

Biogeochemical Cycles -- Syllabus
Fall 2007

Week 1: Overview of the cycles of carbon, oxygen, etc., as motivation for learning about weathering and sediment diagenesis.

Weeks 2-3: Review of necessary tools and scientific background: Thermodynamics calculations, kinetic theory, theory of isotopic fractionation (kinetic and thermodynamic)

Weeks 4-5: Weathering and soil formation. Introductory mineralogy and differentiation of the crust. Physical erosion, processes and controls of chemical weathering (clay formation), differentiation of soils into horizons as controlled by the biota and hydrology, observations of the dissolved and particulate loads of rivers, weathering in the CO₂ cycle, potential for climate control of weathering.

Weeks 6-8: Chemical oceanography and sediment diagenesis. Ocean circulation, seawater chemistry, marine nutrient cycles. Theory of early diagenesis; the physics of diffusion, the diagenetic red-ox sequence, sediments as carriers of information about the past. This section does overlap somewhat with Chemical Oceanography 234; those of you who have taken that one will have to bear with me for a bit. Can't make a world without oceans.

Weeks 9-10. Worldviews and Just-So Stories. Atmospheric CO₂ controls. Weathering and CO₂; the BLAG model, Himalayan uplift and CO₂, Sillen thermodynamic model (reverse weathering), ocean carbonate balance. Controls on ocean nutrients and atmospheric O₂.

The text for the class will be Earth System Science, edited by Jacobson et al, ISBN 0-12-379370-X. Chapters from the text will be introduced in class to facilitate your reading of it. I will also post pdf files of readings from the primary scientific literature on the class web site in chalk, <http://chalk.uchicago.edu>.

I would like the students to do some independent reading on a topic of their choice. Two or three papers is ideal. Relate them together, do they agree, disagree, complement each other, how do they fit together? I'd like a short paper, just one or two pages, as if you were reviewing the paper. There will also be student presentations throughout the quarter, apropos the lecture material.

There will be approximately weekly or biweekly problem sets, a midterm and a cumulative final exam. October 26, Friday, midterm exam. The final exam will be given during finals week whenever our official slot is, but in addition to that, we will have an optional early screening of the final for those wishing to leave town early.