

EAS 209 - FALL TERM 2012 - REVISED !!!

Geology of Western Canada and the National and Provincial Parks

<u>Instructor</u>	Dr. Clark, Room 1-16B ESB, Ph. 780-492-3266 e-mail: fred.clark@ualberta.ca
<u>Lectures</u>	A1 T R 1230 - 1350 SAB 3-21
<u>Marks</u>	20% Mid-term #1, Thursday, October 4 (Lectures through October 2 [?], <u>Ordovician</u>)
	20% Mid-term #2, Tuesday, November 6 (Lectures October 2 [?], <u>Devonian</u> , through November 1 [?], <u>Jurassic</u>)
	20% Term Paper, due Thursday, November 15 (Instructions to follow)
	5% Class participation; use of i>clicker
	35% Final exam, Tuesday, December 18 , 1400-1600 (Cumulative, emphasis November 8 to end)

**** Final Exam timing is unofficial; confirm on Bear Tracks when official schedule is set and released by Registrar****

**** Deferred final exam is scheduled for Saturday, Jan. 12, 2013, 0900-1100 ****

Notes **ESSENTIAL.** Lecture outline format, posted online through eClass on an ongoing basis. Files will be in both Word and PDF format. Sample **exam questions** will also be posted here, as well as the term paper guidelines.

Texts *A Traveller's Guide to Geological Wonders in Alberta*, by Ron Mussieux and Marilyn Nelson, The Provincial Museum of Alberta. Highly recommended, very informative and clear.

Alberta: Beneath Our Feet, edited by Brian Hitchon, Geoscience Publishing. Recommended to

useful.

Handbook of the Canadian Rockies, by Ben Gadd, Corax Press, 2nd Edition, 4th printing, 2009. Useful, but potentially confusing, due to detail.

Resources

A number of PowerPoint files are on the web site <http://faculty.eas.ualberta.ca/drclarkrocks>; these serve as an introduction or refresher for rocks and minerals.

Important

Dates

October 4:	Mid-term 1
October 25:	Term Paper proposal due
November 6:	Mid-term 2
November 13:	Fall Term Class Break, no class
November 15:	Term Paper Due
December 4:	Last lecture
December 18:	Final exam, 1400-1600
January 12/2013:	Deferred Final exam, 0900-1100

Class Attendance: You will need to attend class in order to turn the posted lecture outlines into notes. I will not make the material available any other way! As soon as possible, you should get to know one or two other students; in case you miss a class, you will be able to get the missing material from your Study Buddies.

Access To Instructor: Anytime you can find me in my office with the door open; I do not keep set office hours, so feel free to drop by. If you wish to ensure that I will be there, arrange a meeting ahead of time, either by phone or e-mail.

Students with Disabilities: Students who require accommodation in this course due to a disability are advised to discuss their needs with Specialized Support & Disability Services (215 Central Academic Building).

Academic Support Centre: Students who require additional help in developing strategies for better time management, study skills, or examination skills should contact the Academic Support Centre (2-703 Students' Union Building).

Lecture Topics, Provisional Schedule, and Relevant Readings

- pages in Hitchon's book are referred to as "ABOF: 87-92", similarly Gadd as "Gadd: 184-185"; Mussieux and Nelson's book is referred to either by "M&N: p. 10-18", or "M&N: North 18", which would refer to that section of the book.
1. Introduction; Principles of Historical Geology and Stratigraphy (Sept. 6, 11):- **ABOF:** 4-7,48; **M&N:** p. 10-18, North 18; **Gadd:** 48,49,100 (Box).
 2. Geological Time Scale (Sept. 11):- **ABOF:** 5; **M&N:** p. 19-21; **Gadd:** 184-185.
 3. Context/Setting (Sept. 11):- **ABOF:** 30,41-43; **M&N:** p. 6-9, 24-29; **Gadd:** 45-50.
 4. Growth of the North American Craton/Basement (Sept. 11, 13):- **ABOF:** 42-43; **M&N:** North 13, 14; **Gadd:** 50-51.
 5. Proterozoic Sediments (Sept. 13, 18): **ABOF:** 44-47; **M&N:** Rockies 22, South 3, 5, 6; **Gadd:** 51-70, 186.
 6. Sequences; Sauk Sequence (essentially the Cambrian; Sept. 18, 20):- **ABOF:** 49-52; **M&N:** Rockies 14; **Gadd:** 70-75, 186.
 7. Video *Before The Mountains* (Sept. 20):- **M&N:** p. 27.
 8. Burgess Shale and Cambrian Fossils (Sept. 25, 27):- **ABOF:** 50-52; **Gadd:** 76-90 (includes the Owen Creek Formation to the end of Sauk).
 9. Video on Burgess Shale (Sept. 25)
 10. Tippecanoe Sequence (Ordovician and Silurian; Sept. 27):- **ABOF:** 53; **M&N:** Edmonton 6; **Gadd:** 90 (Mount Wilson Formation)-102, 186.
 11. Kaskaskia Sequence - Devonian (Oct. 2, 9):- **ABOF:** 54-65; **M&N:** North no# (p. 42,43), 7, 9, 10, 12, Edmonton 1, Heartland 4, 12, Rockies 12, 19, 27; **Gadd:** 103-115, 187.
 12. Devonian Fossils (Oct. 11):- **ABOF:** 59-65; **M&N:** Rockies 19.
 13. Devonian Resource Geology (Oct. 11, 16, 18):- **ABOF:** 55-57, 118-121, 130-133, 165; **M&N:** Heartland 4, South 7.

