

UNIVERSITY OF CALGARY  
DEPARTMENT OF GEOSCIENCE  
COURSE OUTLINE

1. Course: GEOLOGY 589.08 – PETROLUUM GENERATION AND MIGRATION

|                       |                      |      |             |          |  |
|-----------------------|----------------------|------|-------------|----------|--|
| Lecture Section:      | L01                  | T/Th | 15:30-18:20 | ES 054   | WINTER 2014  |
| <b>Instructor(s):</b> | Dr. S.R. Larter      |      | ES 560A     | 220-7484 | <a href="mailto:slarter@ucalgary.ca">slarter@ucalgary.ca</a>   |
|                       | Dr. T.B.P. Oldenburg |      | ES 546      | 220-3260 | <a href="mailto:toldenbu@ucalgary.ca">toldenbu@ucalgary.ca</a> |

**Blackboard course name:** GLGY 589.08-01

Geoscience Department ES 118; (403) 220-5841; [geoscience.ucalgary.ca](http://geoscience.ucalgary.ca)

2. PREREQUISITE(S): Geology 449 or Geophysics 449, and Geology 461 or Geophysics 457

ANTIREQUISITE(S): Credit for both Geology 589 and 689 will not be allowed.

See section 3.5.C in the Faculty of Science section of the online Calendar (<http://www.ucalgary.ca/pubs/calendar/current/sc-3-5.html>)

3. **GRADING:** The University policy on grading and related matters is described in “Academic Regulations, sections F.1 and F.2” of the online University Calendar (<http://www.ucalgary.ca/pubs/calendar/current/f-1.html> and <http://www.ucalgary.ca/pubs/calendar/current/f-2.html>) In determining the overall grade in the course the following weights will be used:

**Based on CSPG conference-style abstract of a course topic assigned to student teams of two and a Powerpoint presentation of a course topic assigned to student team of two (15 min talk).**

|                     |     |
|---------------------|-----|
| Abstract Assessment | 50% |
| Presentation        | 50% |

Each piece of work (assignment, laboratory report, midterm test or final examination) submitted by the student will be assigned a percentage score. The student’s average percentage score for the various components listed above will be combined with the indicated weights to produce an overall percentage for the course, which will be used to determine the course letter grade.

4. **Missed Components of Term Work.** The regulations of the Faculty of Science pertaining to this matter are found in the Faculty of Science area of the Calendar in section 3.6: <http://www.ucalgary.ca/pubs/calendar/current/sc-3-6.html>. It is the student's responsibility to familiarize himself/herself with these regulations. See also <http://www.ucalgary.ca/pubs/calendar/current/e-3.html>.

5. Dates and times of class exercises held outside of class hours: None

**REGULARLY SCHEDULED CLASSES HAVE PRECEDENCE OVER ANY OUT-OF-CLASS-TIME-ACTIVITY.** If you have a clash with this out-of-class-time-activity, please inform your instructor as soon as possible so that alternative arrangements may be made for you.

6. **EXAMINATION POLICY:** No electronic or written aids (eg. cell phones, tablets, computers, PDAs, notes, textbooks) will be allowed during writing of any exams. Non-programmable calculators will be permitted to answer quantitative questions on exams, if applicable, and permission to do this will be clearly indicated on the examination paper.

Students should also read the Calendar, Section G, on Examinations: <http://www.ucalgary.ca/pubs/calendar/current/g.html>.

7. In this course, the quality of the student's writing in laboratory reports will be a factor in the evaluation of those reports. See also <http://www.ucalgary.ca/pubs/calendar/current/e-2.html>.

