the application of geochemical tools to geochronology, igneous, metamorphic rocks and processes. The formation, classification and geochemical behaviour of elements, isotopes and analytical methods in geochemistry. The application of geochemical tools is examined and the principles of geochronology applied.

### Course content

<table>
<thead>
<tr>
<th>Week</th>
<th>Lecture (Mon 11-12)</th>
<th>Lecture (Weds 1-2 pm)</th>
<th>Lecture (Fri 1 – 2 pm)</th>
<th>Laboratories (Mon 12-2; Weds 2-4)</th>
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</thead>
</table>
| 15 July | Course introduction; Nucleosynthesis – making the elements, Meteorites and Planetary formation | Elements & Isotopes. Properties and classification of the elements | Analytical methods in the environmental and geosciences | 1. Introduction to the research projects  
2. The electron microprobe, major element analyses of minerals, and calculating mineral formulae |
| 22 July | Major elements and their chemical variations in igneous rocks – fractional crystallisation | Trace elements and fractional crystallisation | Partial melting processes | 1. Mantle xenoliths and primary magmas  
2. Understanding and modelling fractional crystallisation processes |
| 29 July | MORB | Ocean island basalts | Continental flood volcanism | 1. Trace element constraints on fractional crystallisation processes  
2. Trace element modelling of partial melting processes, trace element signatures of igneous rocks |
| 5 August | Subduction volcanism | Silicic magmatism | Metamorphism – review of basics, controls and effects | 1. & 2. Multi-element diagrams and crust-mantle evolution (lab tours) |
| 12 August | Mineral assemblages, compositions and textures – a record of processes and changes, P-T paths and P-T-t-d records. | Major rock types and their responses to metamorphism | Important mineral groups, their chemistry & sol solid solution  
Diffusion | 1. Review: Metamorphic rocks & minerals  
2. Interpreting a textural history – Reynolds Range, Northern Territory, Australia |
| 19 August | Geothermobarometry - approaches & considerations | Common diagrams – P, T, T-X, pseudosections, ternaries and projections | Stable isotope thermometry | 1. Diffusion  
2. Traditional geothermometry and geobarometry - input data, calibrations & interpretation |
| 9 September | Open systems and monitors of fluid flow | *prac exam* | P-T-time in metamorphic studies | 1. Stable isotope thermometry  
2. prac exam |
| 16 September | Geochronology: Radiogenic isotopes | U-Pb geochronology | Thermochemistry | 1. Open systems (± isocon analysis)  
2. Dating rocks and minerals (marked) |
| 23 September | Thermochronology | Cosmic dating | Cosmic dating | 1. & 2. T-t paths for crustal rocks (marked) |
| 30 September | Near-surface geochemical cycles | Stable isotopes | Stable isotopes | 1. Cosmic dating  
2. stable isotopes (marked) |
| 7 October | Paleoproxies | Marine geochemistry | Paleoclimate geochemistry | 1. & 2. Manipulating geochemical time series (marked) |
| 14 October | Aqueous geochemistry | Aqueous geochemistry** | Aqueous geochemistry | 1. Speleothems  
2. No lab (additional lecture) |
Course learning objectives
1. define and be able to explain the fundamental concepts, principles and methods of applying geochemical and geochronological tools to studies of the natural world
2. apply geochemistry to the study of igneous processes and the formation of igneous rocks
3. apply geochemistry to the study of metamorphic processes and the formation of metamorphic rocks
4. demonstrate understanding by explaining the process of obtaining and evaluating geochemical data
5. undertake a piece of research involving interpreting geochemical data, and communicate the findings following appropriate guidelines for writing scientific manuscripts

Teaching Format
The lecture material presents geochemical concepts and theoretical background information used to investigate the natural world. Concepts are illustrated using examples from low temperature, environmental studies, to igneous and metamorphic processes, geochronology, and planetary formation. The laboratory components provide hands on experience in using elemental and isotopic data to interpret natural samples. The understanding and application of geochemical techniques and the interpretation of geochemical data is developed in greater detail through a research project. The course is delivered through lectures and laboratory sessions, and group sessions that assist development of a research project and individual research report.

Mandatory course requirements
To pass this course it is necessary to show satisfactory performance in examination and in the laboratory, with a:

- 50% average pass in the internal assessment, and
- 50% pass in Registry examination, and
- 50% average overall.

Notes:
Students who gain at least 50% of the course marks, but fail the course due to not satisfying a mandatory requirement will receive a grade of K.
Students who gain less than 50% receive D or E irrespective of mandatory requirements.
An aegrotat (G grade) is a pass that may be awarded in special circumstances:

- when a student is prevented from attending examinations (or completing an item of assessment), or
- when a student’s preparation for, or performance in, an examination or other item of assessment was impaired because of illness, injury or other circumstances outside of the student’s control.
- An application for an aegrotat pass will normally only be considered if the applicant has completed at least 35% of the course assessment.

