EXERCISES WITH MINERAL NAMES, LITERATURE AND HISTORY

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INTRODUCTION

This is not primarily a laboratory exercise. It is a series of exercises I assign outside of class time, with the purpose of getting students to explore the literature resources that are available for mineralogy. The inspiration for the exercises comes from my exasperation with the repeated questions: "Why do we have to know so many minerals?" and "What about these minerals do we have to know?" Rather than saying "Everything that is important," I hope to show students that what they need to know depends on what questions they hope to answer, and that mineralogy developed in historical context, parallel with other sciences.

The exercises are designed to stretch over several weeks. I begin the first exercise on the first day of class, and give one assignment per week, but the timing of assignments is flexible. Though the assignments can be incorporated, at the end, into a term paper or research report, I find the separate assignments to work better than the assignment of a single term paper at the outset. With the series of exercises, students do all of the work that might go into a term paper without the intimidating impression of a "magnum opus;" they do the work in a logical (?) progression of increasing complexity of information; the evaluation of students' progress is incremental, so that timely help can be given; and the load of correcting the material is distributed over the term. If I assign a paper or report as the final product, I do not tell the students until they receive assignment 5. Specifically to avoid the impression that these are major assignments, I present them informally, just as handwritten notes that indicate the assignment and the due date.

ASSIGNMENT 1

Write a paragraph summarizing the origin and meaning of the mineral name you have been given. Provide references to where you found the information.

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I give each student the name of a mineral. These are taken from the short version of Deer, Howie and Zussman, and are specifically minerals that are <u>not</u> in their mineral sets in lab, and many of which are not in their course text. They are allowed to use any sources they wish to gather information on the mineral name.

When students hand in the mineral name exercises, I briefly discuss the types of literature resources that might be used, specifically pointing out the difference between primary and secondary sources. I also discuss the task of evaluating the reliability of sources.

There are three positive outcomes at this stage of the exercise.

1. Most students have gone to the library, and have accessed the library's databases, looking for relatively uncommon mineral names. In some cases, they haven't found anything.

2. They've begun talking to each other about how to do the exercise. The more inventive have started looking on the shelves in the mineralogy section, or in the reference section. Some have talked with librarians about internet sources and searches. The most exasperated have come to talk to me about how hard the assignment is.

3. Almost all students have had a taste of the "history" of mineralogy, and of how minerals are named. This can serve as a springboard for discussing ideas about what makes one mineral different from another, and what information is needed for distinguishing them.

ASSIGNMENT 2

Find three references in which your mineral is discussed. Hand in a sheet with these citations in GSA format, and a photocopy of the first page of each.

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After reviewing these assignments, I give "awards" (last year, "Looney Tunes" pens!) for the oldest citation (1909), the most recent citation (1996), the most bizarre citation (Journal of Neurophysiology!), the least useful citation (Grolier's Encyclopedia; National Geographic), the best overall assignment, the worst overall assignment, etc. The point is to involve as many students as possible, and to make the assignment series a light-hearted exercise. I reiterate the discussion of primary and secondary sources. I ask for photocopies because some students merely copy references from a catalog or index, and never look for the source material. If they do not look for a particular journal, they may never realize that some literature is not readily accessible, either because the library doesn't have the journal, or because the article is in a foreign language!

The outcome of this assignment is that students become aware of the range of literature that might need to be reviewed, and of the idea that each source has a unique format for reporting information. By now, some students start getting possessive about "their mineral."

ASSIGNMENT 3

Write a page-long summary of why your mineral is important. You can use the references you found in Assignment 2, but you might need to find more information.

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About halfway through this assignment, up to 30% of the students in the class have come to me asking "What do you mean by important? Do you mean that the mineral is used to make something, or what?" Depending on how vocal these students are, their questions can be used as a springboard for addressing the question of "importance" for the whole class. Many students will find the concept of importance to petrology unsatisfying ("Who cares whether it helps to determine the P-T-X conditions in Timbuktu?")! This offers the opportunity for developing the idea that the minerals students encounter in lab and class are but a fraction of those that are important to somebody, for something. Importance is in the eye of the mineral-holder. A student who was assigned melilite couldn't find references to melilite in terrestrial rocks, but found references to melilite in chondritic meteorites, and ended up concluding that melilite was important because it tells us how the solar system formed. Spodumene has been very successful, because recent work in the materials science and ceramics fields have capitalized on the spodumene structure, and several students discovered that there is mineralogy outside of geology. This assignment is the core of the discovery process that the series is designed to facilitate.

ASSIGNMENT 4

Interpret all of the information on the first page of the mineral's description in Deer, Howie and Zussman, and hand in an essay explaining all of the information.

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I give the students copies of the relevant pages from Deer, Howie and Zussman. Some of this is straightforward - the symbols for hardness, density, etc., should, by the fourth week of the term, be readily understood. But some of the data, particularly on unit cell size or optical properties, is opaque to the students. It encourages the students to teach themselves.

This assignment is geared to get students thinking about how they might identify the mineral. Many of them don't get the connection, because I don't babysit them through the exercise. They decide that optical properties or unit cell dimensions or strongest XRD lines are not important or relevant to them. These impressions might be corrected with the next assignment.

ASSIGNMENT 5

Identify this unknown, and write a report detailing your methods of identification.

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I give the students unknowns that contain their mineral, and support them in using whatever means they need to identify the mineral. I encourage them to use optical mineralogy as the initial identification method. For some minerals, it is virtually impossible to find appropriate samples (merwinite, anyone?), but for others, it is relatively easy. Most students haven't expected their mineral to show up as an unknown in their laboratory exercises because it is not in their mineral sets. I have followed through on this part of the assignment series only with a few students, simply for want of good samples. In no case were the students able to link their literature research with processing of an unknown. Some way, short of telling the students that "this unknown contains your mineral," is needed for making this linkage evident.

Obviously, the final report can be a full-blown term paper or research report, or it can be a one-page summary of the identification and analysis procedure.

The minerals I have used in this exercise to date are:

aenigmatite	allanite	astrophyllite	chloritoid	clintonite
eudialyte	kosmochlor	larnite	margarite	melilite
merwinite	mullite	piemontite	rankinite	spodumene
stilpnomelane	tilleyite			

I have found usable sample material for allanite, astrophyllite, chloritoid, eudialyte, margarite, melilite, piemontite, spodumene and stilpnomelane. Kosmochlor is a bust; I found it very difficult to get good information. I'm sure there are other and better minerals to use. My students do not have jadeite, pumpellyite, prehnite, glaucophane or lawsonite in their mineral sets, but do need to know about them in petrology; these would be obvious targets. I have restricted the exercise primarily to silicates because identification of many sulfates, phosphates and carbonates with optical methods is difficult. I have specifically excluded opaque minerals because I do not introduce my students to reflected light microscopy.