



UNIVERSITY OF CALGARY
FACULTY OF SCIENCE
DEPARTMENT OF GEOSCIENCE
COURSE OUTLINE

1. **Course:** GLGY 483, Carbonate Sedimentology -- Winter 2018

Lecture 01: (MWF, 13:00-13:50 in ST143)

Instructor Name	Email	Phone	Office	Hours
Benoit Beauchamp	bbeauch@ucalgary.ca	403 220-8266	ES 146	Fri 2-4 pm or by appointment

Course Site:

D2L: GLGY 483 L01-(Winter 2018)-Carbonate Sedimentology

Department of Geoscience: ES 118, 403 220-5841, geoscience@ucalgary.ca

Students must use their U of C account for all course correspondence.

2. **Prerequisites:**

See section [3.5.C](#) in the Faculty of Science section of the online Calendar.

Geology 323 and 381; one of 491 or 493; and one of 341 or 343.
Credit for Geology 483 and either 461 or 583 will not be allowed.

3. **Grading:**

The University policy on grading and related matters is described in [F.1](#) and [F.2](#) of the online University Calendar. In determining the overall grade in the course the following weights will be used:

Component(s)	Weighting %
Labs (9 @ 2%)	18
Lab Midterm Examination	15
Quiz (4 @ 5%)	20
Final Lab Examination	17
Final Lecture Examination	30

Each piece of work (reports, assignments, quizzes, midterm exam(s) or final examination) submitted by the student will be assigned a grade. The student's grade for each component 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.

The conversion between a percentage grade and letter grade is as follows;

Letter Grade	A+	A	A-	B+	B	B-	C+	C	C-	D+	D
Minimum Percent Required	>92	86-92	82-85	77-81	74-76	71-73	67-70	62-66	58-61	54-57	50-53

All lecture quiz and final exams are multiple choice type questions. Lab exams can be any combinations of multiple choice and short answer questions. Note that all the materials covered in the labs are fair game for the lecture exams. Each piece of work (laboratory report, exam) 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](#). It is the student's responsibility to familiarize himself/herself with these regulations. See also [Section E.3](#) of the University Calendar

5. **Scheduled out-of-class activities:**

There are no out-of-class activities scheduled for this course.

REGULARLY SCHEDULED CLASSES HAVE PRECEDENCE OVER ANY OUT-OF-CLASS-TIME-ACTIVITY. If you have a conflict with the out-of-class-time-activity, please contact your course coordinator/instructor no later than **14 days prior** to the date of the out-of-class activity so that alternative arrangements may be made.

6. **Course Materials:**

Mandatory textbook:

Origin of Carbonate Sedimentary Rocks (2015), Noel. P. James and Brian Jones, Wiley, 446 p.

7. **Examination Policy:**

No electronic or written aids (e.g. 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.

Students should also read the Calendar, [Section G](#), on Examinations.

8. **Approved Mandatory and Optional Course Supplemental Fees:**

There are no mandatory or optional course supplemental fees for this course

9. **Writing across the Curriculum Statement:**

For all components of the course, in any written work, the quality of the student's writing (language, spelling, grammar, presentation etc.) can be a factor in the evaluation of those reports. See also [Section E.2](#) of the University Calendar.

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 [Section E.2](#) of the University Calendar.

10. **Human studies statement:**

Students will not participate as subjects or researchers in human studies.

11. **Reappraisal of Grades:**

A student wishing a reappraisal, should first attempt to review the graded work with the Course coordinator/instructor or department offering the course. Students with sufficient academic grounds may request a reappraisal. Non-academic grounds are not relevant for grade reappraisals. Students should be aware that the grade being reappraised may be raised, lowered or remain the same. See [Section I.3](#) of the University Calendar.

1. **Term Work:** The student should present their rationale as effectively and as fully as possible to the Course coordinator/instructor within **15 days** of either being notified about the mark, or of the item's return to the class. If the student is not satisfied with the outcome, the student shall immediately submit the Reappraisal of Graded Term work form to the department in which the course is offered. The department will arrange for a re-assessment of the work if, and only if, the student has sufficient academic grounds. See sections [I.1](#) and [I.2](#) of the University Calendar

2. **Final Exam:** The student shall submit the request to Enrolment Services. See [Section I.3](#) of the University Calendar.