14. Leduc No. 1 (Oct. 23):- **ABOF:** 60; **M&N:** Edmonton 1.
15. Kaskaskia Sequence - Mississippian (Oct. 23):- **ABOF:** 66-69; **M&N:** Heartland 12, Rockies 20, Calgary 1, South 7; **Gadd:** 115-116.
16. Mississippian Fossils (Oct. 23)
17. Mississippian Hydrocarbons (Oct. 23, 25):- **M&N:** Calgary 1.
18. Absaroka Sequence - Pennsylvanian and Permian (Oct. 25, 30):- **ABOF:** 70-73; **M&N:** Rockies 26; **Gadd:** 116-120.
19. Absaroka Sequence - Triassic (Oct. 30):- **ABOF:** 74-75; **M&N:** Edmonton 6, Rockies 26; **Gadd:** 121, 124-126.
20. Jurassic of the WCSB (Oct. 30, Nov. 1):- **ABOF:** 76-77; **M&N:** Rockies 24, South 9, 13; **Gadd:** 121, 123, 126-129, 187.
21. Video *The Foreland Basin* (Nov. 1):- **M&N:** p. 27.
22. Cretaceous of the Western Canada Foreland Basin (Nov. 8, 15):- **ABOF:** 78-97, 124-126; **M&N:** North 1, 2, 17, 19, Heartland 1, 2, 8, 10, Rockies 6, 7, 18, 24, South 8, 11, 17, 18, 19, 20, 23, 27; **Gadd:** 122-124, 129-134.
23. Video *Birth of the Rockies* (Nov. 20):- **M&N:** p. 24-29, 108-110, Rockies 2, 3, 5, 8, 9, 15, 23, 25, 28, Calgary 1, South 8, 10, 12; **Gadd:** 21-42, 135-142, 187-191.
24. Exploration for Dinosaurs in the Foreland Basin (Nov. 20):- **M&N:** South 8, 14, 20, 26.
25. Mountain Building (Nov. 22, 27):- same as for video; see **ABOF:** 10-13 for faulting and folding.
26. Post-Cretaceous (Nov. 29):- **ABOF:** 98; **M&N:** Edmonton 6, Heartland 2, Calgary 3, South 22, 24; **Gadd:** 142-144.
27. Jasper National Park (Nov. 29, Dec. 4):- **M&N:** Rockies 7, 8, 9, 10, 11, 13, 14, 15, 16, 17.
28. Glaciation (Dec. 4):- **ABOF:** 99-103; **M&N:** p. 29, North 15, 16, 18, Edmonton 2, 5, 8, Heartland 7, 9, 11, Rockies 14, 17, 29, Calgary 2, South 1, 4; **Gadd:** 145-152.

THINGS YOU SHOULD KNOW (PART 1)

Course Description: An overview of the geology and landscapes of Western Canada. The spectacularly exposed rocks of the prairie and mountain parks of Alberta and British Columbia will be fitted into a regional geological framework and examples from parks such as Yoho, Banff, Jasper, Dinosaur, and Kananaskis will be highlighted. Geological processes of mountain building and past and present landscape evolution will be emphasized. Prerequisite: One of EAS 100, 101, 103, 201, 210 or SCI 100.

Course Objectives and Expected Learning Outcomes (Concise Version): To acquaint you with the geological, geographic, climatic, and paleontological history of Western Canada, and to place its significant geological resources in context. Concepts are elucidated from and anchored to specific rock units and locales. You should come to appreciate the change that has happened through time; Western Canada has not always looked this way! You will be expected to be able to articulate these topics, as well as details of the geology to support the broader picture.

