

# GEOL 100 – EARTHQUAKES, VOLCANOES AND NATURAL DISASTERS

Fall 2002, MWF 10:00 – 10:50, Mackay Science Building, 215 August 26, 2002

## TEXTBOOK:

*ESSENTIALS OF GEOLOGY*: Third Edition, by Stanley Chernicoff, and Haydn A. “Chip” Fox, Houghton Mifflin Co., New York. With Geology Explorer including Geology Explorer Plus CD-ROM and Web Site.

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## Graduate Assistants:

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## General Course Information:

GEOL 100 satisfies 3-units of UNR Core Curriculum, Group A, natural science requirement and is designed for non-majors. There are two lecture sections for the course: MWF 10:00 and TTh 9:30 – 10:45. The MWF lecture is taught by Dr. Jim Taranik and the TTh lecture is taught by Dr. Dave Golz.

The MWF lectures are offered in Mackay Science 215 (Geography Department). Each lecture section has four possible laboratory sections. During the semester there are four, 3-hour laboratory periods scheduled for this. The MWF lecture section labs are field labs and indoor labs. The laboratory sections will meet four times during the semester. The indoor laboratories will utilize LMR 353 and LMR 351 in the Laxalt Mineral Research building. The field labs will meet at the south entrance to UNR, near the Parking Shack at Center and 9<sup>th</sup>. The sections are the following:

Monday (1 - 4): Section 001  
Tuesday (2:30 – 5:30): Section 002

Wednesday (1 - 4): Section 003  
Thursday (2:30 – 5:30): Section 004

### **Tentatively Scheduled Laboratories and Dates TBA:**

Laboratory 1: September 23, 24, 25, and 26, indoor lab, LMR 353

Laboratory 2: October 7, 8, 9 and 10, Field Lab, Donner Summit

Laboratory 3: October 28, 29, 30, and 31 Field Lab, Faults in Reno

Laboratory 4: November 18, 19, 20, 21, indoor lab, LMR 351 computer lab

Note: Attend only one of the four days during the week according to your section. The outdoor labs will assemble near the UNR Parking & Visitor Center just off Center and 9<sup>th</sup> and near Morrill Hall Alumni Center on the south end of campus. You should be there not later than 5 minutes before your scheduled lab to ensure a seat on one of the vans. Wear appropriate field clothes and shoes! The vans will depart exactly at 1:00 or 2:30 depending on your section. Don't be late! Check with TA to attend different section.

Core-curriculum science courses must have homework problems that deal with interpretation of science data. In this course homework assignments require meeting with the TA's prior to completing them. These homework assignments are much different than those you have been given in other courses. Read the assignments as soon as you receive them, begin work and consult with the TA's early to receive additional guidance. Don't wait till the night before the assignments are due to start your work!

### **Examinations and Term Paper:**

Two 50-minute midterm examinations and one course-comprehensive, two-hour final examination will cover all the material presented during the semester. Students who cannot take a scheduled mid-term exam must make prior arrangements with the instructor to take the exam at another time and receive credit.

Students will submit a term paper covering earthquake or volcanic hazards in Nevada. The term paper will have approximately 5 pages of text, typed double-spaced using 10 to 12 point font. Content, originality, neatness, spelling and grammar will be graded. Original work by the student is mandatory, with appropriate attribution of information sources required.

There are 1000 points possible for this course. 30% of the grade is based on examinations while 70% of the grade is based on short quizzes, homework, laboratory exercises and the term paper. The weights are distributed as follows:

<b>Quizzes:</b> ten quizzes as 10 points each:	100 points	10%
<b>Homework:</b> four assignments at 50 points each:	200 points	20%
<b>Laboratories:</b> four at 75 points each	300 points	30%
<b>Term Paper: (Due November 27<sup>th</sup>)</b>	100 points	10%
<b>Mid-Term Examinations:</b> two at 75 points each:	150 points	15%
<b>Comprehensive Final Examination:</b>	150 points	15%

## Laboratories and Homework Assignments:

Laboratories and homework are graded on the basis of quality and originality of the material submitted. Lab reports should include the following format:

1. Description of the problem
2. Approach/methods utilized
3. Data collected
4. Observations made
5. How the data were analyzed
6. Interpretations made, hypotheses and assumptions used
7. Conclusions and references cited.

Lab and homework assignments **MUST** be turned in on or before the due date; late assignments will receive less credit, or no credit, and late submissions must be arranged with the TA's or Instructor. Lab papers should be initialed by the TA at the completion of the lab. Lab reports, with working papers, should be handed to the T.A. at the beginning of class on the appropriate day. Do not turn in labs in mailboxes, by sliding them under someone's door, etc. Give them directly to the T.A. on time! **Hint: If you properly do all the labs, homework assignments and the term paper, based on past classes, you will receive at least a passing grade in this course!**

## Assigned Readings and Quizzes:

To have the maximum learning experience in this class assigned readings should be completed before the topic is covered in class. Five-minute quizzes will be given at intervals to cover important parts of the reading assignments. There will be **NO** make up quizzes and missed quizzes will count as a score of zero. However, the two lowest quiz grades will be automatically be dropped from your record (you can miss two without penalty). Students who take all of the quizzes will automatically receive extra credit: one perfect quiz score will replace their lowest counting quiz score. **(HINT: take all of the quizzes!)** The total of all quiz scores count more than a mid-term in determining your final grade.