Students with examinations are obliged to present at university until their exams are finished.

Workload
During an average week during the teaching term, students in this course should expect to attend 3hrs lecture, 4 hrs laboratory, and devote about 12 hrs to study and review. Students should note however, that for some weeks, there may be only two formal lectures given (e.g. week 6 and 12), and others may include additional formal lectures given within the allocated class times, with accordingly reduced workload on laboratory exercises (e.g. week 10). Students should use their course outline to guide their reading in preparation for lectures and in advance of the laboratory sessions.
Assessment

Students are expected to do every lab, and will be held responsible for the course material taught therein.

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<thead>
<tr>
<th>Assessment items and workload per item</th>
<th>%</th>
<th>CLO(s)</th>
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<tbody>
<tr>
<td>1 Research Project (5 – 6000 words)</td>
<td>25%</td>
<td>1 - 5</td>
</tr>
<tr>
<td>2 Practical Exam (2hr)</td>
<td>15%</td>
<td>1 - 4</td>
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<tr>
<td>3 Labs (total 3 or 4 labs, TBA)</td>
<td>10%</td>
<td>1 - 4</td>
</tr>
<tr>
<td>4 Final Registry Examination (3hr)</td>
<td>50%</td>
<td>1 - 4</td>
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THE RESEARCH PROJECT

Research project options will be presented in the first lecture/laboratory session, and you should ideally have selected a project by the end of the week. This gives time to discuss the projects offered with fellow students and the relevant lecturers, who will approve the final project selections.

You must plan ahead! The initial work will be done in groups of 3 – 4. The relevant lecturer will provide your group with the data and some background to the project, how the data were collected, and discuss with you ways to treat and evaluate the data. Individually, you must prepare and submit a formal written report by the due date.

Your report should specifically follow the guidelines given in the following reference. http://www.scidev.net/en/practical-guides/how-do-i-write-a-scientific-paper-.html ("How Do I Write a Scientific Paper?" on SciDev.Net) This is a good summary containing advice for each section of a manuscript, adapted from a text developed by the Applied Ecology Research Group at the University of Canberra, Australia

Submission and return of work

The Research Project can be submitted either as a MS Word or PDF file by email to the course-coordinator or project supervisor, or as a hard-copy to a drop box at CO 311 (School office).

Penalties

In the absence of prior arrangements, assignments turned in late will incur a penalty of 10% per day.

Recommended reading:

Winter, “An Introduction to Igneous and Metamorphic Petrology” powerpoint presentations downloadable at http://www.whitman.edu/geology/winter/JDW_PetClass.htm


Additional reading, worth knowing about (copies available in library)


Holland & Turekian (Eds) “Treatise on Geochemistry” 2004. 10 vols. ISBN 0080437516
Also access to pdf files of each chapter of each volume, via university computers:


Class representative

The class representative provides a useful way to communicate feedback to the teaching staff during the course. A class representative will be selected at the first lecture of the course. Students may like to write the Class Rep’s name and details in this box:

Class Rep name and contact details:

Other important information

The information above is specific to this course. There is other important information that students must familiarise themselves with, including:

- Academic Integrity and Plagiarism: www.victoria.ac.nz/home/study/plagiarism
- Aegrotats: www.victoria.ac.nz/home/study/exams-and-assessments/aegrotat
- Academic Progress: www.victoria.ac.nz/home/study/academic-progress (including restrictions and non-engagement)
- Dates and deadlines: www.victoria.ac.nz/home/study/dates
- Grades: www.victoria.ac.nz/home/study/exams-and-assessments/grades
- Resolving academic issues: www.victoria.ac.nz/home/about/avcacademic/publications2#grievances
- Special passes: www.victoria.ac.nz/home/about/avcacademic/publications2#specialpass
- Statutes and policies including the Student Conduct Statue: www.victoria.ac.nz/home/about/policy
- Student support: www.victoria.ac.nz/home/viclife/studentservice
- Students with disabilities: www.victoria.ac.nz/st_services/disability
- Student Charter: www.victoria.ac.nz/home/viclife/student-charter
- Student Contract: www.victoria.ac.nz/home/admisenrol/enrol/studentcontract
- Turnitin: www.cad.vuw.ac.nz/wiki/index.php/Turnitin
- University structure: www.victoria.ac.nz/home/about
- VUWSA: www.vuwsa.org.nz
GENERAL UNIVERSITY POLICIES AND STATUTES

