

**THE UNIVERSITY OF WESTERN ONTARIO**  
**Department of Geography**  
**GEOGRAPHY 3352B/9200B: Paleolimnology and Global Environmental Change**  
**Winter 2015**

- Instructor:** Dr. Katrina Moser  
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- TA** Oscar Senar  
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- Office Hours:** Dr. Katrina Moser will be available for consultation on W 1:30-2:30. Oscar Senar will be available
- Lectures:** Wed. 11:30-1:30, SCC 3024
- Labs/Tutorials:** Thurs. 10:30-12:30 SSH 3035 (N.B. Check the class schedule carefully as some labs will be held in SSC 1302).
- Field Trips:** Students are required to attend one Saturday field trip which will be held **Saturday Jan. 31 from 9am-4pm**. This is a critical and mandatory part of the course and attendance is required.
- Course Prerequisites:** One of [Geography 2310A/B](#), [2320A/B](#) or [2330A/B](#), or at least 3rd year standing in an Environmental Science or Earth Sciences program, or [Biology 2483A](#), 2484A, [2485B](#) or permission of the instructor. Unless you have either the requisites for this course or written special permission from your Dean to enroll in it, you may be removed from this course and it will be deleted from your record. This decision may not be appealed. You will receive no adjustment to your fees in the event that you are dropped from a course for failing to have the necessary prerequisites.

**INTRODUCTION:**

Paleolimnology is the reconstruction and interpretation of past environments using physical, chemical and biological indicators contained in lake sediments. In the last two decades the field of paleolimnology has undergone rapid expansion. This course is a detailed examination of current methods and theories in paleolimnology. Lecture topics will include a review of:

- dating methods
- paleolimnological techniques, including a detailed survey of a variety of paleoindicators
- current issues in paleolimnology

- paleolimnology and global environmental change.

Labs will provide students with a hands-on experience of field and lab techniques used by paleolimnologists.

### **BASIS FOR COURSE:**

This course provides students with a “hands-on” learning experience in one area of environmental science, Paleolimnology. Students will learn how research questions and hypothesis are developed and then tested. A one day field trip provides students with the opportunity to collect data to test a hypothesis. During the field trip, which provides the basis for the course, students retrieve sediments (mud) from the bottom of a lake and learn to make and record limnologic observations and measurements. The sediments retrieved from the lake become the basis for lab assignments and for a final report which is submitted on the last day of class. Lectures provide the background materials necessary for understanding and interpreting the data collected by students.

### **OBJECTIVES:**

There are content and technical goals for this course.

#### *Content*

The main content objectives of this course are:

1. to provide students with an understanding of the importance of a long-term perspective in environmental research;
2. to provide students with a strong foundation and understanding of the most recent theories and methodologies in Paleolimnology;
3. to provide students with an understanding of the contributions of Paleolimnology to our understanding of global environmental change

#### *Technical*

The main technical objectives of this course are:

1. to provide students with an understanding of the scientific method
2. to provide students with an opportunity to make field observations and measurements and assess the accuracy and precision of the measurements
3. to provide students an opportunity to use the observations to test hypotheses
4. to provide students with an overview of paleolimnological techniques and an opportunity to practice these techniques.

### **CLASSES:**

There will be one 2 hour lecture and one 2 hour lab per week. One **mandatory** Saturday field trip is planned.

### **COURSE TEXT:**

The required course textbook will be Smol, J.P. 2008. *Pollution of Lakes and Rivers: A*

*Paleoenvironmental Perspective Second Edition*. Blackwell Publishing, Oxford.

Below I have listed a few books that I have also found useful which will be available on reserve in the library.

#### Paleolimnology References

1. Last, W.M. and Smol, J.P. (editors), 2001. Tracking environmental change using lake sediments. Kluwer, Boston. **QE39.5P3T73 2001**

*An excellent set of books reviewing many paleolimnological techniques. Useful for paleoindicator assignments.*

2. Pienitz, R., Smol, M.S.V. Douglas and Smol, J.P. (editors), 2004. Long-term environmental change in Arctic and Antarctic lakes. Kluwer, Boston. **QH98.L66 2004**

*A review of Arctic and Antarctic Paleolimnology. Useful for Arctic and Antarctic lake depositional environment assignment.*

3. Cohen, A.S. 2003. Paleolimnology: The history and evolution of lake systems. Oxford University Press, New York. **QE39.5.P3 C63 2003**

*Upper undergraduate to graduate level text on paleolimnology written from a geologic rather than biologic perspective. Useful for many paleoindicator topics (Chapter 9, 10 and 11 and some depositional environment topics (Chapter 2)).*

#### Limnology References

1. Hutchinson, G. E., 1957. A treatise on limnology, 1. J. Wiley & Sons, New York. **QH98.H97 1957**

*A classic! Excellent review of stratification and chemical processes.*

2. Wetzel, R. G., 2001. Limnology: Lakes and River Ecosystems, 3<sup>rd</sup> edition. Academic Press, London. **QH96.W47 2001**

