SAN DIEGO STATE UNIVERSITY—FALL 2004

Geol 530: *Geochemistry*

Mondays & Wednesdays from 9:00-9:50 AM in CSL-425 (Lecture)
Mondays from 10:00-12:40 AM in CLS-427 (Lab)

Dr. Aaron Pietruszka
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GEOCHEMISTRY is defined as the use of chemistry to study the Earth and how it works. The goal of this course is to introduce upper-division undergraduate and beginning graduate students to the fundamental principles of modern geochemistry. When you successfully complete this course, you will understand:

1. the major themes of low- and high-temperature geochemistry and how they relate to other aspects of the geological sciences (the Big Picture!),
2. how to acquire and present high-quality geochemical data, and
3. how to use both simple mathematical expressions and sophisticated computer models to interpret geochemical data.

TEXTS:
Assigned reading will come primarily from the textbook "*Geochemistry: An Introduction*" by Dr. Francis Albarède, which is available for purchase at the SDSU Bookstore. You are expected to complete each reading assignment by the next class meeting (i.e., reading assigned on Monday should be completed by Wednesday). *You will be responsible for understanding all material in Dr. Albarède's book, even if I don't mention it during lecture.*

Another important resource for this class will be the on-line textbook "*Geochemistry*" by Dr. William White, which is available free of charge (thanks to the generosity of Dr. White!) at:

http://www.geo.cornell.edu/geology/classes/geo455/Chapters.HTML

I will not assign reading from Dr. White's book. However, I will draw heavily from this book (in addition to Dr. Albarède's book) for my lectures. *You will be responsible for understanding this lecture material even if it is not mentioned in Dr. Albarède's book.* You will *not* be responsible for material in Dr. White's book if it is not mentioned in lecture. However, I strongly advise you to use Dr. White's fantastic book as a resource to learn more about the wonders of geochemistry! You are responsible for downloading this book. You can print out any text related to the lecture or, to save money and trees, you can read it directly off your PC. Please contact me immediately if you have any trouble opening these files.

Selected reading from the scientific literature may be assigned to supplement the laboratory portion of the course.

FORMAT & POLICIES:

We will meet twice per week. Attendance is mandatory and **class participation** is an important component of the final grade (see below). **Lectures** on Mondays & Wednesdays will provide the necessary background material and an opportunity for active discussion of the reading assignment. **Short quizzes** based on the assigned reading and lecture material will be given without warning to ensure that all students come prepared to learn. **Problem sets** will be handed out on selected Wednesdays and are due at the start of class on the following Wednesday. Following a short break after the lecture on Mondays, **laboratory exercises** will be used to supplement the lecture portion of the course. These exercises will range from the collection of geochemical data in the lab to computer modeling of literature data to panel discussions of controversial topics in geochemistry. **Lab write-ups** are due at the start of class on the following Monday. The requirements for each write-up will be described at the start of the lab. A **short (~3-5 double-spaced pages excluding figures and tables) written case-study of an element** following the style of Chapter 10 in Dr. Albarède's book will be due on Dec. 1. For this project, each student will choose their favorite element from the periodic table (not one already discussed in the book!) at the start of the semester and should pay particular attention to any mention of that element during the semester for clues to its geochemical behavior. That information should be supplemented with fully referenced library research to produce the final report. A **mid-term exam** and a **comprehensive final exam** based on both the lecture and laboratory portions of the course will be given. The exams may include short-answer, multiple choice, and essay questions and mathematical problems and calculations. You do *not* need to memorize the equations that we discuss in class and lab, but you need to understand how to use them!

No late assignments will be accepted without prior approval. Group work on the problem sets and laboratory exercises is encouraged, but cheating and plagiarism will not be tolerated under any circumstances. If you work with others on assignments, make sure to use your own words! Furthermore, you must use full citations for any facts or ideas that are not your own!