## Classroom Decorum and Ethics

Beyond formal classroom instruction, part of the university learning experience is to facilitate your transition into American society and the national workforce. Therefore, your instructors at UNR take matters of personal behavior and ethics very seriously. Previous students have commented on student behavior that has negatively affected their ability to learn in UNR core classes. These behaviors include: Talking in class, sleeping in class, reading papers in class, coming in late to class and walking in front of the instructor, suddenly leaving in the middle of class for no reason, loudly shutting notebooks before the end of class, rudeness to the TA's or the instructor, and other disruptive behaviors. Disruptive students will be asked to leave, and if the behavior persists, they will be asked to leave the course. Consistent with the UNR Student Honor Code, cheating on examinations, copying of other student's assignments, and/or plagiarism of written material will result in dismissal from the course.

The teaching assistants and the instructors are resources for you to use to fully understand the material. If you have difficulty, let us know by e-mail and schedule a meeting with us. Keep us informed of your situation if you have a special problem. We want you to learn something about planet Earth and we want you to succeed in this course!

## **LECTURE OUTLINE – August 12th version (May be modified during the course)**

### **August 26, 2002, Monday #1**

#### **Earthquakes, Volcanoes and Natural Disasters**

Introduction of the Instructor and Graduate Assistants

Hand out the syllabus for the course

Discuss organization of the course and its objectives

Learning goals and objectives for the course

Introduction to the course textbook, Web-based reference materials, and recommended readings

#### **Reading Assignment:**

*Essentials of Geology, Chapter 1, A First Look at Planet Earth, pp. 3-6*

Readings of Interest: Broecker, W. S., 1985, *How to Build a Habitable Planet*: Eldigio Press, LDGO Box #2, Palisades, New York 10964 (Distributed through the Lamont-Doherty Geological Observatory of Columbia University).

### **August 28, 2002 – Wednesday #2**

#### **What is Geology ?**

Geo = Earth, ology = Study, Earth Study

Includes disciplines of: Geophysics, Geochemistry, Hydrogeology

Embraces: Earth System Science which includes: Biology, Meteorology, Climatology, Oceanography, Lunar and Planetary Geology

Relies on: Astronomy and astrophysics, physics, physical and organic and inorganic chemistry.

Utilizes the scientific method.

#### **What is the “Scientific Method?”**

#### **What are “Natural Disasters?”**

#### **What is the “Habitable Zone” in the Universe? Our Milky Way Galaxy? In the Solar System?**

#### **Reading Assignments:**

*Essentials of Geology: A First Look at Planet Earth, Chapter 1, pp. 3 - 10*

**Questions to think about:**

1. **What is the Universe in which we live?**
2. **What makes up the Universe?**
3. **How big is the Universe?**
4. **What is the shape of the Universe?**
5. **Does the Universe have an edge?**
6. **How old is the Universe?**
7. **How did the Universe form?**
9. **When could life first exist in the Universe?**

**August 30, 2001, Friday #3**

**Origin of Our Universe and Natural Disasters**

Scientific observations of the universe

The size of the universe and astronomical distances

Concept of time and the speed of light

The age of the universe: 11 - 13 billion years old?

The “Big Bang”

Evidence: Hubble, redshifts in galaxies, Cosmic background temperature

After 300,000 years, universe transparent, era of recombination

Formation of gas clouds

First stars and galaxies

Nuclear reactions in stars produce elements needed to form Earth

Concept of habitable zones in the Universe

**Reading Assignment:**

***Essentials of Geology:* Review Chapter 1, The Earth in Space, pp. 3 – 10.**

**Questions to think about for next time:**

1. **Where are we located in the Universe?**
2. **Where are we located in the Milky Way Galaxy?**
3. **How old is our galaxy?**
4. **How big is our galaxy?**
5. **What is the shape of our galaxy?**
6. **What is the composition of our galaxy?**
7. **How many stars are there in our galaxy?**
8. **What are the nearest galaxies to our galaxy?**
9. **How many galaxies are there in the universe?**
10. **What is the future of our galaxy?**

**DO YOUR READINGS, QUIZ NEXT WEEK!**

**September 2<sup>nd</sup>, Monday is a Holiday**

**September 4, 2002 – Wednesday #4**

**Origin of the Milky Way Galaxy and Natural Disasters**

Location of our galaxy in the universe, The Local Group, The Local Supercluster

Formation and age of our galaxy in the universe

11 billion years ago

Lumpy mixtures of hydrogen and helium gas

Gravity causes inward collapse and increases rotation

Importance of galactic collisions

Origin and synthesis of the major elements in stars

Cosmic abundances of the elements

The role of supernovae in element manufacture

Size and composition of our galaxy

Evolution and future of our galaxy in the universe

Dark matter and galactic interactions with dark matter

Introduction to nebulae and star formation

Concepts of habitable zones in our Galaxy

**Reading Assignment: *Essentials of Geology*: Chapter 1, pp. 3 –10.**

**Web Assignment: Go to “Our Solar System.”**

<http://www.pauldunn.dynip.com/solarsystem> Browse this site and check out the interactive basics of planet motion and planet size.