*The best textbook available about Limnology.*

#### Biological References

1. Lipps, J. H., 1993. Fossil Prokaryotes and Protists. Blackwell Scientific Publishers, Cambridge. **QE719.5.F67 1993**

*This is a helpful book for some paleoindicator assignments or if you want additional reading on diatoms.*

2. Stoermer, E.F. and Smol, J.P. (editors), 1999. The diatoms: applications for the environmental and earth sciences. Cambridge University Press, Cambridge. **QK569.D54D536 1999**

*An excellent review of how diatoms have been used to address environmental and earth science problems – super book!*

#### Quaternary References

1. Bradley, R.S., 1999. Paleoclimatology: Reconstructing climates of the Quaternary, 2<sup>nd</sup> edition. Harcourt and Academic Press, New York. **QE884.B614 1999**

*Many paleoindicators are covered in this book. It is especially useful for isotopes, radiometric dating and pollen analyses. (Upper undergraduate to graduate level)*

## **EVALUATION:**

There will be five components to students' evaluation:

### **1. Depositional Environments (10%)**

Students will work in groups to prepare and make a short presentation (~10-15 minutes) about one particular type of depositional environment (i.e., Arctic, Alpine and Antarctic lakes, Boreal lakes, saline lakes, tropical lakes, meromictic lakes, glacial lakes, tectonic lakes, fluvial lakes, coastal lakes, volcanic lakes, karst lakes, the Great Lakes). **Please consult with Dr. Moser once you have selected a topic to get some starting references.**

### **2. Paleoindicator Presentation (10%)**

Students will be required to make a short presentation (~10-15 minutes) about a paleoindicator of their choice (excluding diatoms). Paleoindicators which may be selected include Chrysophycean algae, chironomids, Cladocera, molluscs, Protozoa, freshwater sponges (Porifera), freshwater ostracodes, phytoliths, biogeochemical signals (e.g. algal pigments, biogenic silica), charcoal, elemental geochemistry, contaminants, sedimentary characteristics, etc. Students must consult with Dr. Moser about their choice of paleoindicator.

Some items students may wish to cover in their talk include:

1. What exactly is it? What is it composed of?
2. What is its geologic/evolutionary history? e.g., when does it first occur in the geological record?
2. What makes it a good paleoindicator?
3. How is it collected? What are the methods used to isolate it? How is it identified?
4. What are some particularly useful applications?
5. Are there particular geographical areas where it is most useful?
6. What are the limitations or problems associated with this paleoindicator?

### **3. Field and Lab Exercises (10%)**

During the class a field trip will be held to collect a sediment core from Westminster Ponds. The sediment core will form the basis of subsequent lab exercises. Short weekly to biweekly assignments will introduce students to a variety of paleo techniques including some of the following, site selection, field methods, sediment dating, core analyses, subsampling and pollen, diatom, loss-on-ignition, chrysophyte and charcoal analyses. Attending and actively participating in field trips and labs is critical to your success in the course. Although, the lab assignments make up a small percentage of your final grade, feed back on these assignments is critical to writing an excellent final report.

### **4. Final Report (25%)**

A final report will be submitted at the end of class that summarizes your findings on analyses of a sediment core collected during a field trip. The field trip and labs provide the data for your report. Lab assignments will help you to interpret the data and prepare your report.

## 5. Quiz (15%)

One quiz will be given during the class worth 10% of the final grade and will be comprised of multiple choice, fill in the blank and short answer questions. No electronic devices will be allowed during quizzes. The quiz is designed to help you prepare for the final exam.

## 6. Final Exam (30%)

This will be a similar format to the quizzes.

### SUMMARY OF EVALUATION

Depositional Environment Presentation.....	10%
Paleoindicator Presentation.....	10%
Lab Assignments.....	20%
Quiz.....	10%
Final Report.....	20%
Final Exam.....	30%
<b>TOTAL.....</b>	<b>100%</b>

**Evaluation for those registered in Geography 9200B will be the same as above, but will also include a term paper or project (to be determined in discussions with Katrina Moser), which will be worth 20% of your grade. The final exam will only be worth 20% and the lab assignments 10% to adjust for the term paper.**

You are expected to attend all lectures, labs/tutorials, and the field trip, and to complete the assigned readings. The final exam (scheduled by the Registrar) will be 3 hours in length. Exam questions will be based on all material covered in lectures, labs, the field trip, and assigned readings. All assignments must be typed and handed in on time.

### Statement on Use of Electronic Devices

No calculators will be required or permitted in the exams. Students who require electronic assistance with language translation must obtain prior approval from the instructor.

### Penalties

*Exams:* In accordance with university policy, missed exams cannot be made up except on written medical grounds and notification prior to exam date.

