SIO108 Introduction to Paleoclimatology
Fall Quarter, 2017

Course Instructor: Dr. Jane L. Teranes, LSOE, Scripps Institution of Oceanography
Course Schedule: MWF 2:00-2:50pm Eckart 236
Instructor Contact Information: Vaughan Hall 308 Phone: 822-2099 Email: jteranes@ucsd.edu
Instructor's Office Hours: Tues. 12:30-2 pm in Galbraith Hall 367 (Revelle College)
W 3-4 pm in Vaughan Hall 308 (Scripps Institution of Oceanography)

Course Description: An introduction to basic principles and applications of paleoclimatology, the study of climate and climate changes that occurred prior to the period of instrumental records. A review of processes and archives of climate data will be investigated using examples from Earth history.

Rationale and goals: Paleoclimate records provide the necessary context for understanding long-term climate variability and for assessing extreme climate conditions. Such longer perspectives on climatic variability can be obtained by studying natural phenomena that are modulated by climate and that leave a lasting mark in the geologic record. This survey course covers an introduction to the methods of paleoclimate reconstruction and the current state of knowledge about the paleoclimate history of the Earth- from the early Earth to the recent climate change. Topics include an evaluation of climate forcings and response as well as a comprehensive examination of the theory and assumptions inherent in the most commonly used methods for reconstructing paleoclimate data. The goal of this course is to provide a foundation in the study of and current research in paleoclimatology, and provide the background to understand how paleoclimatology can inform policy-making related to current and future climate change.

Objectives: Upon successful completion of this course, students will be able to:

- Be able to identify climate forcings and responses.
- Discuss the various components of Earth's climate system, such as the cryosphere, atmosphere, biosphere, and hydrosphere. Understand the complex component interactions and have the ability to map out both negative and positive feedback loops.
- Investigate the variable time scales upon which different climate processes occur and understands as residence time, and periodicity.
- Discuss tools and techniques used to interpret changes in Earth's climate through geologic time.
- Recognize and critique modern paleoclimate studies through the use of primary literature in climate science.

Course Grade and Description:
Assignments (20%); Midterm (20%); Research Paper and Presentation (20%); Participation (10%)
Final (30%)

Textbook: *Earth's Climate: Past and Future* 3rd edition, William Ruddiman.

Overview of topics

I. Fundamentals of Paleoclimate

Sept. 29 Introduction and Why Study Paleoclimate

Oct. 2 Overview of Climate Sciences (Ch. 1)
Oct. 4 Earth's Climate System Today (Ch. 2)
Oct. 6 Climate Archives, Data and Models (Ch. 3)

II. Tectonic-Scale Climate Change

Oct. 9 CO2 and Long-Term Climate (Ch. 4)
Oct. 11 Gaia Hypothesis and Snowball Earth (Ch. 4)
Oct. 13 Plate Tectonic Drivers (Ch. 5)

Oct. 16 Greenhouse Climates (Ch. 6)
Oct. 18 PETM (Ch. 6)
Oct. 20 Greenhouse to Icehouse (Ch. 7)

Oct. 23 Paleoclimate Evidence from Oxygen Isotope Measurements (Ch. 7)

III. Orbital-Scale Climate Change

Oct. 25 Long term changes in the Earth's Orbit (Ch. 8)
Oct. 27 Orbital Parameters (Ch. 8)

Oct. 30 Changes in Insolation (Ch. 8)
Nov. 1 Midterm Exam
Nov. 3 Ice ages, Ice Cores and Insolation Control of Ice Sheets (Ch. 10)

Nov. 6 North Hemisphere Ice Sheet History (Ch. 10)
Nov. 8 Orbital-Scale interactions (Chs. 11 and 12)
Nov. 10 No Class – Veteran's Day Observation

IV. Glacial/Deglacial Climate Change

Nov. 13 The Last Glacial Maximum (Ch 13)
Nov. 15 Climate Change since the last Deglaciation (Ch. 14)
Nov. 17 Millennial Oscillations of Climate (Ch. 15)

V. Humans and Climate Change

Nov. 20 Early Humans and Climate Change (Ch. 16)
Nov. 22 No Class – Thanksgiving Break
Nov. 24 No Class-Thanksgiving Break

Nov. 27 Climate Change over the last 1,000 years (Ch. 17)
Nov. 29 Climate Change since 1850 (Ch. 18)
Dec. 1 Current and Future Climate Change (Ch. 19, 20)

Dec. 4 Student Presentations
Dec. 6 Student Presentations
Dec. 8 Student Presentations

Final Exam: Wed. Dec. 13, 3-6pm