**8. OTHER IMPORTANT INFORMATION FOR STUDENTS:**

- (a) **ACADEMIC MISCONDUCT** (cheating, plagiarism, or any other form) is a very serious offence that will be dealt with rigorously in all cases. A single offence may lead to disciplinary probation or suspension or expulsion. The Faculty of Science follows a zero tolerance policy regarding dishonesty. Please read the sections of the University Calendar under K. Student Misconduct (<http://www.ucalgary.ca/pubs/calendar/current/k.html>) to inform yourself of definitions, processes and penalties
- (b) **ASSEMBLY POINTS in case of emergency during class time. Be sure to FAMILIARIZE YOURSELF with the information at <http://www.ucalgary.ca/emergencyplan/assemblypoints>.**
- (c) **ACADEMIC ACCOMMODATION POLICY.** Students with documentable disabilities are referred to the following links:  
Calendar entry on students with disabilities: <http://www.ucalgary.ca/pubs/calendar/current/b-1.html>  
Student Accessibility Services: [www.ucalgary.ca/access](http://www.ucalgary.ca/access)
- (d) **SAFEWALK:** Campus Security will escort individuals day or night (<http://www.ucalgary.ca/security/safewalk/>). Call **220-5333** for assistance. Use any campus phone, emergency phone or the yellow phones located at most parking lot pay booths.
- (e) **FREEDOM OF INFORMATION AND PRIVACY:** This course is conducted in accordance with the Freedom of Information and Protection of Privacy Act (FOIPP). As one consequence, **students should identify themselves on all written work by placing their name on the front page and their ID number on each subsequent page.** For more information see also <http://www.ucalgary.ca/secretariat/privacy>.
- (f) **STUDENT UNION INFORMATION:** VP Academic **Phone:** 220-3911 **Email:** [suypaca@ucalgary.ca](mailto:suypaca@ucalgary.ca).  
SU Faculty Rep. **Phone:** 220-3913 **Email:** [sciencerep@su.ucalgary.ca](mailto:sciencerep@su.ucalgary.ca) Website <http://www.su.ucalgary.ca/home/contact.html>.  
Student Ombudsman: [www.ucalgary.ca/provost/students/ombuds](http://www.ucalgary.ca/provost/students/ombuds); [ombuds@ucalgary.ca](mailto:ombuds@ucalgary.ca) 220-6420
- (g) **INTERNET and ELECTRONIC COMMUNICATION DEVICE Information.** You can assume that in all classes that you attend, **your cell phone should be turned off.** Also, communication with other individuals, via laptop computers, Blackberries or other devices connectable to the Internet is not allowed in class time unless specifically permitted by the instructor. If you violate this policy you may be asked to leave the classroom. Repeated abuse may result in a charge of misconduct.

UNIVERSITY OF CALGARY  
DEPARTMENT OF GEOSCIENCE  
COURSE OUTLINE

GEOLOGY 589.08  
PETROLEUM GENERATION AND MIGRATION

TERM: Winter 2014

PREREQUISITE(S): Geology 449 or Geophysics 449, and Geology 461 or Geophysics 457

ANTIREQUISITE(S): Credit for both Geology 589 and 689 will not be allowed.

LECTURER(S): Dr. S.R. Larter ES 560A 220-7484 [slarter@ucalgary.ca](mailto:slarter@ucalgary.ca)  
Dr. T.B.P. Oldenburg ES 546 220-3260 [toldenbu@ucalgary.ca](mailto:toldenbu@ucalgary.ca)

LECTURE : L01 T/Th 15:30-18:20 ES 054

MARK DISTRIBUTION: A. Composition of Final Grade

Abstract Assessment 50%  
Presentation 50%

B. Components of Course for Which a Passing Grade is Essential

Students must achieve a passing grade (minimum of D) on both the lecture portion of the course (average of the midterm and final exams) and the laboratory portion of the course to qualify for a passing grade overall.

D. Grading Scheme

| <b>Grading Scale:</b> |               |               |               |                 |               |
|-----------------------|---------------|---------------|---------------|-----------------|---------------|
| <b>A+</b>             | <b>A</b>      | <b>A-</b>     | <b>B+</b>     | <b>B</b>        | <b>B-</b>     |
| <b>100-96%</b>        | <b>95-91%</b> | <b>90-86%</b> | <b>85-81%</b> | <b>80-76%</b>   | <b>75-71%</b> |
|                       |               |               |               |                 |               |
| <b>C+</b>             | <b>C</b>      | <b>C-</b>     | <b>D</b>      | <b>F</b>        |               |
| <b>70-66%</b>         | <b>65-61%</b> | <b>60-56%</b> | <b>55-51%</b> | <b>&lt; 50%</b> |               |

**Course content 589.02/689.02/589.08/689.08:**

1. What is petroleum? Oil viscosity: Methods. (One lecture plus one lab)
2. Petroleum reservoir group (PRG) laboratory visit.
3. The molecular geochemistry of petroleum. (One lecture plus one lab)
4. Petroleum Systems and Processes. (One lecture plus one lab)
5. Petroleum Alteration: Biodegradation, Gas washing/biogenic gas and Heavy oil. (One lecture plus one lab)
6. Reservoir Geochemistry-inferring petroleum system parameters from analysis of reservoir oil. (One lecture plus one lab)
7. Generation and Primary Migration. (One lecture plus one lab)
8. Fluid flow, migration physics (PVT) and chemistry of secondary migration. (One lecture plus one lab)
9. Selected case studies. (Two lectures plus two labs)
10. How to give a talk and write an abstract. (Abstract and presentation clinic) (One lecture plus one lab)
11. Petroleomics – Petroleum Geochemistry for the 21<sup>st</sup> Century. (One lecture plus one lab)
12. Tesla laboratory visit.