**Also go to: “Students For the Exploration and Development of Space.”**

<http://www.seds.org> Click on: “Nine Planets Solar System Tour.” Pay attention to the Introduction (provides a map of the site), Overview (look At the “Big Questions.”

**Questions to think about:**

- 1. Where is our solar system located in the Milky Way Galaxy?**
- 2. When, in the evolution of our Galaxy did our solar system form?**
- 3. What are the nearest stars to our solar system?**
- 4. What is the composition of our solar system?**
- 5. Where did the materials come from for building our planets and moons?**
- 6. How long will our solar system last into the future?**
- 7. When could life exist in our solar system?**

**September 6, 2002 – Friday #5**

**Origin of the Solar System and Natural Disasters**

Location of our Solar System in the Milky Way Galaxy

2/3 the way from the galactic center

On the edge of the Orion arm

Our solar system has made 21 orbits of the Galaxy in its lifetime

Nebulae and formation of the accretion disk

Processes of planetary accretion

Collisions and cratering  
Concept of habitable zones in our solar system

**Reading Assignment: *Essentials of Geology*: Chapter 1, pp. 3 – 10.**  
**Remember to use your Textbook CD-ROM as an additional resource.**

**Questions to think About:**

1. **How old is the Earth?**
2. **How did we determine the age of the Earth?**
3. **Where does the internal heat come from in the Earth?**

**September 9, 2002 – Monday #6**

**Origin of the Earth-Moon System**

The Earth prior to collision with a proto-planet  
The great collision, the age of the Earth and Moon  
Re-constitution of the Earth and Moon after the collision  
Early geochemical differentiation of the Earth and Moon  
General internal composition of the Earth and Moon  
Importance and timing of cratering processes on the Earth, Moon and Planets  
Comparative planetology of the solar system  
    Mercury, Venus, Earth, the Moon and Mars  
    Asteroid belt, Jupiter, Saturn, Uranus, Neptune and Pluto

**Questions to think about:**

1. **How big is our Sun compared to other stars?**
2. **How old is the Sun?**
3. **How long will the Sun last?**
4. **What will happen as the Sun reaches the end of its lifetime?**
5. **What are asteroids? Comets?**
6. **Do asteroids and comets pose a threat to Earth?**
7. **What happens when an asteroid hits Earth?**

***MID-TERM STUDY GUIDE HANDED OUT!***

**September 11, 2002 – Wednesday #7**

**The Sun, Asteroids, Comets and Natural Disasters**

The Sun  
    Origin of the Sun, lighting the solar furnace  
    The primeval solar wind and planetary atmospheres  
    Solar energy through time  
    The Sun's radiation and the Earth, photosphere  
    Variations in solar radiation, sun spots  
    Age: 4.5 billion years, lifespan 10 billion years  
Asteroids, and comets

**Questions to think about:**

1. **Where did the Earth's atmosphere come from?**
2. **What atmospheres do other planets have?**
3. **What was the composition of the early atmosphere?**
4. **Where did the oxygen come from?**
5. **When did oxygen occur in abundance?**
6. **When did ozone occur in abundance and how did it form?**
7. **What is the importance of ozone for development of life on Earth?**
8. **What happened to Carbon Dioxide over geologic time?**
9. **Why is Carbon Dioxide important?**

**September 13, 2002 – Friday #8**

**Origin of the Atmosphere**

The Earth's Early Atmosphere, Hydrogen and Helium

The Early Precambrian atmosphere, Carbon Dioxide, Nitrogen, Methane

Where did oxygen and ozone come from? When did oxygen reach a 10% level?

Importance of oxygen and ozone for development of life

Crustal recycling, rainfall, Carbon Dioxide recycling.

