

**Geology 34: Global Climate Change
Syllabus— Winter, 2005**

| | |
|--|--|
| Lecture: M,W,F (12:05-1:10); (Olin 307) | Instructor: Dr. Donald T. Rodbell |
| | Office: Olin 314 Phone: 388-6034 (w) EMAIL: rodbell@union.edu |

TEXT: *Earths Climate: Past and Future* by William F. Ruddiman 2001 W.H. Freeman and Company

Two-Mile Time Machine by Richard Alley 2000 Princeton University Press

also: 3 outside readings to be handed out in class

course web page: <http://nunatak.geology.union.edu/courses/climate/climate.htm>

PART I. Framework of Climate Science, and Climate Change on 10⁴-10⁷ year time scales

| Week | Date | Lecture Topic(s) | Reading |
|-------------|-------------|--|---------------------------------------|
| 1 | Jan. 3 | <ul style="list-style-type: none"> ○ Class overview ○ Response times and feedbacks | Chapter 1 |
| | Jan. 5 | <ul style="list-style-type: none"> ○ Radiation and the atmosphere ○ Heat transfer in the atmosphere and ocean ○ Deep water, ice, and vegetation | Chapter 2 |
| | Jan. 7 | <ul style="list-style-type: none"> ○ Climate data and models | Chapter 3 |
| | | | |
| 2 | Jan. 10 | <ul style="list-style-type: none"> ○ Faint Young Sun | Chapter 4 |
| | Jan. 12 | Discussion of 2-Mile Time Machine #1 (3-77) | <i>Two Mile Time Machine</i> p. 3-77. |
| | Jan. 14 | <ul style="list-style-type: none"> ○ Basics of plate tectonics ○ The BLAG theory: CO₂ input ○ Climate on Pangea ○ Uplift and weathering: CO₂ removal | Chapter 5 |
| | | | |
| 3 | Jan. 17 | <ul style="list-style-type: none"> ○ The Cretaceous greenhouse climate ○ Tectonic-scale changes in sea level | Chapter 6 |
| | Jan. 19 | Literature Discussion #1 Chicken or the egg paper | Outside Reading #1 |
| | Jan. 21 | Nova Video: <i>Cracking the Ice Age</i> | |
| | | | |
| 4 | Jan. 24 | <ul style="list-style-type: none"> ○ Oxygen Isotopes ○ Causes of cooling during the last 55 Myr | Chapter 7 |
| | Jan. 26 | Midterm Exam | |

Part II. Climate Change on 10¹-10⁴ year time scales

| Week | Date | Lecture Topic(s) | Reading |
|------|----------|---|--|
| 4 | Jan. 28 | <ul style="list-style-type: none"> ○ Orbital variations ○ Variations in insolation received on Earth | Chapter 8 |
| 5 | Feb. 31 | Orbital changes in monsoons | Chapter 9 |
| | Feb. 2 | Orbital changes in ice sheets | Chapter 10 |
| | Feb. 4 | Literature Discussion #2 | Outside Reading #2 |
| 6 | Feb. 7 | <ul style="list-style-type: none"> ○ Ice core records: CO₂, CH₄, dust ○ Carbon isotopes and orbital changes in deep water | Chapter 11 |
| | Feb. 9 | Orbital-scale interactions in the climate system | Chapter 12 |
| | Feb. 11 | Discussion of 2-Mile Time Machine #2 (pages 83-159) | <i>Two Mile Time Machine</i> p. 83-159. |
| 7 | Feb. 14 | <ul style="list-style-type: none"> ○ Survey of the last glacial maximum ○ The tropical cooling debate | Chapter 13 |
| | Feb. 16 | <ul style="list-style-type: none"> ○ The last deglaciation ○ Climate changes of the last 7000 years | Chapter 14 |
| | Feb. 18 | Millennial changes: $\delta^{18}\text{O}$ in ice sheets | Chapter 15 |
| 8 | Feb. 21 | <ul style="list-style-type: none"> ○ Millennial changes in other regions ○ Causes of millennial changes | Chapter 15 |
| | Feb. 23 | Historical climate: The Little Ice Age | Chapter 16 |
| | Feb. 25 | Historical climate: tree rings, corals, and instrumental records | Chapter 16 |
| 9 | Feb. 28 | El Niño | Chapter 16 |
| | March 2 | <ul style="list-style-type: none"> ○ Impacts of climates on early humans and civilizations ○ Anthropogenic inputs of gases | Chapter 17 |
| | March 4 | Literature Discussion #3 | Outside Reading #3 |
| 10 | March 7 | The greenhouse debate: natural changes and CO ₂ sensitivity | Chapter 18 |
| | March 9 | Future climate: industrial emissions, CO ₂ levels and the fate of CO ₂ | Chapter 19 |
| | March 11 | <ul style="list-style-type: none"> ○ Discussion of 2-Mile Time Machine #3 (p. 169-192) ○ Course evaluations | <i>Two Mile Time Machine</i> p. 169-192. |

Grades: Grades will be based according to the following: final exam (40%), midterm exam (30%), class discussion of outside readings (15%), and homework assignments (15%).