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University of Toronto at Scarborough
Department of Physical and Environmental Sciences

EES A06 Introduction to Planet Earth

Winter 2009

Lectures: Friday: 10-12 Room AA112

Professor Nick Eyles

Teaching Assistants: Lisa Tutty and Shannon Carto

Overview

This is an introductory course aimed at anyone in the sciences or humanities. Note that *there are no practicals or tutorials*.

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

Please take the time to read this course outline carefully: You are urged to check the web site regularly for updates. Lecture notes will not be posted on the intranet; you have the course textbook, which I follow closely and you also need to develop the skill of listening and note taking in class.

Please note I *do not reply* to emails regarding course material unless you have pressing medical issues in which case I am happy to help. I will make myself available before and after the lecture for any concerns you have.

We have excellent teaching assistants so utilize them; they are there to assist you.

Rationale

Planet Earth formed about 4.56 billion (Giga annum or Ga) years ago by condensation and accretion of 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 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.

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.

Lecture Topics and Textbook Readings

January 9th Lecture 1:

Introduction to course: expectations and outcomes
Earth's beginnings and how the planet works.
Continental drift vs. plate tectonics
Readings: Chapters 1 and 2, pp.1-64

January 16th Lecture 2:

Earth's beginnings and how the planet works.
Continental drift vs. plate tectonics cont'.
Readings: Chapters 1 and 2, pp.1-64

January 20th First quiz on Blackboard; weekly quizzes thereafter every Tuesday.

January 23rd Lecture 3:

Plate tectonics II: Earthquakes and the Earth's interior:
Readings: Chapters 3 and 4, pp. 65-127.

January 30th Lecture 4

The rock cycle: Minerals and rocks as records of ancient paleoenvironments I
Readings: Chapters 5 to 7, 9 and 10.

February 6th Lecture 5

Minerals and rocks: Records of ancient paleoenvironments II
Readings: Chapters 5 to 7, 9 and 10

February 13th Lecture 6

Changing the face of the Earth: Weathering and erosion
Readings: Chapter 13-14, 17, 18

February 16th- 20th Reading Week University closed; no lecture

February 27th Lecture 7

Time and geology: Stratigraphy and the geological timescale

Readings: Chapters 11 and 19.
Note: Written assignment due by 12 noon

March 6th Lecture 8
Climates through time
Readings: Chapter 16

March 13th Lecture 9
The story of life on Earth; evolution of the biosphere

March 20th Lecture 10
Geological resources: feeding a hungry planet.
Readings: Chapter 12

March 28th Lecture 11
The geological evolution of Canada: the comings and goings of supercontinents
Readings: Chapter 20 and Glossary (pp. 557-567).

April 3rd Lecture 12: Environmental problems in Canada

NOTE: FIRST QUIZ: TUESDAY 20th JANUARY AND SUBSEQUENT TUESDAYS ON BLACKBOARD

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 will 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.

Office Hours: My office hours for this course are on Fridays 12-2 in S-567.

Method of Evaluation and marks

Weekly quizzes (10 quizzes at 5 marks each) starting Jan 20th	50
Short written assignment (title to be announced)	15
Final exam (multiple choice)	35

Note:

1. There is no mid-term exam for this course. The final exam will cover everything in the course.

2. Written Assignment: topics will be announced later. Due: Friday February 27th by 12 noon. Late work will be docked 10% per day. Plagiarism will not be tolerated; it is an academic offence and you will be given zero and reported to the Dean.

Concerns: If you experience any difficulties that interfere with your academic performance (illness etc) please let me or the Teaching Assistants know. If we don't know we can't help.

Given the large class size, I would be grateful if you would **not** contact me via email but come and see me before or after the lecture or use the TA contact hours.

Please take advantage of these opportunities to discuss the course and your education with us.

Nick Eyles

January 2009