**Questions to think about:**

1. **Where did the water come from to make the oceans?**
2. **How old are the oceans?**
3. **Do other planets have oceans?**
4. **What was the early composition of the oceans?**
5. **Did the oceans ever completely cover planet Earth?**
6. **When did life first develop in the oceans?**

**First Midterm Study Guide Handed Out. Use your Textbook CD-ROM!**

***Remember ! FIRST MID-TERM EXAMINATION, WEDNESDAY,  
SEPTEMBER 18<sup>TH</sup>!***

**September 16, 2002 – Monday #9**

**Origin of the Oceans**

The origin of water on Earth and its importance to life

The composition of ocean water

The Earth's early anoxygenic ocean and life

Stromatolytes, cyanobacteria and oxygen

The origin and importance of Precambrian red beds

**Read all prior assignments, study lecture materials on the web, review CD-ROM,  
and study for the First Mid-Term Examination.**

September 18, 2002 – Wednesday #10

**FIRST MID-TERM EXAMINATION I**

September 20, 2002 – Friday #11

**REVIEW OF FIRST MID-TERM EXAMINATION**

**HOMEWORK 1 handed out**

**Reading Assignment: *Essentials of Geology*: Chapter 2, Minerals, pp. 25 – 47**

**Questions to think about:**

1. What is a mineral? What is a crystal? What is a rock?
2. Why are silicate minerals most abundant in nature?
3. Where did the elements come from that form minerals?
4. Why does the Earth have a great diversity of mineral species compared to other planets?
5. How and when did the original continental lithosphere form?
6. What processes have modified the continental lithosphere through time?

September 23, 2002 – Monday #12

**Origin of the Earth's Crust and Natural Disasters**

Nature and Composition of the crust

Differences in the oceanic and continental crust

Comparative planetology from a crustal viewpoint

Introduction to minerals

**LABORATORY 1 THIS WEEK, Sections 1 and 3 - LMR 353 1-4 (MW)  
Sections 2 and 4, LMR 353 2:30 – 5:30 (TR)**

**Reading Assignment: *Essentials of Geology*: Chapter 3, Igneous Processes and Igneous Rocks, pp. 49 - 69.**

**Questions to think about:**

1. What is a magma and how does it form?
2. What happens as magmas move upward through the crust?
3. What is a plutonic rock? An extrusive rock?
4. How do plutonic rocks of different compositions from the same magma?
5. What mineral crystals form first from a cooling magma? Last?
6. How does an igneous rock form that has big crystals in a fine-grained groundmass (a porphyritic rock)?

7. **What kinds of rocks are formed when magma is extruded onto the surface of the Earth?**

**September 25, 2002 – Wednesday #13**

**The Origin of Rocks I – Igneous Rocks**

Introduction to the Rock Cycle

Introduction to rock forming minerals

The igneous rocks

    Bowen's reaction series

    Intrusive igneous rocks

    Extrusive igneous rocks

**Reading Assignment: *Essentials of Geology*: Chapter 5, Weathering and the Breakdown of Rocks, pp. 97 - 115. Chapter 6, Sedimentation and Sedimentary Rocks, pp. 117 – 137.**

**Questions to think about:**

1. **What is the difference between weathering and erosion?**
2. **Describe the processes that account for the two major types of weathering.**
3. **What are the differences between detrital and chemical sedimentary rocks?**
4. **How do geologists use sedimentary rock textures to interpret environments of transport and deposition?**
5. **How do geologists use sedimentary structures to interpret environments of deposition?**
6. **What happens to sedimentary rocks as they are increasingly buried by overlying sediments?**
7. **What kinds of rocks form as evaporates?**

**September 27, 2002 – Friday #14**

**The Origin of Rocks II – Sedimentary Rocks**

Rock weathering and mineral stability

    Goldich's stability series

Importance of Carbon Dioxide and Carbonic Acid in rock weathering

Mechanical weathering

Classification of the sedimentary rocks

Soils

Importance of carbonates in the rock cycle

**Reading Assignment: *Essentials of Geology*: Metamorphism and Metamorphic Rocks, Chapter 7, pp. 139 - 155.**

**Questions to think about:**

1. How do metamorphic rocks form from sedimentary rocks?
2. What happens to minerals in sedimentary rocks when they are subjected to directed pressure and increasing temperature?
3. What are metamorphic facies?
4. What happens to metamorphic rocks that are heated above 1000 degrees Centigrade?

**September 30, 2002 – Monday #15**

**The Origin of Rocks III – Metamorphic Rocks**

Concept of Metamorphism  
Burial depth, heat and pressure  
Types of metamorphic rocks  
Metamorphic grade and facies

**Reading Assignment: *Essentials of Geology: Chapter 19, A Brief History of Earth and its Life Forms*, pp. 411 - 430.**

**Questions to think about:**

1. When did life first originate on Earth?
2. Where did the Last Universal Common Ancestor (LUCA), the earliest life form come from?
3. How are all life forms on Earth related?
4. What are prokaryotes and Eukaryotes and when did they form?
5. What are Edicaran fauna and when did they form?
6. How was oxygen important in the development of life?
7. What role did glacial (ice house) climates play in the development of life?

