

**GEOL658: EARTH SYSTEMS THROUGH DEEP TIME: Global Change, Paleoclimate, and Life**  
**Drs. Grossman, Raymond, Miller, Olszewski, Thomas, and Wiltchko and others**

LECTURE: Monday-Wednesday, 1:50 - 3:05 PM, Halb. 354

LAB: none

OFFICE AND OFFICE HOURS: TBA

WEB-SITE: <http://geoweb.tamu.edu/faculty/grossman/GEOL658/index.htm>

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| <u>GRADING:</u> | Paper presentations as discussion leader | 45% |
|                 | Term project and presentation            | 30% |
|                 | Class discussion and pre-class questions | 25% |

COURSE DESCRIPTION: History and cause of global change in the Earth System, Archean to Holocene; impact of biotic change on the Earth System; influence of tectonics on paleochemistry and climate change; influence of climate on tectonics; methods and models for evaluating global change

CLASS READING, PREPATORY DISCUSSION QUESTIONS, and CLASSROOM DISCUSSION: Everyone is expected to read the papers, participate in discussions, ask questions, and answer questions concerning the reading assignments. Students should come prepared with **two questions for each paper assigned**. Quality of questions (for example, insightfulness) and class participation will be included in your grade.

PAPER PRESENTATION AND DISCUSSION LEADER: Class members will choose two topics on which to serve as discussion leader. Discussion leader picks the papers and leads discussion. Faculty members will serve as advisors for each topic. One of the two topics will be within the heading of "Causes of Mass Extinctions, Recoveries, and Biotic explosions." We will spend a week on each topic, with conflicting hypotheses presented and debated.

TERM PAPER/PROJECT: We will try to answer the question: What initiated the Carboniferous icehouse? Paleogeography, mountain-building, carbon sequestration, ocean gateways? Each student will take one aspect of the Earth system (e.g., terrestrial biosphere, ocean chemistry, paleoclimate, tectonics, etc.) and examine changes during the time interval, interactions between systems, and causes and effects. The culmination will be oral presentations with discussion and a 10-page term paper.

### **PRELIMINARY OUTLINE AND POTENTIAL TOPICS**

#### **Review of the Earth System (3-4 weeks)**

- Earth's energy balance and atmospheric circulation
- Ocean circulation
- Productivity and metabolism
- Ocean productivity and chemistry
- Terrestrial productivity
- Lithosphere and tectonics/climate interaction
- Proxies for paleoclimate and the paleochemistry of Earth's past oceans and atmospheres

#### **Climate Change: Relation to Biosphere and Lithosphere (4 weeks)**

- Modern global warming: hypothesis versus fact
- Glacial climate: a comparison of the Pleistocene and Carboniferous
- Magnitude and timing of Late Paleozoic glaciation
- Strontium and osmium isotopes, weathering, and Tertiary cooling
- Rates of tectonic processes (e.g., mountain-building, spreading rates) through the Phanerozoic: How have they varied?
- Do erosion rates control tectonics?
- Superplumes and Earth system history
- Volcanism and Climate
- The early Tertiary climate maximum: Do gas hydrates modulate climate
- Spread of land plants and erosion—The Devonian as a case study

- Icehouse to hothouse: formation of Gondwana and its effect on land climates
- Snowball Earth: fact or myth

### **Evolution of Oceans and Atmosphere (2.5)**

- Chemistry of Phanerozoic oceans: Calcite and aragonite seas
- Chemistry of Phanerozoic oceans: Link to extinctions and originations
- Oxygenation of the atmosphere: when and why
- Earth System Modeling. Carbon and sulfur burial in the Paleozoic: Isotopes, box models, and atmospheric O<sub>2</sub>
- Earth System Modeling. Atmospheric CO<sub>2</sub> throughout the Phanerozoic: The GEOCARB Approach

### **Causes of Mass Extinctions, Recoveries, and Biotic Explosions (3 weeks)**

- The Cambrian explosion
- Frasnian-Famnenian extinction
- The Permian-Triassic extinction
- Cretaceous-Paleogene extinction

### **Presentation of Class Projects (1.5 weeks)**

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**The Americans with Disabilities Act (ADA):** is a federal anti-discrimination statute that provides comprehensive civil rights protection for persons with disabilities. Among other things, this legislation requires that all students with disabilities be guaranteed a learning environment that provides for reasonable accommodation of their disabilities. If you believe you have a disability requiring an accommodation, please contact the Department of Student Life, Services for Students with Disabilities in Room 126 of the Koldus Building. The phone number is 845-1637.

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### **AGGIE HONOR CODE: "An Aggie does not lie, cheat, or steal or tolerate those who do."**

For more information, see Honor Council Rules and Procedures. <http://www.tamu.edu/aggiehonor>

Academic integrity is an essential force in the academic life of a university. It enhances the quality of education and celebrates the genuine achievements of others. It is, without reservation, a responsibility of all members of the Texas A&M University Community to actively promote academic integrity. Apathy or acquiescence in the presence of academic dishonesty is not a neutral act -- failure to confront and deter it will reinforce, perpetuate, and enlarge the scope of such misconduct.

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**PLAGIARISM:** As commonly defined, plagiarism consists of passing off as one's own the ideas, words, writings, etc., which belong to another. In accordance with this definition, you are committing plagiarism if you copy the work of another person and turn it in as your own, even if you should have the permission of that person. Plagiarism is one of the worst academic sins, for the plagiarist destroys the trust among colleagues without which research cannot be safely communicated. (Please see <http://library.tamu.edu/aggiehonor>.)