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

a. **Misconduct:** 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 [Section K](#), Student Misconduct to inform yourself of definitions, processes and penalties. Examples of academic misconduct may include: submitting or presenting work as if it were the student's own work when it is not; submitting or presenting work in one course which has also been submitted in another course without the instructor's permission; collaborating in whole or in part without prior agreement of the instructor; borrowing experimental values from others without the instructor's approval; falsification/ fabrication of experimental values in a report. **These are only examples.**

- b. **Assembly Points:** In case of emergency during class time, be sure to FAMILIARIZE YOURSELF with the information on [assembly points](#).
- c. **Academic Accommodation Policy:** Students needing an accommodation because of a disability or medical condition should contact Student Accessibility Services in accordance with the procedure for accommodations for students with disabilities available at [procedure-for-accomodations-for-students-with-disabilities_0.pdf](#).
- Students needing an accommodation in relation to their coursework or to fulfill requirements for a graduate degree, based on a protected ground other than disability, should communicate this need, preferably in writing, to the Sr. Instructor of the Department of Geoscience, Dr. Rudi Meyer by email rmeyer@ucalgary.ca or phone 403-210-7848. Religious accommodation requests relating to class, test or exam scheduling or absences must be submitted no later than **14 days** prior to the date in question: <http://www.ucalgary.ca/pubs/calendar/current/e-4.html>
- d. **Safewalk:** Campus Security will escort individuals day or night (www.ucalgary.ca/security/safewalk/). Call [403-220-5333](tel:403-220-5333) 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). 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 www.ucalgary.ca/legalservices/foip.
- f. **Student Union Information:** [VP Academic](#), Phone: [403-220-3911](tel:403-220-3911) Email: suvpaca@ucalgary.ca. SU Faculty Rep., Phone: [403-220-3913](tel:403-220-3913) Email: sciencerep@su.ucalgary.ca. Student Ombudsman, Email: suvpaca@ucalgary.ca.
- g. **Internet and Electronic Device Information:** Unless instructed otherwise, cell phones should be turned off during class. All communication with other individuals via laptop, tablet, smart phone or other device is prohibited during class unless specifically permitted by the instructor. Students that violate this policy may be asked to leave the classroom. Repeated violations may result in a charge of misconduct.
- h. **Surveys:** At the University of Calgary, feedback through the Universal Student Ratings of Instruction ([USRI](#)) survey and the Faculty of Science Teaching Feedback form provides valuable information to help with evaluating instruction, enhancing learning and teaching, and selecting courses. Your responses make a difference - please participate in these surveys.
- i. **SU Wellness Center:** The Students Union Wellness Centre provides health and wellness support for students including information and counselling on physical health, mental health and nutrition. For more information, see www.ucalgary.ca/wellnesscentre or call [403-210-9355](tel:403-210-9355).

Tentative Course and Lab schedule GLGY 483 (W2018)

	Monday (lecture)	Wednesday (lecture)	Friday (lecture)	Tuesday-Thursday (Lab)
W	1:00 – 1:50 ST 143	1:00 – 1:50 ST 143	1:00 – 1:50 ST 143	B02 Tu 11:00-1:50 ES 147 B03 Tu 2:00-4:50 ES 147 B06 Th 11:00-1:50 ES 147 B07 Th 2:00-4:50 ES 147
1	1A Jan 08 2018 Course Introduction <ul style="list-style-type: none"> o Course info o Review of previous courses o Review of topic to be covered in this course 	1B Jan 10 2018 A Review of Life and the Fossil Record <ul style="list-style-type: none"> o Origin of life o Tree of life o Microbial life o Cambrian Explosion o Fossils through time o Evolution and mass extinctions o Fossil preservation 	1C Jan 12 2018 Constituents of Carbonate Rocks – I <ul style="list-style-type: none"> o Grain, matrix, cement o Fossils - I 	Jan 9, 11 2018 No Lab