**October 2, 2002 – Wednesday #16**

**Origin of Life on Earth and Natural Disasters**

The Earth's Environment at 3.9 billion years.  
Pasteur – bacteria arise from parents reassembling themselves.  
Darwin – Differences inherited, organisms adapt to environmental pressures.  
The last universal common ancestor (LUCA).  
RNA might have produced DNA  
Surface chemical origin, comets, dust and meteorites, deep-sea vents.  
The early organisms  
The Cambrian Explosion

**Reading Assignment: *Essentials of Geology: Chapter 8, Telling Time Geologically*, pp. 157 - 174.**

**Questions to think about:**

1. How did geologists determine the age of the Earth?

2. What is the difference between absolute and relative age dating?
3. What principles and laws do geologists use to do relative dating of rock sequences?
4. What are unconformities and what do they tell about natural disasters?
5. What is the atomic basis for radiometric dating?
6. What is the basis for the magnetic time scale?

October 4, 2002 – Friday #17

***LABORATORY 1 write up due!***

**The Geological Dating and the age of the Earth**

History of the development of the time scale

Bishop of Usher, Lord Kelvin, Astronomers, Arthur Holmes

The foundations of stratigraphy and stratigraphic correlation

Relative dating

William Smith's map and cross sections

Arthur Holmes and the Radiometric time scale

The Magnetic time scale

**Reading Assignment: *Essentials of Geology*: Chapter 10, Earthquakes and The Earth's Interior, pp. 197 - 223.**

**Questions to think about:**

1. What causes earthquakes?
2. What is the difference between the focus of an earthquake and its epicenter?
3. What kinds of earthquake waves are produced when an earthquake occurs?
4. How do the different types of earthquake waves reveal properties of the Earth's interior?
5. What is the Moho and how was it discovered?
6. What are the differences between the inner and outer core of the Earth?

October 7, 2002 – Monday #18

***2<sup>ND</sup> LABORATORY, FIELD EXERCISE, Meet at UNR South Entrance between Clark Administration and Morrill Alumni Center Parking Lot, MTWTh, Secs. 1-4. Dress for cool to cold weather as appropriate.***

**Comparative Anatomy of the Earth and Natural Disasters I**

How we learn about the Earth's interior

Earthquakes and Seismology

Seismic Tomography

The Inner and Outer Core

Liquid outer core, solid inner core

Rotation of the inner core

Origin and properties of the mantle

**Questions to think about:**

1. What is the origin of the Earth's magnetic field?
2. What are the magnetic fields of the other planets?
3. What is the origin of heat in the Earth?
4. How is the gravity field of the Earth measured?
5. How do gravity and magnetics allow geologists to determine the characteristics of the crust of the Earth?

**October 9, 2002 – Wednesday #19**

**Comparative Anatomy of the Earth and Natural Disasters II**

The Earth's internal processes

Origin, characteristics, and variations of the magnetic field

Comparative planetology of magnetic fields in the Solar System

Origin of heat flow in the Earth, circulation of heat in the mantle

Origin of hot spots and mantle plumes

Measurement of the Earth's gravity field

**Reading Assignment: *Essentials of Geology*: Chapter 11, Plate Tectonics: Creating Oceans and Continents, pp. 225 - 246, Review Chapter 1, A First Look at Planet Earth, pp. 10 - 23.**

**Questions to think about:**

1. How did geologists figure out that crustal plates move?
2. What was the evidence for a supercontinent called Pangea?
3. How was continental drift confirmed?
4. What are the forces that cause continental drift?
5. What are mantle plumes and how do they form?

**October 11, 2001 – Friday #20**

***MIDTERM II Study Guide Handed Out***

**The Understanding Crustal Plate Motion and Natural Disasters**

Development of Plate Tectonic Theory

Alfred Wegener

Arthur Holmes

Global Fold Belts

Precambrian/Paleozoic Glaciation

Distribution of Plants and Animals

Polar wandering

Sea Floor Spreading

Confirmation of Continental Drift

NASA Laser Ranging and Very Long Baseline Interferometry  
Global Positioning System

Importance of Mantle Convection and rates of plate motion

Models for Mantle convection and mantle plumes.

**Reading Assignment: *Essentials of Geology*: Review Chapter 11, Plate Tectonics: Creating Oceans and Continents, pp. 195 – 217. Read Chapter 19, A Brief History of Earth and Its Life Forms, pp. 417 – 422, The Paleozoic Era.**

**Questions to think about:**

1. **How does the formation of supercontinents and breakup of supercontinents affect global climates?**
2. **What are the relationships between supercontinent formation and breakup and the production and destruction of Carbon Dioxide in the atmosphere?**
3. **What caused the great extinction of life at the end of the Permian?**
4. **What causes supercontinents to form and break up?**

**October 14, 2002 - Monday #21**

***HOMEWORK 2 Handed out.***

**Plate Motions and Natural Disasters Through Geologic Time I**

Precambrian through Paleozoic Continental Drift

Continental Drift and the Rock Cycle

Gondwana and Pangea Supercontinents

Continental Drift and Precambrian/Paleozoic Climates

Greenhouse to Icehouse

Continental Drift and the Evolution of life in the Paleozoic

The origin of fishes

The origin of amphibians

The evolution of plants, the Carboniferous

The great Permian Extinction

**Reading assignment: *Essentials of Geology*: Chapter 19, A Brief History of Earth and its Life Forms, The Mesozoic Era, pp. 422 – 425.**