Course Objectives and Expected Learning Outcomes (Long Version):
By the end of this course, you should be able to:

- 1) Name and explain the basic principles of historical geology, as well as the various types of unconformities that constitute gaps in the rock record.
- 2) Reproduce the Geological Time Scale at the level of Periods and higher subdivisions.
- 3) Name and briefly characterize the three main geologic subdivisions of Western Canada: the Shield, the Western Canada Sedimentary Basin (WCSB), and the Cordillera.
- 4) Name and describe the principal formations that comprise the Purcell Supergroup as exposed in Waterton Lakes National Park, explain what setting they represent, and characterize the Windermere Supergroup, as exposed in the Cordillera, both supergroups as examples of the Precambrian history of Western Canada.
- 5) Explain the origin and setting of Grand Cycles in the Cambrian rocks and their expression in the Main Ranges of

the Canadian Rockies, and as the context for the Burgess Shale and its fauna; describe the essentials of the discovery, elements, and significance of the Burgess fauna.

6) Characterize the Williston Basin, and its relationship to the WCSB; describe the Ordovician Tyndall Formation, arguably Western Canada's most famous building stone.

7) Describe the pattern of deposition of Devonian rocks, and name and describe the principal rock units, with emphasis on reefs and related evaporite rocks.

8) Describe the major resources recovered from Devonian rocks: what they are, how they originate, and their setting/host.

9) Name and describe the major Mississippian rocks units that have significant expression in the Rockies, and their importance in the accumulation of resources.

10) Explain the major elements of change in Western Canada as signaled by the Absaroka Sequence, with reference to specific rock units and their depositional setting; you should come to be able to articulate the main aspects of change throughout the geologic history of Western Canada.

11) Explain what the Foreland Basin is, and how it differs from the WCSB; name and describe the major stratigraphic units and their depositional setting, and their role as hosts for hydrocarbons, especially the oil sands.

12) Name and characterize the subdivisions of the Cordillera: its five Belts, and the five zones that comprise its easternmost belt, the Foreland Belt; name and characterize the mechanisms of mountain building.

13) Identify and briefly describe some of the more geologically significant features exposed in Jasper National Park, especially as examples of major ideas or themes we have developed in the course.

14) Briefly explain glaciation and its impact on the landscapes you can see in Western Canada.

15) Name, briefly describe, and place in time the major fossil groups we highlight throughout the course.

THINGS YOU SHOULD KNOW (PART 2)

Class Participation: Throughout the term, we will be using i>clicker technology to review material and/or survey opinions on various topics. Your participation in these questions forms the basis for your class participation mark. To give you an idea, response on 90% or more of the questions will get you 5/5, 70-89% gets 4/5, and so on.

In addition to the sample exam questions posted on the course web site, a number of additional questions will be posed in class; several of these will appear on the exams.

If you do not yet have one, you will need to purchase an i>clicker remote, available at the University Bookstore, and register it (i.e. identify it as yours). Registration is to be done on-line, going to www.iclicker.com, then Support, then Register Your Clicker. Of course, use your first and last name as indicated, and for your ID use your CCID (e.g. Charlie Brown's CCID might be cbrown. Do **not** use your student ID#).

You are responsible for bringing a functioning remote to class every day; I will neither provide "loaners" nor batteries. Using more than your own remote in class constitutes an academic offence - both you, and the person whose remote you are using, are misrepresenting that person's attendance and participation.

Format of Exams: Exams are half multiple choice, half written-answer. On both the midterms, this comprises 25 multiple choice questions and two written-answer questions, one worth 10 marks and the other worth 15 marks, total of 50 marks. The cumulative final exam is exactly double that.

Term Paper: A detailed set of instructions and criteria will be provided in a separate document, in a timely (before end of September) manner.

Grading Criteria: Grades are assigned only at the end of the course, based on the total mark as determined according to page 1 of the syllabus. Grades will be assigned neither with pre-determined numerical cut-offs, nor with slavish adherence to a curve or so-called historical distribution. That distribution is used as a rough guide to what the marks distribution could be, but a talented class that

performs well will be rewarded with higher grades than "normal"; conversely, an underachieving class will not be propped up by the curve, but will bear the consequences. Any course total mark over 80% will almost certainly get an A of some kind, and below that, every 3 or 4% mark reduction may see a drop of one grade (8 grades lie between ~50 and 80%). Where natural breaks in the mark distribution do not occur, the final lecture exam is used as the discriminator to set grade breaks. Unofficial grades and final exam scores will be posted on eClass once they are calculated. Grades remain unofficial until approved by the Department and/or Faculty offering the course.