2	<p>2A Jan 15 2018</p> <p>Constituents of Carbonate Rocks - II</p> <ul style="list-style-type: none"> o Fossils " II 	<p>2B Jan 17 2018</p> <p>Classifications of Carbonate Rocks</p> <ul style="list-style-type: none"> o Clastic clone o Folk (1958, 1962) o Dunham (1962) o Embry and Klovan (1969) 	<p>2C Jan 19 2018</p> <p>Chemistry of Calcium Carbonate</p> <ul style="list-style-type: none"> o Aquatic carbonate system o CaCO3 equilibrium o pH buffering o CO2 degassing o Silicate weathering o Earth system / rock cycle o Mineralogy o Chemistry (Mg/Ca; Sr; Fe) 	<p>Jan 16, 18 2018</p> <p>Basics of Petrographic Microscope</p> <p>Constituents</p> <p>Corals</p> <p>Stromatoporoids</p> <p>Foraminifers</p> <p>Trilobites</p>
3	<p>3A Jan 22 2018</p> <p>Carbonate Factories through Time - I</p> <ul style="list-style-type: none"> o Sun radiation o Latitudinal range of carbonate deposition o Photic zone o Nutrients 	<p>3B Jan 24 2018</p> <p>Carbonate Factories through Time - II</p> <ul style="list-style-type: none"> o Carbonate factories o Carbonate-forming fossils in time o Aragonite vs calcite seas 	<p>3C Jan 26 2018</p> <p>Carbonate Facies Analysis and Facies Models</p> <ul style="list-style-type: none"> o Differences between clastic and carbonate facies analysis o Response to sea level fluctuations o Microfacies analysis o Bathymetric interfaces (Tidewater, FWWB, SWWB, Photic Zone, Lysocline, CCD, O2 minimum) o Standard model o Overview of all carbonate environments 	<p>Jan 23, 25 2018</p> <p>Constituents</p> <p>Brachiopods</p> <p>Echinoderms</p> <p>Bryozoans</p> <p>Bivalves</p> <p>Ostracods</p>
4	<p>4A Jan 29 2018</p> <p>Quiz 1 (Lectures 01A-03C)</p> <p>Warm Water Reef_Modern</p> <ul style="list-style-type: none"> o Biological processes o Barrier reefs o Atolls o Classification o Modern examples o Reef bleaching 	<p>4B Jan 31 2018</p> <p>Warm Water Reef_Ancient - I</p> <ul style="list-style-type: none"> o Biological processes o Deep oligophotic vs framework reef o Classification o Reef types and distribution 	<p>4C Feb 02 2018</p> <p>Warm Water Reef_Ancient - II</p> <ul style="list-style-type: none"> o Ancient examples o Devonian of Western Canada 	<p>Jan 30, Feb 01 2018</p> <p>Constituents</p> <p>Algae</p> <p>Green</p> <p>Red</p> <p>Blue Green</p> <p>Microbial fabric</p> <p>Sponge spicules</p>
5	<p>5A Feb 05 2018</p> <p>Shelf and Lagoon_Modern</p> <ul style="list-style-type: none"> o Biological processes o Energy settings o Salinity restriction o Teepee, fenestral fabric o Sea grass o Modern examples 	<p>5B Feb 07 2018</p> <p>Shelf and Lagoon_Ancient</p> <ul style="list-style-type: none"> o Ancient examples o Shelf cycles 	<p>5C Feb 9 2018</p> <p>Peritidal carbonates</p> <ul style="list-style-type: none"> o Tidal Flats o Beaches o Eolianites 	<p>Feb 06, 08 2018</p> <p>Constituents</p> <p>Other grains</p> <p>Oncoids</p> <p>Ooids</p> <p>Aggregates</p> <p>Intraclasts</p>
6	<p>6A Feb 12 2018</p> <p>Carbonate Slope_Modern and Ancient - I</p> <ul style="list-style-type: none"> o Stratal pattern o Slopes o Processes o Deposits 	<p>6B Feb 14 2018</p> <p>Carbonate Slope_Modern and Ancient - II</p> <ul style="list-style-type: none"> o Modern examples o Ancient examples 	<p>6C Feb 16 2018</p> <p>Carbonate Slope_Modern and Ancient " III</p> <p>Instructions Microfacies I lab (Chad Morgan)</p> <p>Cambrian shelf-margin</p>	<p>Feb 13, 15 2018</p> <p>Lab Exam I</p>