**Questions to think about:**

1. **How did the fragmentation of Pangea affect Mesozoic life?**
2. **How did fragmentation of Pangea affect global climates?**
3. **What caused the evolution of large animals during the Mesozoic?**
4. **What terminated the evolution of most of the large animals at the end of the Mesozoic?**

**STUDY FOR THE SECOND MIDTERM ON THIS FRIDAY. Remember to use your textbook CD-ROM as a study resource.**

**October 16, 2002 – Wednesday #22**

**Plate Motions and Natural Disasters Through Geologic Time II**

Mesozoic Continental Drift and the breakup of Pangea  
Opening of seaways and ocean circulation  
Mesozoic climates  
Evolution of Mesozoic life  
    The evolution of large animals, Dinosaurs, etc.

**October 18, 2002 - Friday #23**

***MID-TERM II, EXAMINATION***

**Questions to think about for Monday's lecture:**

- 1. How could Continental Drift affect ocean circulation?**
- 2. How does ocean circulation affect global air temperature?**
- 3. How frequently do large asteroids/comets hit the Earth's surface?**
- 4. What are different explanations for extinctions of life on Earth?**

**October 21, 2002 - Monday #24**

**Plate Motions and Natural Disasters Through Geologic Time III**

Continental Drift, Ocean Circulation and Global Temperature  
Asteroids, Comets and Extinctions  
The Great Cretaceous/Tertiary Extinction in North America

**Reading assignment: *Essentials of Geology*: Chapter 19, A Brief History of Earth and its Life Forms, The Cenozoic Era, pp. 425 - 427.**

**Questions to think about:**

- 1. After the almost complete destruction of all life on the North American Continent by the K/T asteroid, how did life get reintroduced?**
- 2. What caused global temperatures to drop from 20 degrees higher than today's temperature, to a more glacial climate in the Tertiary?**
- 3. What is the relationship between global temperatures and the evolution of hominids?**

**October 23, 2002 - Wednesday #25**

***LABORATORY 2 write up due today!***

**Origin of Life II – Tertiary Life and Natural Disasters**

Re-introduction of life to North America

Evolution of life in North America  
Continental drift, climate change and life.

**Reading assignment: *Essentials of Geology: Chapter 4, Volcanoes and Volcanism, pp. 71 - 95.***

**Questions to think about:**

- 1. What causes volcanoes?**
- 2. Where are volcanoes generally located?**
- 3. What are the different types of volcanic lava?**
- 4. What causes the different types of lava?**
- 5. What causes different types of volcanic edifices?**

**October 25, Friday – HOLIDAY, NEVADA DAY**

***LOOK AHEAD! TERM PAPER DUE NOVEMBER 27<sup>TH</sup>!!!***

**October 28, 2002 – Monday #26**

***HOMEWORK 2 due today!***

***HOMEWORK 3 handed out.***

***LABORATORY 3, FIELD LAB THIS WEEK, meet at the UNR south entrance, near the parking shack, sections 1-4 (MTWR)***

**Volcanoes, Plate Tectonics and Natural Disasters**

Continental plate margin volcanoes

Volcanoes and mantle plumes/hot spots

Hawaii

Yellowstone

Magma composition, extrusive rock types and volcanic landforms

**Reading assignment: *Essentials of Geology: Chapter 4, pp. 71 - 95.***

**Questions to think about:**

- 1. What are volcanic hazards and how do geologists identify them?**
- 2. Why are stratovolcanoes more dangerous than shield volcanoes?**
- 3. Where are sites in North America that are volcanic threats to nearby residents?**
- 4. How do geologists predict volcanic eruptions?**

**October 30, 2002 – Wednesday #27**

**Volcanoes and Natural Disasters.**

Detecting and monitoring earthquake hazards

Shield volcano eruptions, Hawaii

Composite volcano eruptions, Mt. St. Helens  
Volcano risk assessment  
Mt. Ranier, Mammoth Hot Springs,  
Volcano hazard maps

**Reading assignment: *Essentials of Geology*: Chapter 9, Folds, Faults and Mountains, pp. 177 - 195.**

**Questions to think about:**

1. What are the three principal types of stress that act on rocks?
2. What happens as rocks deform plastically?
3. What happens as rocks deform by brittle failure?
4. How are faults classified?
5. How fast to major plates move?
6. Where do earthquakes occur?

**November 1, 2002 – Friday # 28**

**Earthquakes, Plate Tectonics and Natural Disasters**

Folds, faults and mountains  
Rates of motion for plates  
Where earthquakes occur  
San Andreas Fault System  
Ocean Transform Faults  
New Madrid Fault

**Reading assignment: *Essentials of Geology*: Review Chapter 10, Earthquakes And the Earth's Interior, pp. 197 - 223.**

**Questions to think about:**

1. How are earthquakes located?
2. How are earthquake focal mechanisms determined?
3. How is the Richter magnitude of Earthquakes determines?
4. What is the Mercalli Intensity scale?
5. What are typical effects of earthquakes?
6. How are earthquakes predicted?