Your work will be weighted as follows:

Class participation	5%
Quizzes	5%
Problem sets	10%
Lab write-ups	15%
Mid-term exam	15%
Case-study of an element	20%
Final exam	30%

Your final grade will be based on a percentage of the total available points:

A (90% or above), ***B*** (89-80%), ***C*** (79-70%), ***D*** (69-60%), ***F*** (59% or below).

The good news! You will be graded relative to the performance of your fellow students, rather than an arbitrary point scale. The total available points will be determined from the score of the student with the highest number of points. However, I will hold you to the highest standards and evaluate your performance rigorously. There will be no grade inflation!

COURSE SCHEDULE:

WEEK 1
Aug. 30
Lecture: Properties of the Elements
Lab #1: The Periodic Table & the Chart of the Nuclides
Assigned reading: Albarède (Introduction, Ch. 1)

Sep. 1
Lecture: Properties of the Elements

WEEK 2
Sep. 6 (No Lecture/Lab—Labor Day Holiday)

Sep. 8
Lecture: Properties of the Elements
Assigned reading: Albarède (Appendix F)

WEEK 3
Sep. 13
Lecture: Geochemical Data & Analytical Techniques ***(Choose an Element TODAY!)***
Lab #2: Introduction to the Geochemistry Laboratory
Assigned reading: Albarède (Ch. 2 up to and including section 2.1)

Sep. 15
Lecture: Conservation of Mass; Mixing
Assigned reading: Albarède (remainder of Ch. 2)

WEEK 4
Sep. 20
Lecture: Elemental Fractionation; Introduction to Thermodynamics
Lab #3: Geochemical Data Analysis

Sep. 22
Lecture: Elemental Fractionation; Introduction to Thermodynamics

WEEK 5
Sep. 27
Lecture: Elemental Fractionation
Lab #4: Atomic Absorption Spectrometry I

Sep. 29
Lecture: Isotopic Fractionation

WEEK 6
Oct. 4
Lecture: Isotopic Fractionation
Lab #5: Atomic Absorption Spectrometry II

Oct. 6
Lecture: Isotopic Fractionation; Distillation
Assigned reading: Albarède (Ch. 3)

WEEK 7
Oct. 11
Lecture: Geochronology
Lab #6: Atomic Absorption Spectrometry III

Oct. 13 ***(Mid-term Exam!)***

WEEK 8
Oct. 18
Lecture: Geochronology
Lab #7: Atomic Absorption Spectrometry IV

Oct. 20
Lecture: Geochronology
Assigned reading: Albarède, Ch. 4

WEEK 9
Oct. 25
Lecture: Element Transport
Assigned reading: Albarède, Ch. 5
Lab #8: Low-T Geochemistry Project (Part I)

Oct. 27
Lecture: Geochemical Systems
Assigned reading: Albarède, Ch. 6

WEEK 10
Nov. 1
Lecture: Natural Waters
Lab #9: Low-T Geochemistry Project (Part II)

Nov. 3
Lecture: Natural Waters

WEEK 11
Nov. 8
Lecture: Natural Waters
Lab #10: Low-T Geochemistry Project (Part III)

Nov. 10
Lecture: Natural Waters
Assigned reading: Albarède, Ch. 7

WEEK 12
Nov. 15
Lecture: Mineral Reactions
Assigned reading: Albarède, Ch. 8
Lab #11: Low-T Geochemistry Project (Part IV)

Nov. 17
Lecture: The Solid Earth

WEEK 13
Nov. 22
Lecture: The Solid Earth
Lab #12: High-T Geochemistry Project (Part I)

Nov. 24
Lecture: The Solid Earth

WEEK 14
Nov. 29
Lecture: The Solid Earth
Assigned reading: Albarède, Ch. 9
Lab #13: High-T Geochemistry Project (Part II)

Dec. 1
Lecture: The Earth in the Solar System

WEEK 15
Dec. 6
Lecture: The Earth in the Solar System
Lab #14: High-T Geochemistry Project (Part III)

Dec. 8
Lecture: The Earth in the Solar System ***(Case Study of an Element DUE TODAY!)***