Earth/Env S 169: Tracer Hydrology  J. Clark
T Th 9:30-10:45  2115 Webb
PSB-S 2712  893-7838
Office Hours: Tuesday 8:30-9:20 & by appointment
TA: Tim Becker (Office hours: Tuesday 12-2 & by appointment, 1023 Noble)

Reading will be available at GauchoSpace

Reference Texts:  
- *Applied Hydrogeology* (1979) by C. W. Fetter  
- *Environmental Isotopes in Hydrology* (1997) by Clark and Fritz

Chapter 9, Bair (1995) from *Environmental Hydrogeology*

Week 2 (4/8): Stable Isotopes  
Chapter 8, Kehew (2001): pp. 256-265

Week 3 (4/15): Geochemical Dating: Tritium/He-3 & CFCs  
Chapter 8, Kehew (2001): pp. 277-282  
4/17 Problem set #1 due

Week 4 (4/22): Radiocarbon, & Paleoclimate records  
4/24 Problem set #2 due

Week 5 (4/29): Basin Imaging & Regional and local flow system separation  
5/1 Problem set #3 due

Week 6 (5/6): Overrun/Review & Midterm  
5/8 Mid-term  
5/8 Problem set #4 due

Week 7 (5/13): Mass Transport & Deliberate Tracer Experiments  
Chapter 11, p. 453-472, in *Applied Hydrology*

Week 8 (5/20): Groundwater Plumes  
Chapter 8, Kehew (2001): pp. 313-331  
5/19 Problem set #5 due

Week 9 (5/27): Managed Aquifer Recharge (MAR)  
5/27 No Class--Memorial Day  
5/26 Problem set #6 due

Week 10 (6/3): PPTs & Review  
6/2 Problem set #7 due

Choice of Final Exam or Term Paper (5-10 pages): Wednesday June 12, 8-11 (will confirm room)
Class Objectives:

We will examine how trace components in groundwater can be used to define groundwater flow patterns, ages (dates), recharge rates, and recharge location. Along the way, basic principals of geochemistry will be introduced. The class will focus on shallow groundwater and problems associated with groundwater contamination plumes, aquifer storage and recovery, and agricultural impacts.

Geochemical data is most often presented in graphical form. The class will help develop your skills to quickly read and interpret graphs/figures.

What is a tracer?

A tracer is a component (isotopic or chemical; natural or anthropogenic) of groundwater that has KNOWN sources and sinks.

Requirements:

<table>
<thead>
<tr>
<th>Requirement</th>
<th>Percentage</th>
</tr>
</thead>
<tbody>
<tr>
<td>Problem Sets</td>
<td>30%</td>
</tr>
<tr>
<td>Midterm</td>
<td>30%</td>
</tr>
<tr>
<td>Class Participation</td>
<td>10%</td>
</tr>
<tr>
<td>Final</td>
<td>30%</td>
</tr>
</tbody>
</table>
Final Paper Guidelines

Your paper will be done in three steps. The abstract and reference list is due to Dr. Clark via an email attachment as a .doc file on Oct 27. The first draft of the paper is due as an email attachment on Nov 14. These will be peer reviewed and returned to you by Dec 1. Email peer review comments to Dr. Clark before Nov. 28. You are then to revise your text taking into account the peer review and email it to Dr. Clark before Dec 7. Keep in mind the paper (20%) and peer review (10%) combine to make up 30% of your grade so spend the time getting it done right.

Paper Guidelines:
1. Argue a problem.
2. Use primary references. Textbooks are not primary references, nor is wikipedia or other websites.
3. Use a standard reference format.
4. Make it about 5-8 pages of text.
5. Include 2-3 relevant figures.
6. Cite at least 3 primary references.
7. Write an abstract
8. Include a title
9. Attribute ideas, data, figures to proper sources.
10. Do your own work.

Introduction Guidelines:
Your introduction must communicate several things in a relatively brief amount of space:

- The question that your paper will help answer.
- Why this question is important.
- Relevant background on the research (what the reader needs to know in order to understand the paper)
- What your position or viewpoint on the topic is.

The introduction should be at least three paragraphs.

Peer Review
For the peer review, you will read the text of one of your fellow students and provide comments in two ways 1) written comments with suggestions about the overall content and structure (e.g., organization, clarity, flow), 2) editorial marks on a printed copy of the paper (e.g., pointing out misspellings, rewording suggestions). We will discuss the comments in small groups in section on June 4. This will provide everyone with some feedback prior to turning in the final paper. Please use the track change tool in Word (found under the tools menu; you must select “Highlight Changes” and click on the box next to “track changes while editing”)

Some tips:
- Always point out strengths as well as elements that need more work
- Be specific. Point to particular places in the paper where revision will be helpful
- Don’t hesitate to respond as a reader, pointing out where you got confused or where a good argument was made.
• Make comments in the spirit of helpfulness. Take comments in the spirit of helpfulness.