**November 4, 2002 – Monday #29**

***HOMEWORK 4 handed out***

**Earthquakes and Natural Disasters I**

Richter Scale  
Seismic Hazard Maps  
Seismic energy, earthquake waves and surface materials

November 6, 2002 – Wednesday #30

### **Earthquakes and Natural Disasters II**

**Reading assignments: Reading assignment: *Essentials of Geology*: Chapter 15, Glaciers and Ice Ages, pp. 315 - 339. Chapter 19 A Brief History of Earth and its Life Forms, The Quaternary Period, pp. 387 – 390.**

**Questions to think about:**

- 1. What geological processes have affected global climates through geologic Time?**
- 2. Was the Earth ever frozen completely?**
- 3. How does climate change affect planetary life?**
- 4. How can asteroid and comet impacts affect climate? Did climate change in the Tertiary influence evolution of hominids?**
- 5. How did continental drift and ocean circulation affect evolution in the Tertiary and Quaternary.**
- 6. What role did Australia and Antarctica in climate change in the Tertiary?**
- 7. How many periods of glaciation were there in the Tertiary, in the Quaternary?**
- 8. What were Tertiary drivers to climate change? Quaternary drivers?**

November 8, 2002 – Friday, #31

### ***LABORATORY 3 write up due!***

#### **Cenozoic Climate Change, Human Evolution and Natural Disasters**

Tertiary Continental Drift, Ocean Circulation and Climate Change

Revisited

The Antarctica, Australia and Climate Change in the Tertiary

The importance of the Panamanian Isthmus and Climate

Origin of Humankind in Africa

Evolution of Hominids in the Tertiary

Evolution of Hominids in the Quaternary

November 11, 2002 – Monday, **HOLIDAY – VETERAN’S DAY**

**Reading assignment: *Essentials of Geology*: Chapter, 15 Glaciers and Ice Ages, pp. 315 - 339.**

**Questions to think about:**

- 1. Geologically, when did astrophysical drivers to climate change become important?**
- 2. What are the three major astrophysical drivers?**

3. **What happens to sea level during a period of glaciation? Is this a natural disaster?**
4. **Can glaciation change the Earth's rotation?**
5. **What role does Carbon Dioxide play in glaciation?**

**November 13, 2002 – Wednesday #33**

***HOMEWORK 3 write up due!***

***TERM PAPER DUE NOVEMBER 27<sup>TH</sup>!!!!***

**Glaciation, Sea Level, Climate Change and Natural Disasters**

Milankovitch climatic forcing functions

Variations in the Earth's rotation, tilt and orbit around the Sun

Gravitational effects on the Earth's orbital plane

Concepts of solar insolation, seasons and climate variations

Glaciation through geologic history

The last million years of climate change

Processes

Orbital forcing

Ocean circulation

Periodicities

Interglacials

Ice caps and glaciers

Sea level

Ocean and air temperature

The last interglacial, the Eemian

**Questions to think about:**

1. **How big were continental ice sheets during the Last Glacial Maximum?**
2. **What happens to Earth rotation as water is moved from the oceans to glaciers at polar latitudes?**
3. **What caused the Earth to quickly warm up at the end of the LGM?**
4. **What caused the Earth to cool suddenly between 12,000 ago and 11,000 Years ago?**
5. **What happened to sea level as continental glaciers melted?**
6. **What happened to the Earth's glacial ecosystems as the Earth warmed?**

**November 15, 2002 – Friday #33**

**Our Holocene Interglacial**

The Last Glacial Maximum

Continental and Alpine Glaciers

Recession of the Great ice sheets and rise of Sea Level

The Saline Ocean Conveyor

Holocene climate fluctuations and Holocene extinctions

The Altithermal, 1000 year droughts and Lake Tahoe

**Questions to think about:**

1. How did climate change affect the evolution of humankind?
2. How did human civilization change with changing climates?
3. What role did the industrial revolution play in climate change?
4. What should we do about global warming?

**November 18, 2002 - Monday #34**

***LABORATORY #4 – This Week, Meet in Laxalt Mineral Research, 351, Computer Laboratory.***

**Global Climate Change, Natural Disasters and our future**

Climate change and the evolution of humankind

Air temperature, precipitation history from the last glacial maximum

How the Earth's Environments change in response to climate

How will our interglacial end

Are we influencing our future climate?

**Reading assignment: *Essentials of Geology*: Chapter 13, Streams and Floods, pp. 269 – 289.**

**Questions to think about:**

1. What is the hydrologic cycle?
2. What governs stream velocity
3. What is a graded stream and how is it related to sediment load?
4. What causes floods?
5. What is a floodplain? A 100-year floodplain?