*Assignments:* Late assignments will have a penalty of 10% per day. Assignments submitted more than 5 days late will not be accepted. Exceptions can be made for documented medical and other significant reasons beyond your control (see subsequent sections).

### Non-medical Absences

Non-medical absence from the midterm requires prior approval of the instructor or approval by the Dean's office (appropriate documentation will be required by the Faculty Dean's Office for approval if it is not obtained prior to the midterm).

## **Medical Absences**

Students seeking academic accommodation on medical grounds for any missed tests, exams, participation components and/or assignments worth **10% or more** of their final grade must apply to the Academic Counselling office of their home Faculty and provide documentation. Academic accommodation cannot be granted by the instructor or department.

For UWO Policy on Accommodation for Medical Illness and a downloadable SMC see:

[http://www.uwo.ca/univsec/handbook/appeals/accommodation\\_medical.pdf](http://www.uwo.ca/univsec/handbook/appeals/accommodation_medical.pdf)

Downloadable Student Medical Certificate (SMC): <https://studentservices.uwo.ca> under the Medical Documentation heading

When medical illness affects work worth **less than 10%** of the total course grade (i.e. an assignment), please contact the course instructor for academic accommodation (documentation not required).

## **University Statement on Academic Offences**

“Scholastic offences are taken seriously and students are directed to read the appropriate policy, specifically, the definition of what constitutes a Scholastic Offence, at the following Web site:

[http://www.uwo.ca/univsec/handbook/appeals/scholastic\\_discipline\\_undergrad.pdf](http://www.uwo.ca/univsec/handbook/appeals/scholastic_discipline_undergrad.pdf).”

“Computer-marked multiple-choice tests and/or exams may be subject to submission for similarity review by software that will check for unusual coincidences in answer patterns that may indicate cheating.”

## **Mental Health**

If you or someone you know is experiencing distress, there are several resources here at Western to assist you. Please visit the site below for more information on mental health resources:

<http://www.uwo.ca/uwocom/mentalhealth/>.

## GEOGRAPHY 3352A/9200B: Paleolimnology and Global Environmental Change

DATE	SUBJECT	READINGS, ASSIGNMENTS, NOTES
Jan. 7	LECTURE 1: Course Introduction	
Jan. 8	LECTURE 2: What is Paleolimnology?	Smol Chapter 2 LAB TOUR
Jan. 14	LECTURE 3: Water	Smol Chapter 1
Jan. 15	LAB 1: Thermal Stratification LAB ASSIGNMENT 1	LAB: Please meet in Room SSC1314
Jan. 21	LECTURE 4: Lakes and Sediments	Smol Chapter 3 <b>Depositional Environments Sign Up</b>
Jan. 22	LAB 1: Thermal Stratification	Lab Assignment 1: Continued
Jan. 28	LECTURE 5: Dating	Smol Chapter 4 <b>LAB ASSIGNMENT 1 DUE</b>
Jan. 29	LECTURE 6: Paleoindicators	Smol Chapter 5
Jan. 31 (?)	FIELD TRIP Westminster Ponds 9:00am-4:00pm	
Feb. 4	LECTURE 7: Interpreting Paleolimnological Data	Smol Chapter 6
Feb. 5	<b>DEPOSITIONAL ENVIRONMENTS PRESENTATIONS (1) DUE</b>	
Feb. 11	<b>Review Depositional Env'ts (con't)</b>	<b>Field Trip Assignment Due</b>
Feb. 12	<b>QUIZ 1</b>	
Feb. 16-20	<b>READING WEEK – NO CLASSES</b>	
Feb. 25	LECTURE 8: Landscape Change and Erosion	Smol Chapter 12
Feb. 26	LAB 3: Loss-On-Ignition and Chla	LAB: Please meet in Room SSC1302
March 4	Lecture 9: Eutrophication	Smol Chapter 11
March 5	<b>PALEOINDICATOR PRESENTATIONS (2) DUE</b>	
March 11	Lecture 9: Atmospheric Pollution and Acidification	Smol Chapter 7 and 8
March 12	LAB 4: Microscopes and Diatoms LAB ASSIGNMENT 3	LAB: Please meet in Room SSC1302 <b>LAB ASSIGNMENT 2&amp;3 DUE</b>
March 18	TIME TO WORK ON REPORTS ETC.	
March 19	LAB 5: Geochemical Techniques LAB ASSIGNMENT 4	<b>Location To Be Announced LAB ASSIGNMENT 4 DUE</b>
March 25	LECTURE 12: Diversity	Smol Chapter 13
March 26	LAB 6: Chironomids and Pollen LAB ASSIGNMENT 5	LAB: Please meet in Room SSC1302 <b>LAB ASSIGNMENT 5 DUE</b>
April 1	LECTURE 13: Climate Change	Smol Chapter 14
April 2	LAB 6: Data Analyses	<b>Report Writing</b>

April 8	LECTURE 14: The Future	Smol Chapter 16 <b>Final Reports Due</b>
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