Syllabus for Earth Systems Science
Spring Term 2005
Professor Bruce Fegley, Jr.

My office is in Earth & Planetary Sciences Building 143. My office hours for this class will be 2:30 - 4:00 PM on Tuesday and Thursday. You can also contact me by telephone: 935-4852, FAX: 935-4853, or e-mail: bfegley@levee.wustl.edu. You can also get assistance from Laura Schaefer (Tel: 935-6310, e-mail: laura_s@levee.wustl.edu). The class will meet in Earth & Planetary Sciences 204 on Tuesdays and Thursdays from 1:00 to 2:30 pm. The text for the course is *The Planetary Scientist's Companion* by Katharina Lodders and Bruce Fegley, Jr. This is available in the campus bookstore under textbooks and general science books. Additional reading material, generally copies of, or excerpts from, scientific articles in books and journals, will also be distributed electronically.

The course is a quantitative introduction to physical and chemical interactions among the atmosphere, oceans, and solid Earth. Use of the geologic record to infer how such interactions varied over geologic time is discussed. The applications of physical chemistry, in particular chemical thermodynamics and chemical kinetics, to these problems will be emphasized.

The course will be divided into three parts:

(1) Current geochemical cycles. Topics to be discussed include the carbon cycle, anthropogenic effects on atmospheric chemistry, photochemistry of Earth's atmosphere, oceanic chemistry. (January 18th - March 1st)

(2) Evolution of the atmosphere and oceans. Topics to be discussed include geochemical and geological evidence for life on the early Earth, photosynthetic fractionation of carbon isotopes, changes in atmospheric and oceanic composition, effects of the KT impact on the atmosphere and oceans. (March 1st - March 24th)

(3) Origin and bulk composition of the Earth. Topics to be discussed include chemistry of the solar nebula, accretion of the Earth and terrestrial planets, estimates of planetary bulk compositions for the terrestrial planets, inferences from meteorites about planetary compositions, composition of Earth's earliest atmosphere. (March 24th - April 28th)

CALENDAR

1/18 & 1/20	Composition and structure of Earth's present atmosphere
1/25 & 1/27	Chemistry of Earth's atmosphere I - review of chemical kinetics. HW #1 handed out on 1/27 due on 2/8
2/1	Chemistry of Earth's atmosphere II - stratospheric chemistry
2/3	Chemistry of Earth's atmosphere III -tropospheric chemistry
2/8	Chemistry of Earth's oceans I - review of aqueous thermochemistry. HW #2 handed out, due on 2/22.
2/10	Chemistry of Earth's oceans II
2/15 & 2/17	Terrestrial carbon cycle & introduction to box modeling.

2/22 & 2/24	Terrestrial sulfur, nitrogen, and phosphorus cycles. HW #3 handed out on 2/22, due on 3/3.
3/1	Origin of the Earth's atmosphere.
3/3	EXAM
3/8 & 3/10	Spring Break - no class
3/15 & 3/17	Accretion of volatiles by Earth
3/22	Formation and composition of Earth's earliest atmosphere. HW#4 handed out, due on 4/5.
3/24	Effect of KT impact on the Earth
3/29	Bulk composition models for Earth and other terrestrial planets
3/31 & 4/5	Planetary accretion models. HW#5 handed out, due on 4/14.
4/7	Chemistry during accretion of the Earth and formation of the Moon
4/12	Origin of the solar system
4/14	Solar nebula equilibrium chemistry. HW #6 handed out, due on 4/26.
4/19	Classification and chemistry of meteorites
4/21 & 4/26	Inferences from meteorites and nebular chemistry about planetary bulk compositions
4/28	EXAM 2 & last class
Grading will be based on six assignments (10% each, 60% total), two exams (15% each, 30% total), and 10% from performance in class. The schedule for the assignments and exams will be determined after class starts. There will be no make up exams or extra credit work. Ninety % and above of the total points = A^-, A, A^+; 80-90% = B^-, B, B^+, etc.	