

**University of Toronto at Scarborough
Department of Physical and Environmental Sciences**

EES A06 Introduction to Planet Earth

Winter 2011

Lectures: Friday: 10-12 Room AA112

Professor Nick Eyles: Office hours Fridays 12-2 in S-567.

**Teaching Assistants: Lisa Tutty, Kathy Wallace. Atheena DY and K.
OFarrell**

Overview

This is an introductory course aimed at anyone in the sciences or humanities. It is organized around the 5 part *Geologic Journey- World* series which aired on CBC's 'The Nature of Things' in late 2010. We will learn how planet Earth works by visiting countries in very different geologic settings and by meeting some of the peoples that live in very dangerous areas affected by earthquakes, tsunamis and volcanic eruptions. We will also examine how the earth has worked in the remote ancient past, how we determine the age of ancient rocks and events and the nature of changing paleoenvironments on the planet. The course will conclude with a brief review of the geologic history of Canada and some of the environmental problems facing the country.

Lecture notes will not be posted on the intranet; you have the course textbook which contains test questions and a glossary of terms.

The course will be evaluated by ten weekly web-hosted quizzes/assignments, a poster assignment on a topic(s) to be assigned later, and a multiple-choice final exam.

You are urged to check the Blackboard course site regularly for updates. Enquiries regarding course material must be directed to the TA's via the Blackboard discussion board or in person to me and the TA's during office hours. Their office hours will be posted very shortly on Blackboard. We have excellent teaching assistants so utilize them; they are there to assist you.

Required course text:

Plummer, McGeary, Carlson, Eyles, C. and Eyles, N. (2007) *Physical Geology and the Environment*. 2nd Canadian Edition: McGraw-Hill, Ryerson, 606 pp.

Rationale

Planet Earth formed about 4.56 billion (Giga annum or Ga) years ago by condensation and accretion of dust and planetary debris. The oldest rocks are dated at about 4 Ga, the oldest bacterial life forms at about 3.5 Ga and an oxygenated atmosphere developed somewhere around 2 Ga before present. Multicellular animal life forms became abundant about 600 million years ago (600 Ma: mega annum: Ma) and the history of life has been conditioned by episodic extinction events possibly created by meteorite impacts.

The rocky surface of the planet (its crust) is broken into large lithospheric plates that are moved around at velocities up to 25 cm/yr by large convection cells in the hotter Earth's interior (the mantle). Alfred Wegener suggested the drift of continents in 1912 but it was rejected as implausible; how could continents move through solid rock? Today, it is realized that continents are carried around as part of the larger lithospheric plates; this process is called *plate tectonics* and it has been in operation for at least 3 Ga. It may not be the only way in which planet Earth functions however and there is increasing recognition of so-called vertical tectonics involving giant mantle plumes and the outpouring of enormous volumes of magma at the Earth's surface.

Lithospheric plates are created at mid-ocean ridges (called spreading centres) where new magma rises to the surface from the underlying mantle and cools before being pushed apart by new magma arriving from depth. The movement of plates leads to collisions between adjoining plates (called *orogeny*) and destruction of some plates by a process called *subduction*. The entire process can be likened to a conveyor belt where new material is created at spreading centres and eventually destroyed by subduction. In this way, the Earth is neither expanding nor shrinking in size. In some cases, orogenic events result in the fusing together of plates and the creation of even larger plates (called supercontinents). Geologists have recognised a cycle of supercontinent formation and breakup (the Wilson cycle). Ancient environments are preserved in the form of rocks and by study of the rock record we can reconstruct ancient paleoenvironments. The concept that the present is the key to the past is called *uniformitarianism*. Apart from catastrophic events like large meteorite impacts that result in widespread extinctions, the concept has served geologists well. We shall examine the history of life on planet Earth and how it reflects broader tectonic and climatic events.

The course concludes by looking at the 4 billion years long geological history of Canada and Ontario including reference to modern environmental problems facing Canadians.

