SOUTHEAST MISSOURI STATE UNIVERSITY

Department of Geosciences — Catalog No. GO458/658

Environmental Geochemistry — New: Fall 2005

I. Catalog Description and Credit Hours of Course:

Application of chemical principles to the study of near surface environments. (3) Two lectures, 1 two-hour laboratory.

II. Prerequisites:

CH186 General Chemistry II or equivalent.

III. Objectives of the Course:

A. To become familiar with solubility, acid-base, complexation and oxidation-reduction behaviors of earth materials.
B. To become familiar with the chemical composition of natural waters.
C. To become familiar with the solid-solution interface (adsorption).
D. To become familiar with isotope techniques and their application.
E. To become familiar with clay structures and their reactivity.

IV. Expectations of the Student:

A. Prepare for and attend all classes.
B. Content mastery as revealed by successful completion of problem assignments and examinations.
C. Successful use of software to model and predict chemical behavior.
D. Successful development and professional presentation of a case study involving the application of low temperature geochemistry.
E. Graduate students will write a manuscript, nearly suitable for publication, concerning their project.

V. Content of Course:

Lecture

- Introduction to geochemistry and thermodynamics **(4 lectures)**
- Acids - Bases (**2 lectures)**
  - Nature and strengths of acids - bases, (humic and fulvic acids)
  - Activity and pH scales
  - Numerical equilibrium calculations using MinteqA2
- Carbon dioxide and weathering in sediments **(2 lectures)**

Hour Examination (#1) (one lecture)

Precipitation - Dissolution **(2 lectures)**
- Solubility of Al, Fe, and Mn Oxides/hydroxide
- Carbonates
- Activity of the solid phase in soil systems
- Effect of inert electrolyte on solubility
- Crystal formation

Hour Examination (#2) (one lecture)

Metal ions in aqueous solution **(3 lectures)**
- Stability of hydrolysis species
- Metal ions and ligands
- Complex formation and the solubility of solids
- Chelation and inorganic complexes in natural waters

Oxidation - Reduction **(4 lectures)**
- Redox equilibria and electron activity
- The electrical potential: Peters - Nernst equation
- pe - pH diagrams with particular reference to submerged soils
- Sulfur-sulfide chemistry and uranium, iron systems

Solid - Solution Interface **(2 lectures)**
- Forces at interfaces
- The electric double layer
- Surface chemistry of oxides
- Ion exchange involving K-Ca with clay minerals

Hour Examination (#3) (one lecture)

Clay Mineralogy and Clay Reactivity **(7 lectures)**

Hour Examination (#4) (one lecture)

Laboratory (15 hours)

The laboratory component will involve group and individual projects. The laboratory will provide procedures and instrumentation covering the determination of cationic and anionic species in water, phosphate adsorption, acid-base activities of oxides, and oxidation-reduction of chromium compounds, plus complexation of transition metals. All systems will involve earth and soil materials collected from completely sampled and classified sites.

VI. Textbook and References:

Text: Langmuir, D.L. 1997. *AQUEOUS ENVIRONMENTAL GEOCHEMISTRY*. Prentice-Hall.

References: Various other materials will be supplied.

VII. Basis of Student Evaluation:

A.	Hour examinations (4)	400 points
B.	Computer software mastery and assigned problems	100 points
C.	Final Examination	100 points
D.	Laboratory Activities	100 points
E.	Project manuscript writing **(Graduate only)**	100 points

Total Possible Points	
Undergraduate	700 points
Graduate	800 points

		Undergraduate	Graduate
Grade Scale	A	100-91%	100-91%
	B	90-81%	90-81%
	C	80-71%	80-71%
	D	70-61%	---------
	F	<61%	<71%

The weight of evaluation criteria may vary at the discretion of the instructor and will be indicated at the beginning of each course.

VIII. Policy on Academic Honesty:

This course will adhere to the statement of academic policy as written in the 2004-2005 Southeast Missouri State University Undergraduate Bulletin (page 17-19). This statement includes student expectations concerning cheating and plagiarism. Graduate students are asked to review the same policy in the 2004-2005 Southeast Missouri State University Graduate Bulletin.