In the years 2010 and 2011, without either a term paper or class participation mark, the GPA was 2.62 and 2.66 respectively, with a median grade of B-. The most recent year for which a term paper was assigned (worth 20%, no class participation mark), the GPA was 2.72 and median grade B. The style of delivery of course material was not directly comparable, however.

Examinations Through SSDS: Students who will be writing exams through SSDS (Specialized Support and Disability Services) should bring their Letter of Introduction to the instructor as early in the term as possible, and the Exam Instructions & Authorization (orange form) sheet to the instructor at least one week before individual exams. As well, you should book the exams with SSDS as soon as possible, as the demand for spaces is high and they may not be able to accommodate you if you try to book too close to the exam date(s).

Deferred Midterm Examinations: A student who cannot write a midterm examination due to incapacitating illness, severe domestic affliction or other compelling reasons may be granted a deferral (difficult to do and unlikely, given the need to arrange them within students' schedules, as well as be timely), or an excused absence (weight transferred to Final Exam). In either case, suitable supporting documentation (e.g. doctor's note, statutory declaration, or other as determined in consultation between student and instructor) is required. Deferral of term work is a privilege and not a right; there is no guarantee that a deferral will be granted. Misrepresentation of facts to gain a deferral or excused absence is a serious breach of the *Code of Student Behaviour*.

Deferred Final Examinations: A student who cannot write the final examination due to incapacitating illness, severe domestic affliction or other compelling reasons can apply for a deferred final examination. Such an application must be made to the student's Faculty office within 48 hours of the missed examination and must be supported by a Statutory Declaration (*in lieu* of a medical statement form) or other appropriate documentation (Calendar section 23.5.6). The course instructor does not have authority to grant deferred final examinations, although they may have input into the decision to grant a deferred exam. Deferred examinations are a privilege and not a right; there is no guarantee that a deferred examination will be granted. Misrepresentation of facts to gain a deferred examination is a serious breach of the *Code of Student Behaviour*. The date for said deferred exam, should it be granted, is noted on the schedules on the first and second pages.

Reexaminations: There will be no reexaminations in this course, because the final exam counts less than 40% toward the course mark (see Calendar section 23.5.5[1b]).

STUDENT RESPONSIBILITIES

Academic Integrity: The University of Alberta is committed to the highest standards of academic integrity and honesty. Students are expected to be familiar with these standards regarding academic honesty and to uphold the policies of the University in this respect. Students are particularly urged to familiarize themselves with the provisions of the *Code of Student Behaviour* (online at www.ualberta.ca/secretariat/appeals.htm) and avoid any behaviour which could potentially result in suspicions of cheating, plagiarism, misrepresentation of facts and/or participation in an offence. Academic dishonesty is a serious offence and can result in suspension or expulsion from the University.

All forms of dishonesty are unacceptable at the University. Any offense will be reported to the Senior Associate Dean of Science who will determine the disciplinary action to be taken. Cheating, plagiarism and misrepresentation of facts are serious offenses. Anyone who engages in these practices will receive at minimum a grade of zero for the exam or paper in question and no opportunity will be given to

replace the grade or redistribute the weights. As well, in the Faculty of Science the sanction for **cheating** on any examination will include **a disciplinary failing grade** (no exceptions) and senior students should expect a period of suspension or expulsion from the University of Alberta.

Students should also be aware of the Faculty of Science's stance on plagiarism, as described on their web site, and the Truth in Education (TIE) issues covered on the web site <http://www.uofaweb.ualberta.ca/TIE/>.

Examinations: Your student photo I.D. is required at exams to verify your identity. Students will not be allowed to begin the final examination after it has been in progress for 30 minutes, and students must remain in the exam room until at least 30 minutes has elapsed. Electronic equipment cannot be brought into examination rooms and hats should not be worn (there have been instances of employing them for the purpose of cheating).

Cell Phones and Other Electronic Devices: Cell phones and related devices are to be turned off and stowed (i.e. off the desk/tablet top) during lectures, and are not to be brought to exams. Given that course materials are posted online and intended for in-class use, students may use laptop computers in class to make/fill in notes. Any other use of laptops in class is prohibited. Recording is permitted only with the prior written consent of the professor or if recording is part of an approved accommodation plan.

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DISCLAIMER: Any typographical errors in this Course Outline are subject to change and will be announced in class.