Papers read during Spring 2011 with questions for Mineralogy

All papers were taken from Geology

Goals

- Give the students an understanding of how mineralogy relates to current research in geology
- Introduce the students to reading primary literature with relatively interesting, comprehensible papers
- Move away from pure lecture towards more discussion during class

Format

- pdfs of papers posted early in the week on Moodle along with reflection questions
- Answers to the questions were due back to the instructor (typed) at least 30 minutes before the start of class on discussion day
- Responses used by instructor to start the discussion, which attempted to involve all of the students
- Discussions varied from a short 15 min to the full 50 minutes available depending on student interest

Choosing papers

- Top 11 minerals for entire course chosen and each mineral then given one paper (we missed three due to snow / campus-wide shutdowns)
- Tried to find papers published within the last year, but allowed for a maximum of 10 years if more recent couldn't be found
- Attempted to cover a wide-range of sub-disciplines with geology to spark the different interests of the students

Successes & Pitfalls

- Some papers just couldn't drum up any student interest
- For some minerals, there is not much choice in the recent Geology archives
- The magnetite paper resulted in the students ON THEIR OWN coming up with a Nature/Science-worthy study if only Gustavus had the appropriate lab space
- Over the course the semester, the students asked more & more intelligent questions about how various studies were conducted and the methods employed
- The methodology varied quite a bit from paper to paper and gave me a chance to discuss a wider range of techniques used in geology then I otherwise would have addressed in mineralogy
- Taking the time to find papers and write intelligent reflection questions varied quite a bit from week to week

Questions asked every week

- terms you didn't understand?
- concepts that were hard to grasp?

1st week: quartz

Amor et al. (2008) – A Precambrian proximal ejecta blanket from Scotland

- make a list of the characteristics of an impact crater vs. a volcanic unit
- what kinds of data did the authors use to support the impact hypothesis for the Stac Fada Member?
- why is quartz important for this study?

2nd week: magnetite

Paasche & Lovlie (2011) – Synchronized postglacial colonization by mangetotactic bacteria

- what are MTBs?
- what is the primary question the authors are trying to address?
- what kind of data did the authors use?
- would this kind of study work in MN? How would you choose your lakes?
- to support the "bird repopulated the MTB" theory, what kind of study do you think might help?

3rd week: K-feldspar

Tyrrell et al. (2007) – Drainage reorganization during breakup of Pangea revealed by in-situ Pb isotopic analysis of detrital K-feldspar

- why is galena useful is nailing down the Pb isotopic composition? (hint: look at its formula)
- what site does the Pb2+ reside in K-feldspar? What kind of solid solution does that represent?
- what was the main question the authors were trying to address?
- what data did the study use?
- how is the data used to determine which way currents flowed during the Triassic & Jurassic?
- looking at figure 3, to test current direction theory pick another site to analyze the sediments in. Where is it & why did you pick that location?

4th week: halite

Schubert et al. (2009) – How do prokaryotes survive in fluid inclusions in halite for 30 k.y.?

- What is the main question the authors are trying to address?
- what is a halophilic prokaryote?
- what are some of the previous problems with this type of study?
- wbat are the arguments that their data "clean" of the former problems?
- what kind of data did the study use?
- what is the success rate for growing the Archaea?

- why did they emphasize that Dunaliella was present several times?

5th week: plagioclase
de Silva et al. (2008) – Triggering explosive eruptions—The case for silicic magma recharge at Huaynaputina, southern Peru

- what is the main argument the paper is trying to make?
- what kind of data is used by the paper?
- what are the five (remember the microlites!) types of plagioclase (in your own words)?
- where do the authors believe each type of plagioclase formed? why?
- can you come up with an idea of why Fig. 3 goes from part (a) at the bottom to parts (d) & (e) at the top?

6th week: pyrite
Pufahl et al. (2010) – Does the Paleoproterozoic Animikie Basin record the sulfidic ocean transition?

- what's the main purpose of this paper?
- why is it important to understand when the ocean became oxygen-rich?
- why did the study look at disseminated types of pyrite?
- in what types of environments was the pyrite found?
- what is a euxinic environment?
- what is the importance of when the meteorite impact occurred at Sudbury for this study?
- if you were these authors, what would your next proposal to NSF involve?
- <u>Comment and reply exist for this paper, though not discussed in class because they were published after the semester was over</u>

7th week: garnet
chosen paper: Pandey et al. (2010) – Evidence of former majoritic garnet in Himalayan eclogite points to 200-km-deep subduction of Indian continental crust

problem: it was retracted between the date I chose it in January & when the class was going to read it in late March

solution: ask each student to find their own garnet paper in the <u>Geology</u> archives and then answer the following questions:

- why did you choose this paper? (be honest!)
- what's the main point of the paper?
- what kind of data did the paper use?
- how do the author's interpretations link back to their data?
- if you were using this paper as the touching off point for an application for funding from NSF, what would you propose to do?

Other solution I consider: read the retracted paper & discuss why it was retracted, but I decided to give the students a chance to pick a paper for once

8th week: olivine

Berry et al. (2005) – Fingerprinting the water site in mantle olivine

- why is WHERE water resides in the mantle an important question?
- how does this paper help address the question of where the water is located?
- what kind of data is used by the paper?
- look up the formulas for humite & clinohumite -- what kind of minerals are they?
- what is the take-home message of this paper?