University of Toronto at Scarborough
Department of Physical and Environmental Sciences

EES A06 Introduction to Planet Earth

Winter 2014

Lectures: Monday: 10-12 Room AC 223

Professor Nick Eyles: Office hours Mondays 12-2 in SY205

Senior Teaching Assistant: Katherine Wallace

First Class Monday January 6th!

Introduction

This is an introductory Earth Science 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 and which is downloadable from the CBC website.

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.

The course textbook contains test questions and a glossary of terms and is purchasable as an ebook (see below). Lectures will be videotaped and available for 2 weeks after the lecture.

Evaluation

The course will be evaluated by a) a multiple choice mid-term exam b) a poster assignment on a topic(s) to be assigned later and which can be done on your own or in groups of up to 4, and; c) a multiple-choice final exam.

Planet Earth Conference: Poster Assignment

This will consist of research and presentation of a printed poster at a special 'Planet Earth Conference' to be held in the meeting place on early March in place of the normal lecture. Students can work in groups of up to 4 in number.

You are required to check the Blackboard course site regularly for updates.

Enquiries regarding course material must be directed to the Blackboard discussion board or in person to the instructor and TA's *during office hours only*. *Do not email the instructor as it will not be answered*. TA office hours will be posted very shortly. We have excellent teaching assistants so utilize them; they are there to assist you.

Overview of course

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 the effects of geologically recent glaciations, and concludes by looking at environmental problems facing Canadians.

Text book: Plummer et al., 2007. 'Physical Geology and the Environment.' 2nd Canadian Edition.

You can locate and purchase the book online by following these simple steps:

OPTION A:

1. Go to

https://create.mcgraw-hill.com/shop/#/catalog/details/?isbn=9781121398719

2. Search for and select book by Title, ISBN, Author, or State/School.

ISBN: 9781121398719

Title: Physical Geology and the Environment

3. Add the book to your cart and pay using a credit card or access code

OR

OPTION B:

Purchase access code at UTSC Bookstore (option not avail. until Jan. 9th):

You can visit our UTSC bookstore and purchase an ACCESS CODE for the on-line book. Then once you have purchased the access code go to:

https://create.mcgraw-hill.com/shop/#/catalog/details/?isbn=9781121398719

and input your pre-purchased access code to obtain the book.

Tips for success:

Read assigned chapters (to be posted later) *ahead of the lecture*

'Terms to remember' are listed at the end of each chapter in the textbook and have been grouped into a Glossary on pp. 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 mid- and final exams.

Reading week: Feb 17th through 21st

Last day of classes: April 4th

	Date	Lecture Topic	Readings
Lectures 1/2	Jan 6, 13	Basic geology: *Continental drift vs. plate tectonics.* The *'Wilson cycle'* of supercontinent formation and breakup	Chapters 1 - 4
Lecture 3	Jan 20	The Earth's deep interior: the mantle	Chapters 1- 4
Lecture 4	Jan 27	*How oceans are born*: The African Rift from Kenya, Ethiopia, Egypt, Jordan, Israel and Turkey.	Chapter 2 CBC Episode 2 *Along the African Rift*
Lecture 5	Feb 3	*How oceans widen and mature*: Iceland and the Atlantic Ocean	Chapter 2 Episode 1 *Tectonic Europe*
Lectures 6,7	Feb 10, 24	*How oceans die: the beginning of the next supercontinent* The Mediterranean Sea and Pacific Ocean; from Italy to New Zealand, Indonesia, Japan, Nepal, Alaska, California and Chile	Chapter 2 Episode 3, *The Western Pacific Rim* 4 *Pacific Rim Americas* 5 *Collision Zone : Asia*
No lecture	Feb 17	**Reading Week**	
Lecture 8	March 3	Rocks and minerals; clues to ancient environments	Chapters 5, 6, 7, 9 & 10 & 11, 19
Lectures 9,10	March 10, 24	Geological history of Canada and Ontario: 4 billion years of environmental change	Chapters 16,20
No lecture	March 17	**Poster presentation: Planet Earth Conference: Ontario: 3 billion years of environmental change**	Chapters 16,20 **http://planetrocks.ca**
Lecture 10	March 31	Why geoscience is important: managing environmental problems	Exam revision