	Date	Lecture & Quiz Topics	Readings
Lecture 1	Fri Jan 14	In the beginning: formation of planet Earth. Some basic organizing principles of geology: Continental drift vs. plate tectonics. The 'Wilson cycle' of supercontinent formation and breakup.	Ch 1&2.
Lecture 2	Fri Jan 21	Going deep: Earthquakes and the Earth's interior.	Ch 3&4.
Quiz 1	Mon Jan 24	Quiz on material from lectures 1 & 2	
Lecture 3	Fri Jan 28	How oceans form (Part I): The African Rift from Kenya, Ethiopia, Egypt, Jordan and Israel.	
Quiz 2	Mon Jan 31	Quiz on material from lecture 3	
Lecture 4	Fri Feb 4	How oceans widen (Part II): Iceland, Great Britain, and Switzerland.	
Quiz 3	Mon Feb 7	Quiz on material from lecture 4	
Lecture 5	Fri Feb 11	How oceans close and are destroyed: The Pacific Rim from New Zealand to Japan to Alaska, California and Chile.	
Quiz 4	Mon Feb 14	Quiz on material from lecture 5	
Lecture 6	Fri Feb 18	The biological record: The story of life on Earth and the evolution of the planet's biosphere (Lisa Tutty)	
	Feb 21-25	Reading Week, no class; no quizzes on Feb 21, 28.	
Conference	Fri Mar 4	No lecture: Department of Physical and Environmental Sciences 'Planet Earth Conference': Meeting Place: 10 am-12 noon.	
Quiz 5	Mon Mar 7	Quiz on material from lecture 6	
Lecture 7	Fri Mar 11	The rock record: Minerals and rocks as clues to ancient paleoenvironments.	Ch 5-7, 9 & 10.
Quiz 6	Mon Mar 14	Quiz on material from lecture 7	
Lecture 8	Fri Mar 18	Dating the history of planet Earth: the science of geochronology.	Ch 11 & 19.
Quiz 7	Mon Mar 21	Quiz on material from lecture 8	
Lecture 9	Fri Mar 25	The future of planet Earth: the next supercontinent. From the Himalayas to India to Indonesia.	
	Sun Mar 27	UTSC drop date for 'S' courses (including EESA06)	
Quiz 8	Mon Mar 28	Quiz on material from lecture 9	

Lecture 10	Fri Apr 1	The geological evolution of Canada.	
Quiz 9	Mon Apr 4	Quiz on material from lecture 10	
Lecture 11	Fri Apr 8	Environmental challenges facing Canada. Exam revision session. In class quiz.	Chapter 20 & Glossary.
Quiz10	Fri Apr 8	Quiz IN CLASS on material from lecture 11. PLEASE NOTE DIFFERENT QUIZ DAY.	

Method of Evaluation and marks

10 Weekly quizzes/assignments (4 marks ea) starting Mon Jan 24th	40
Poster assignment (due March 4th)	25
Final exam (multiple choice)	35

Assignment

The assignment will consist of research and presentation of a printed poster at a special 'Planet Earth Conference' to be held in the meeting place on Friday March 4th in place of the normal lecture. Students can work in groups of up to 4 in number. I will provide details later as to topics.

Additional comments

Terms to remember: these are listed at the end of each chapter in the textbook and have been grouped into a **Glossary** on p. 585-595.

Testing your knowledge: please read and think about the questions listed at the end of each chapter, these may be used in the in quizzes each week.

Expanding your knowledge: some broad questions are listed at the end of each chapter (together with web resources you can use) to think further about the material we cover in class.

Notes

1. There is *no* mid-term exam for this course *nor* practicals or tutorials.
2. **Poster Assignment:** topics will be announced later. Late work will be docked 10% per day. Late submissions for medical reasons require full documentation on *UTSC medical forms* [available in the content section on BB].
3. To receive consideration for **illness** (quiz, poster deadlines) you must submit the medical form along with your name & student number, the course code and a description of the missed deadline to Pat Woodcock *within one week* of the missed deadline. Note: *Late enrollment is not a valid reason for missing quizzes.*
4. **Plagiarism** will not be tolerated; it is an academic offence and will be immediately reported to the Dean.
5. Students with diverse learning styles and needs are welcome in this course. In particular, if you have a disability/health consideration that may require accommodations, please feel free to approach me and/or the **AccessAbility Services** as soon as possible.

AccessAbility Services staff (located in Rm SW302, Science Wing) are available by appointment to assess specific needs, provide referrals and arrange appropriate accommodations 416-287-7560 or email ability@utsc.utoronto.ca. The sooner you let us know your needs the quicker we can assist you in achieving your learning goals in this course.

Nick Eyles