THE UNIVERSITY OF WESTERN ONTARIO
Department of Geography

GEOGRAPHY 3352A: Paleolimnology and Global Environmental Change
Fall 2012

Instructor:	Dr. Katrina Moser Office: SSC 2407 Phone: 661-2111 ext. 80115 e-mail: kmoser@uwo.ca
TA	**TBA**
Office Hours:	Dr. Katrina Moser will be available for consultation on W 1:30-2:30.
Lectures:	W 10:30-12:30, UC-30
Labs/Tutorials:	**Section 001** 12:30-2:30 **P&AB 148** (N.B. Check the class schedule carefully as some labs will be held in SSC 1314).
Field Trips:	Students are required to attend one Saturday field trip which will be held **Saturday Oct. 13 from 9am-5pm**. 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.

<u>Paleolimnology References</u>
1. Last, W.M. and Smol, J.P. (editors), 2001. Tracking environmental change using lake

sediments. Kluwer, Boston. **4 volumes**. **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 paleoindictor 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, 3rd 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, 2nd 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)
2. Faure, G., 2005. Isotopes: principles and applications, 3rd edition. Wiley, New York. **QE515.F28**
Useful for radiometric dating and stable isotopes.
3. Warner, B.G., 1990. Methods in Quaternary ecology. Geological Association of Canada, St. John's. **QE741.M48 1990**
Many of the biological paleoindicators covered. Very nice review although a bit dated.
4. Lowe, J.J. and Walker, M.J.C. 1997. Reconstructing Quaternary Environments. 2nd Edition. Longman Group Ltd., Harlow England.

Many paleoindicators are covered in this book. (Undergrad level)

No single text adequately covers the subjects included in this class, so readings will be assigned for individual topics. These readings and all lecture notes will be available online.

EVALUATION:
There will be five components to students' evaluation:

1. Depositional Environments (10%)
Students will be required to 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, chryosphyte 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	10%
Quiz	15%
Final Report	25%
Final Exam	30%
TOTAL	**100%**

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. Late hand-ins will be penalized at the rate of 10%/day late, but will not be accepted at all beyond 5 days unless you have proper documentation (e.g., medical, close family death). 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 Counseling 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

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

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/scholoff.pdf .

GEOGRAPHY 3352A/9216: Paleolimnology and Global Environmental Change

DATE	SUBJECT	READINGS, ASSIGNMENTS, NOTES
Sept. 12	LECTURE 1: Course Introduction	
Sept. 13	LECTURE 2: What is Paleolimnology?	Smol Chapter 2 LAB TOUR
Sept. 19	LECTURE 3: Water	Smol Chapter 1
Sept. 20	LAB 1: Thermal Stratification LAB ASSIGMENT 1	
Sept. 26	LECTURE 4: Lakes and Sediments (Beth Hundey)	Smol Chapter 3 **Depositional Environments Sign Up**
Sept. 27	LAB 2: Thermal Stratification	Lab Assignment 1: Continued
Oct. 3	LECTURE 5: Dating	Smol Chapter 4 **LAB ASSIGNMENT 1 DUE**
Oct. 4	LECTUE 6: Paleoindicators	Smol Chapter 5
Oct. 10	LECTURE 7: Interpreting Paleolimnological Data	Smol Chapter 6
Oct. 11	**DEPOSITIONAL ENVIRONMENTS PRESENTATIONS (1) DUE**	
Oct. 13	FIELD TRIP Westminster Ponds 9:00am-5:00pm	
Oct. 17	**QUIZ 1**	**Field Trip Assignment Due** **Sign up for Paleoindicator Assignment**
Oct. 18	LAB 3: Loss-On-Ignition and Chla LAB ASSIGNMENT 2	LAB: Please meet in Room SSC1314
Oct. 24	LECTURE 8: Acidification	Smol Chapter 7
Oct. 25	LAB 4: Microscopes	LAB: Please meet in Room SSC1314
Oct. 31	LECTURE 9: Eutrophication	Smol Chapter 11 **LAB ASSIGNMENT 2 DUE**
Nov. 1	**PALEOINDICTAOR PRESENTATIONS (2) DUE**	
Nov. 7	LECTURE 10: Landscape Change and Erosion	Smol Chapter 12
Nov. 8	LAB 5: Diatoms LAB ASSIGNMENT 3	LAB: Please meet in Room SSC1314 **LAB ASSIGNMENT 3 DUE**
Nov. 14	LECTURE 11: Atmospheric Pollution	Smol Chapter 8
Nov. 15	LAB 6: Chironomids and Pollen LAB ASSIGNMENT 4	LAB: Please meet in Room SSC1314 **LAB ASSIGNMENT 4 DUE**
Nov. 21	LECTURE 12: Diversity	Smol Chapter 13
Nov. 22	LAB 7: Data Analyses	**Report Writing**
Nov. 28	LECTURE 13: Climate Change	Smol Chapter 14
Nov. 29	LECTURE 14: The Future	Smol Chapter 16 **Final Reports Due**
Dec. 5	Review	