Department of Earth and Planetary Sciences
EPSC-580B - Aqueous Geochemistry

Generic Outline

Instructor: **Prof. Alfonso Mucci**
Lecture Periods: **2 x 1.5-hour lectures**
Office Hours: FDA 201(when the door is open, most of the time).
Teaching Assistant TBA

Weeks	**Subjects**
1	Introduction Thermodynamic Terminology Gibbs Phase Rule
2	Fundamental Variables, State Functions and the Laws of Thermodynamics Gibbs Free Energy, Chemical Potential and the Equilibrium Constant Influence of Temperature and Pressure on Equilibrium
3-4	Properties and Thermodynamics of Electrolyte Solutions Properties of Water Electrolyte Solutions Ionic Strength Activities and Activity Coefficients of Dissolved Species
5-6	Acids and Bases Definitions: strength, dissociation constants Carbon Dioxide and the Carbonic Acid System Humic and fulvic acids pH measurements and scales Acidity and Alkalinity Acid-Base titrations Buffer Systems
7-8	Aqueous Complexation Ion pairs, inner-sphere and outer-sphere complexes Metal ions and ligand classification Mixed complexes
9	Stability Relationships and Solubility Control More carbonate chemistry! Metastability and particle size Solid solutions
10-11	Redox Equilibria Electron activity and equilibrium constants Eh measurements Eh-pH diagrams Redox conditions in natural waters

12-13 Adsorption and Desorption Reactions: The Solid-Solution Interface
- Empirical models
- Ion exchange models and concepts
- Electrostatic adsorption and surface complexation models
- Sorption of hydrophobic substances on organic-carbon bearing particles

14 Water-atmosphere interactions
- Acid precipitation
- Gas-water partitioning in the atmosphere
- Geochemical Computer Models

1. Marking Scheme:
   - A. Assignments: 30%
   - B. Mid-term: 30%
   - C. Final: 40%

   Please note that assignments will be submitted to the instructor and there will be a 10% deduction per day if the work is turned in late.

2. The outline of this course will closely but not strictly follow the content of the following recommended textbooks. They are not required but highly recommended.

   Langmuir D. (1997) Aqueous Environmental Geochemistry. Prentice Hall, N.J.

   Stumm, W. and Morgan, J.J. (1996) Aquatic Chemistry: Chemical Equilibria and Rates in Natural Waters. 3rd Edition. Wiley-Interscience, NY.
   THE BIBLE OF AQUEOUS GEOCHEMISTRY

   There are also a number of other very good references:

   Anderson, G.M. (1996) Thermodynamic of Natural Systems. Wiley & Sons, Toronto.

   Anderson, G.M. and Crerar, D.A. (1993) Thermodynamics in Geochemistry: The Equilibrium Model. Oxford University Press, NY.

   Drever, J.I. (1997) The Geochemistry of Natural Waters: Surface and Groundwater Environments. 3rd Edition. Prentice-Hall, NJ.

   Nordstrom, D.K. and Munoz, J.L. (1986) Geochemical Thermodynamics. Blackwell Scientific Publications, CA.

   Morel F.M.M. (1983) Principles of Aquatic Chemistry. Wiley-Interscience, N.Y.

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