

GLY 5246

Introduction to Geochemistry

Tuesday-Thursday, 1:30-2:45 PM

What is geochemistry? A discipline that analyzes and interprets the role of chemical reactions in any and all geologic processes. Consequently, no single course, book, or lifetime can cover all aspects of this discipline, and we have to make decisions about what aspects to address. In this course we will try to provide an overview of the basic geochemical processes that have controlled the evolution of the solid Earth. Topics will include the following:

1. How did the elements originate and aggregate to form Earth. And how does Earth “fit in” the solar system? An important theme here is the nature of equilibrium and its relation to fractionation. Equilibrium is the only quantifiable state of matter.
2. What is the chemical composition of the Earth (elemental and isotopic)? How did it form? When did it form?
3. How and when did the major geochemical reservoirs on Earth form and achieve their current compositions?
4. How do we use thermodynamics to understand geochemical processes?
5. How do we use isotopes to determine sources and radioactivity, more generally, to determine rates of geologic processes and when geologic events occurred?

Goals:

What do I hope you learn?

1. That geochemical reactions are pervasive in Earth systems and are able to recognize when and where geochemical reactions are important.
2. Be familiar with the geochemical literature, including web resources.
3. How to synthesize concise explanations of important information, in this case geochemical information.

The course:

1. The accompanying spreadsheet lays out the schedule I hope to keep during the semester. As you can see the topics are laid out in a roughly historical sequence beginning with our cosmochemical beginnings and ending with petrochemistry and chemical weathering. We will use a zoom format. Several of you have probably had more experience with this format than me, so feel free to comment or contact me with any suggestions that you think will improve the class as we go along. The college (CLAS) has also produced a list of guidelines for “virtual”

presentations on Zoom or equivalent that include the option for students not to display their pictures in the participant windows. You can view the guidelines at the college website.

2. Grades will be based on attendance-participation in class and the presentations noted on the attached schedule. During the semester I will also give you problems to solve or address. We will go over your “answers” to these questions during the next class period. If you collectively want to add other formats for grading, this is open for discussion. We will try to stay on a schedule in which we meet from 1:30 to 2:45 PM on Tuesdays and Thursdays, although there will be occasional short or slightly displaced periods due to other events in the department, such as faculty meetings.

3. There is no required textbook. Before each session I will send you a PDF of “slides” that will form the basis of the class. Class will essentially be going over these slides each session. Many of the images in the slides are from copyrighted sources that share their intellectual property with us for educational purposes only. Be mindful of that restriction.

4. Note on the attached schedule that I would like for each of you to subscribe to two Science Daily newsletters: Earth Science and Space Science. I also recommend that you subscribe to table of contents alerts for at least these two journals: *Geochimica Cosmochimica Acta* (Geochemical Society and the Meteoritical Society) and *Chemical Geology*. We will address papers in these journals as time and topic allow. We may also alter our schedule to help you prepare for any seminar speaker whose talk touches on topics in the course.

5. I have set aside 3 class periods to take up topics we will not likely have time to address, make up days lost to storms, etc., so you have some time to think about what other topics you would like to discuss, if the opportunity arises.

6. Normally I include some kind of hands on exercise for the class, e.g., we went to Haile quarry to hunt for micrometeorites last year and grew synthetic zircons the year before. I had hoped to grow monazite or titanite this year, but that doesn't look promising right now. Maybe by November things will change. The meteorite project was at the end of the semester, so many of the samples were not completely prepared. If any of you are interested in finishing one off, or starting anew, see:

>Genge, M.J., Larsen, J., Van Ginneken, M. and Suttle, M.D., 2017. An urban collection of modern-day large micrometeorites: Evidence for variations in the extraterrestrial dust flux through the Quaternary. *Geology*, 45(2), pp.119-122. Or

>Taylor, P.L., Nusbaum, R.L., Fronabarger, A.K., Katuna, M.P. and Summer, N., 1996. Magnetic spherules in coastal plain sediments, Sullivan's Island, South Carolina, USA. *Meteoritics & Planetary Science*, 31(1), pp.77-80. Or

>Meyer, M., Harries, P.J. and Portell, R.W., 2019. A first report of microtektites from the shell beds of southwestern Florida. *Meteoritics & Planetary Science*, 54(7), pp.1594-1603.

7. Warning: I have been struggling with computer issues for the last month or so, including unintended shutdowns. If this occurs during class, just hang on and I will try to get back on

asap. If not, I will close class with an email, and you will have the PDF for that day. We will catch up as best we can the following meeting.

8. I hope that we will be able to use a common password and ID for the semester:

Meeting ID: 915 2836 6986

Passcode: 170888