**November 20, 2002 – Wednesday #35 – Guest Lecture, Jim in NYC**

**Water Resources, Natural Disasters and our future**

Surface Water and Floods

The hydrologic cycle

Water resource availability

Stream topography

Stream velocity and discharge

Stream erosion and deposition

**Reading assignment: *Essentials of Geology*: Chapter 14, Groundwater, Caves And Karst, pp. 291 - 313.**

**November 22, 2002 - Friday #36**

***HOMEWORK 4, write up due!***

## **Natural Disasters and our future**

Groundwater and Karst

Groundwater recharge

Concept of porosity and permeability

Groundwater flow and the water table

Aquifers

Natural springs and geysers

Groundwater depletion

Water quality

Caves and Karst Topography

**Reading assignment: *Essentials of Geology*: Chapter 12, Mass Movement, pp. 249 - 267.**

### **Questions to think about:**

- 1. What are the factors that determine if mass wasting will occur?**
- 2. What causes a landslide?**
- 3. How does water promote mass movement?**
- 4. What is the difference between a flow and a slide?**
- 5. How is slope stability determined?**

**November 25, 2002- Monday, #37**

## **Natural Disasters and Our Future II**

Mass Wasting, Slope Stability and Natural Disasters

1. Gravity and slope stability.
2. Slope composition.
3. Role of water in slope stability.
4. Types of mass movement.
5. Flows
6. How to chose a stable home site.

**Reading assignment: *Essentials of Geology*: Chapter 18, Human Use of the Earth Resources, pp. 387 – 407.**

### **Questions to think about:**

- 1. What is the difference between a resource and a reserve?**
- 2. How do “fossil fuels” form?**
- 3. What are source rocks and reservoir rocks?**
- 4. How does gas form in an oil and gas reservoir?**
- 5. What is the difference between oil shale and an oil reservoir?**
- 6. How much oil and gas is available to the U. S. economy?**

November 27 – Wednesday, #38

***TERM PAPER DUE TODAY!!!***

**Energy Resources and Our Future I**

Oil and Gas

1. Origin of petroleum
2. Source rocks, reservoir rocks and impermeable rocks
3. Types of petroleum traps
4. Petroleum potential of the world

**Reading assignment: *Essentials of Geology*: Chapter 18, Human Use of the Earth Resources, pp. 387 - 407.**

**Questions to think about:**

1. How does coal form?
2. When in geologic history did coal deposits form in abundance?
3. How do different grades of coal form?
4. What are the geologic environments that promote development of coal?
5. How much coal is available to the U. S. economy?
6. How does burning of coal contribute to global warming?
7. What are “clean coal” technologies and are they adequate to permit continued burning of coal for electrical energy?

November 28 and November 29, THANKSGIVING HOLIDAY

December 2, 2002 – Monday, #39

**Energy Resources and our future II**

Coal

**Reading assignment: *Essentials of Geology*: Chapter 18, Human Use of the Earth's Resources, pp. 387 - 407.**

**Questions to think about:**

1. How does nuclear fission produce nuclear energy?
2. What are the advantages of nuclear power? The disadvantages?
3. What is spent nuclear fuel? Transuranic waste? Low level waste?
4. How is spent nuclear fuel to be handled and disposed?
5. How much spent nuclear fuel is to be stored by volume? By weight?
6. Why doesn't the United State reprocess spent nuclear fuel?

December 4, 2002 – Wednesday, #40

**Energy Resources and our Future III**

Nuclear Energy

**Questions to think about:**

1. Why is Nevada called the “Saudi Arabia” of geothermal energy?
2. What limits geothermal development in Nevada?
3. How much energy could geothermal power produce for the U. S Economy?
4. What are the advantages of wind power? Disadvantages?
5. Could wind power provide enough energy to power the entire U. S.
6. How many solar panels would be needed to provide enough energy For the U. S. economy?

**December 6, 2002 – Friday, #41**

***LABORATORY 4 write up due!***

***FINAL EXAMINATION STUDY GUIDE HANDED OUT.*** Use the study guides for Midterm exams one and two, plus questions on this study guide and your Textbook CD-ROM as resources for final examination preparation.

**Energy Resources and our Future IV**

Geothermal, Wind and Solar Energy

Geothermal reservoirs

Development of geothermal systems

Economics of geothermal energy development

Technologies for wind power generation

Environmental impact of wind power

Economics of wind power use and development

Technologies for solar power

Environmental impact of solar power

Economics of solar energy development

**Reading assignment: *Essentials of Geology*: Chapter 18, Human Use of the Earth’s Resources, pp. 387 – 407.**

**December 9, 2002 – Monday, #42**

**Class Review for Final Examination. Course Evaluations.**

**December 11, 2002 – Wednesday**

**Finals Preparation Day, No Classes**

**December 13, 2001 – Friday**

***FINAL EXAMINATION, 9:45 – 11:45AM, MS 215***