**Objectives 589.02/689.02/589.08/689.08:**

1. Students will learn how petroleum is generated.
2. Mechanisms how petroleum expels from source rock and migrates to a potential reservoir.
3. Different petroleum alteration processes in the reservoir.
4. How to predict secondary migration pathways/distances using geochemical proxy tools.
5. How to predict in-reservoir alteration processes such as biodegradation which has strong influence on the petroleum quality (e.g. viscosity increase [decrease in fluid mobility], increase in acidity [corrosion issues]).
6. How to distinct source rocks and identify their paleoenvironments using geochemical parameter.
7. How to identify the source rock of a reservoir fluid.
8. How to identify the charge direction of petroleum into a reservoir.
9. How to categorize petroleum fluids from different reservoirs (are they belonging to the same oil family?).
10. How to identify fill-spill routes in a petroleum system.
11. Geochemical analytical methods.
12. How to measure fluid properties of extreme heavy oil/oil sands.
13. How to write an excellent scientific abstract.
14. How to prepare and to give an excellent scientific presentation.

**RESOURCE MATERIALS****Courses 589.02/689.02/589.08/689.08**

A huge selection of course related articles (pdf files) from national and international journals will be provided. Important reading supporting texts are:

1. Petroleum Geoscience, Jon Gluyas and Richard Swarbrick, Blackwell, 2004, ISBN 0-632-03767-9, 359pp
2. The Petroleum System-From Source to Trap, AAPG memoir 60.(1994) Eds. L.Magoon and G. Claypool, 1994. Published by AAPG, 1994; 644pp.Parts 1-4 and selected bits of parts 5,6.
3. Seals, traps and the petroleum system, AAPG memoir 67. (1997), Ed. R.C.Surdam, 314pp.
4. Understanding Petroleum Reservoirs: Towards an Integrated Reservoir Engineering and Geochemical approach, J.M.Cubitt, W.A. England, S.R. Larter, Geological Society Spec. Publ., 237, 2004, 395 pp
5. Hunt, J.M.( 1984) Petroleum Geochemistry and Geology, Freeman, 617pp
6. The Pepper et al trilogy of papers in Marine and Petroleum Geology-supplied as PDFs.

\*Plus additional papers selected through the course.

**Additional useful texts**

1. Cooper, B. (1990) Practical Petroleum Geochemistry, Robertson Scientific Publications, 174pp
2. North, F.K. (1985) Petroleum Geology. Unwin, 630pp OR
3. Selley, R.C. (1998) Elements of Petroleum Geology. 2nd Edition. OR
4. Bjorlykke, K. (1884) Sedimentology and Petroleum Geology, Springer Verlag, 363pp  
Introduction to Organic Geochemistry, S. Killops and V. Killops, Blackwell, 2005, ISBN-0-632-06504-4, p393.  
The Biomarker Guide (2005) (Volumes 1 and 2) Peters, Walters, Moldowan. Cambridge University Press, New York.

**CLASSROOM CONDUCT**

It is important that the classroom-learning environment is one of mutual respect. Please note the following basic statements below that outline expectations for student conduct.

1. Every student has the right to learn as well as the responsibility not to deprive others of their right to learn.
2. Please arrive on time and do not schedule other activities during class time. Late arrivals and early departures are disruptive.
3. In order to get the most out of this class please attend all scheduled classes. The class will be made as interesting, active and informative as possible.
4. Please let the instructor know immediately if you have a problem that is preventing you from performing satisfactorily in this class.

Below is what you can expect of the instructor.

1. Course expectations will be clear.
2. Class will start and end on time.
3. The instructor and/or TA's will be available to you for help outside of classroom times should you want to review concepts that you do not understand or learn material beyond the course content.  
Classroom disruptions will be managed so that you have a safe and distraction-free learning environment.