7	6A Feb 19 2018 Reading Week - No class	6B Feb 21 2018 Reading Week - No class	<i>Guest: Nikita Fernandes</i> 6C Feb 23 2018 Reading Week - No class	Feb 20, 22 2018 Reading Week - No Lab
8	8A Feb 26 2018 Carbonate Slope_Modern and Ancient - IV Ordovician Escarpment <i>Guest: Keith Dewing</i>	8B Feb 28 2018 Quiz 2 (Lectures 04A-08A) Lacustrine and Spring Carbonates <ul style="list-style-type: none"> Lacustrine carbonates Spring Carbonates 	8C Mar 02 2018 Cool-water Carbonates <ul style="list-style-type: none"> Thermocline Latitudinal distribution Linkage to oceanography Open ramp models Heterozoan carbonates in space and time Polar carbonates Ancient examples 	Feb 27, Mar 01 2018 Microfacies Analysis I <ul style="list-style-type: none"> Classification Biotic components Textures Fabrics
9	9A Mar 05 2018 Instructions Microfacies II lab Lime Mud Factory <ul style="list-style-type: none"> In situ factories Whittings Microbial carbonates Bioerosion Mud mounds 	9B Mar 07 2018 Methane seep carbonates <ul style="list-style-type: none"> Modern setting Ancient examples Arctic examples Hybrid reefs 	9C Mar 9 2018 Precambrian and post-extinction carbonates <ul style="list-style-type: none"> Stromatolites Microbialites Sea floor fans Anachronistic facies Depositional systems 	Mar 06, 08 2018 Microfacies Analysis II <ul style="list-style-type: none"> Grouping of observations MF definition MF interpretation
10	10A Mar 12 2018 Instructions Microfacies III lab Oceanic and Basinal Carbonates - I <ul style="list-style-type: none"> Oceanography <ul style="list-style-type: none"> Atmospheric cells Wind patterns Upwelling CCD, acidification Carbon pump Pelagic carbonates <ul style="list-style-type: none"> Planktonic forams Coccoliths, chalk Chert 	10B Mar 14 2018 Oceanic and Basinal Carbonates - II <ul style="list-style-type: none"> Enclosed shallow to deep basins <ul style="list-style-type: none"> Humid Evaporative Anoxic 	10C Mar 16 2018 Introduction to Carbonate Diagenesis <ul style="list-style-type: none"> Introduction Recrystallization Neomorphism Dissolution Analytical tools Paragenetic sequences Porosity Carbonate reservoirs 	Mar 13, 15 2018 Microfacies Analysis III <ul style="list-style-type: none"> Vertical section Walther's law of facies Depositional system
11	11A Mar 19 2018 Quiz 3 (Lectures 8B-10C) Chemistry of Carbonate Diagenesis <ul style="list-style-type: none"> Chemistry Isotopes 	11B Mar 21 2018 Submarine Diagenesis <ul style="list-style-type: none"> Submarine diagenetic zones Cement types Water pumping Beachrock Sea floor fans 	11C Mar 23 2018 Meteoric diagenesis I <ul style="list-style-type: none"> Dissolution Precipitation Role of CO2 Karsts and caves Vadose cementation Phreatic cementation Mixing zone 	Mar 20, 22 2018 Diagenesis Submarine Meteoric Burial Dolomite
12	12A Mar 26 2018 Meteoric diagenesis II <ul style="list-style-type: none"> Soil Caliche profiles Carbonate-rich soil profiles Subaerial unconformities <i>Microcodium</i> 	12B Mar 28 2018 Burial diagenesis <ul style="list-style-type: none"> Compaction / stylolites Syntaxial overgrowth Sparry calcite P-T gradients 	12C Mar 30 2018 Dolomite I <ul style="list-style-type: none"> Dolomite problem Dolomite mineral Stability Dedolomite 	Mar 27, 29 2018 Core Analysis Swan Hills
13	13A Apr 02 2018 Dolomite II <ul style="list-style-type: none"> Dolomite models Hydrothermal dolomite Dolomite cement <i>Guest: Dr. Omid Ardakani</i>	13B Apr 04 2018 Carbonate Petroleum Exploration in Western Canada I <i>Guest: Dr. Christian Viau</i>	13C Apr 06 2018 Carbonate Petroleum Exploration in Western Canada II <i>Guest: Dr. Christian Viau</i>	Apr 03, 05 2018 Lab Exam II
14	14A Apr 09 2018 Quiz 4 (Lectures 11A-13C) USRI Surveys	14B Apr 11 2018 BSD - No class	Apr 13 2018 No class	Apr 10, 12 2018 No Lab

Department Approval:

Electronically Approved

Date: 2017-12-12 17:31

Course Outcomes

1. Explain what are the main processes and products for all marine and non-marine carbonate forming environments
2. Recognize the wide variety of diagenetic products in carbonate rocks and interpret their origin in terms of early to late diagenetic environments
3. Interpret the environmental parameters and corresponding depositional environments from the observation of microscopic (thin-sections) and megascopic (hand samples, cores) features in carbonate rocks
4. Assess the origin and quality of porosity in carbonate rocks as it relates to hydrocarbon resources exploration and exploitation
5. Communicate how the succession of facies in a vertical section translates into a horizontal proximal-to-distal depositional system
6. Identify the vast gamut of grains, cement and matrix in carbonate rocks and classify such rocks using various classification schemes
7. Explain the principal biological, physical and chemical processes that lead to dissolution and precipitation and of carbonates in a variety of depositional and diagenetic environments
8. Communicate the similarities and differences between modern and ancient carbonate depositional systems
9. Perform a microfacies analysis of a complex carbonate succession and propose a depositional model for this succession