Students should familiarise themselves with the University’s policies and statutes, particularly the Assessment Statute, the Personal Courses of Study Statute, the Statute on Student Conduct and any statutes relating to the particular qualifications being studied; see the Victoria University Calendar or the University’s policy website,

http://www.victoria.ac.nz/home/about/policy

Student and staff conduct

The Statute on Student Conduct together with the Policy on Staff Conduct ensure that members of the University community are able to work, learn, study and participate in the academic and social aspects of the University’s life in an atmosphere of safety and respect. The Statute on Student Conduct contains information on what conduct is prohibited and what steps are to be taken if there is a complaint. For information about complaint procedures under the Statute on Student Conduct, contact the Facilitator and Disputes Advisor or refer to the statute on the Victoria policy website at:

http://www.victoria.ac.nz/home/about/policy

The Policy on Staff Conduct can be found at:

http://www.victoria.ac.nz/home/about/policy

Academic grievances

If you have any academic problems with your course you should talk to the tutor or lecturer concerned; class representatives may be able to help you in this. If you are not satisfied with the result of that meeting, see the Head of School or the relevant Associate Dean; The VUWSA Student Advocate is available to assist in this process. If, after trying the above channels, you are still unsatisfied, formal grievance procedures can be invoked. These are set out in the Academic Grievance Policy which is published on the Victoria website at:

http://www.victoria.ac.nz/home/about/policy

There is also a leaflet explaining the grievance process available from the AVC (Academic) website at:

http://www.victoria.ac.nz/home/about_victoria/avcacademic/Publications.aspx#grievances

Students with Impairments

Refer to the Meeting the Needs of Students with Impairments Policy, available on the University’s policy website http://www.victoria.ac.nz/home/about/policy

The University has a policy of reasonable accommodation of the needs of students with impairments. The policy aims to give students with disabilities the same opportunity as other students to demonstrate their abilities. If you have a disability, impairment or chronic medical condition (temporary, permanent or recurring) that may impact on your ability to participate, learn and/or achieve in lectures and tutorials or in meeting the course requirements, please contact the course coordinator as early in the course as possible. Alternatively, you may wish to approach a Student Adviser from Disability Support Services (DSS) to discuss your individual needs and the available options and support on a confidential basis. DSS are located on Level 1, Robert Stout Building:

telephone: 463-6070
email: disability@vuw.ac.nz

The name of your School’s Disability Liaison Person is in the relevant prospectus or can be obtained from the School Office or DSS.
Student Support
Staff at Victoria want students to have positive learning experiences at the University. There are a number of support services available to help you directly if your academic progress is causing concern or if there are elements in your life that are affecting your ability to study. These include:

- Your course coordinator or programme director;
- Staff in your Faculty Student Administration Office Student Dedicated learning support through Student Learning Support Service; Kaiwawao Māori ;Maanaki Pihiphipinga; Disability Support Services and Victoria International;
- Wider holistic support through the Health Service; Counselling Service; Financial Support and Advice; Accommodation Service and Career Development and Employment. Find out more at www.victoria.ac.nz/st_services/ or email student-services@vuw.ac.nz;
- VUWSA employs a Student Advocate who deals with academic problems and provides support, advice and advocacy services, as well as training and supporting class representatives and faculty delegates. The Education Office is located on the ground floor, Student Union Building. Email education@vuwsa.org.nz or tel. 463-6716 or 463-6984.

Academic Integrity and Plagiarism
Academic integrity means that university staff and students, in their teaching and learning are expected to treat others honestly, fairly and with respect at all times. It is not acceptable to mistreat academic, intellectual or creative work that has been done by other people by representing it as your own original work.

Academic integrity is important because it is the core value on which the University’s learning, teaching and research activities are based. Victoria University’s reputation for academic integrity adds value to your qualification.

The University defines plagiarism as presenting someone else’s work as if it were your own, whether you mean to or not. ‘Someone else’s work’ means anything that is not your own idea. Even if it is presented in your own style, you must acknowledge your sources fully and appropriately. This includes:

- Material from books, journals or any other printed source
- The work of other students or staff
- Information from the internet
- Software programs and other electronic material
- Designs and ideas
- The organisation or structuring of any such material

Find out more about plagiarism, how to avoid it and penalties, on the University’s website: www.victoria.ac.nz/home/studying/plagiarism.html

Use of Turnitin
Student work provided for assessment in this course may be checked for academic integrity by the electronic search engine http://www.turnitin.com. Turnitin is an online plagiarism prevention tool which compares submitted work with a very large database of existing material. At the discretion of the Head of School, handwritten work may be copy-typed by the School and subject to checking by Turnitin. Turnitin will retain a copy of submitted material on behalf of the University for detection of future plagiarism, but access to the full text of submissions is not made available to any other party.

Communication of additional information
Find key dates, explanations of grades and other useful information at www.victoria.ac.nz/home/study. Find out about academic progress and restricted enrolment at www.victoria.ac.nz/home/study/academic-progress. The University’s statutes and policies are available at www.victoria.ac.nz/home/about/policy, except qualification statutes, which are available via the Calendar webpage at www.victoria.ac.nz/home/study/calendar (See Section C). Further information about the University’s academic processes can be found on the website of the Assistant Vice-Chancellor (Academic) at www.victoria.ac.nz/home/about_victoria/avcacademic/default.aspx