Jackfork Group research project

What I want them to do:

1. Make observations on the rock types encountered in the JFG units.
2. Make basic interpretations of processes based on these observations.
3. Make observations on bedding style in the JFG units.
4. Make basic interpretations of processes based on these observations.
5. Make basic observations of grain size in the JFG units.
6. Make basic interpretations of processes based on these observations.
7. Write up their observations and interpretations.

Recall that the major goal of this course is to teach you how to interpret the sedimentary rock record. In general, you do this using three, fundamental steps:

1. Make careful observations of the rocks
2. Make reasonable interpretations of the details of the rocks based on these observations
3. Stitch your interpretations together to create an internally consistent interpretation of the environment in which the rocks were deposited.

In fact, this pretty much describes what geologists do whenever they interpret rocks; it's just that it's much clearer to see how this works for sedimentary rocks than for, say, igneous or metamorphic rocks.

For you to learn how to do this, you need practice. The projects in this course are designed to give you that practice. For this first project, I will lead you through the steps necessary to do this. Each future project will build on the material you've learned in the prior project.

Exercise: Basic clastic lithologies

Goal: make key observations of sandstone, shale, breccia, conglomerate

Give them grain size cards for this exercise.

Do this as a gallery walk: each group will have 2-3 minutes each and must make as many observations as possible. Can modify other observations if necessary. Come back and summarize their initial poster.

Cycle around a second time and make an interpretation or a guess at some type of place on earth where this rock might form of each rock. Then summarize at end.

Exercise: Jackfork Group lithologies

Goal: to come up with a 1 or 2 paragraph description of the rock types found in the Jackfork Group DeGray spillway section.

Stations with computers that are pictures. Stations with rocks for samples I do have. Write up description of each in their own words, then exchange write-up with a partner and read for content and grammar. Then have some of them read them out loud.

Mud-poor sandstone
Mud-rich sandstone
Mudstone
Mud-clast breccia
Shale (very rare)

Exercise: Jackfork Group lithologies in thin section

Goal:
1. Give inexperienced scope users some practice with the scope.
2. Determine composition of the sandstones and be able to visually distinguish between a mud-rich and mud-poor sandstone in thin section

In pairs—one scope-experienced, one not—look at examples of mud-rich and mud-poor sandstones.

- Recognize difference between framework grains and matrix
- They need to be able to identify the composition of the framework grains
- Describe the matrix and framework grains

Have five thin sections and each pair for the first ts, gets 10-20 minutes, then rotate through ts. Each pair gets 6-8 minutes. Give them photomicrograph of a mudclast

breccia as one of the ts's.   In the end, have an unknown ts projected and they have to take a quiz on the ts and turn it in.

Exercise: observing, characterizing, and interpreting bedding
Goal: to interpret a sequence of strata based on the geometry of bedding and the lithologies present.

Not sure how to do this effectively.

Do something that gets them to think about what is meant by the term 'bed'. Get them to understand the idea of a 'sedimentation unit' versus a 'bed.' Understand what is meant by 'bedset' versus 'bed.' Get them to think about laminae versus beds.

Do something that gets them to interpret a sequence just in terms of bedding geometry and basic lithology.

Exercise: estimating grain size from thin section

Each student estimates grain size based on long axis grain lengths of 20 grains, selected at random. Then pool the data into a larger dataset to see what happens to estimate of mean. Use Excel to plot cumulative freq histogram. Make estimates of median, mean, and std. deveiation.

Exercise: sieve analysis of grain size of the St. Peter: do as an each-one-teach-one

Collect suite of samples from end of street. Each student sieves and analyzes their sieved sample.

Exercise: analyzing grain size data through JFG clean sandstone beds.

I provide data in Excel format. Students correlate these data with strat columns.

Exercise: physical modeling of a gravity flow

Exercise: in-class discussion of reading on particle transport by sediment-gravity flows

Exercise: *Graph du jour* for St. Peter

Exercise: *Graph du jour* for JFG

Lecture topics

- Statistical parameters of grain size; plotting grain size data
- Using Excel
- What is a strat column
- Sandstone petrography: dominant compositions of framework grains (QFL); detrital vs. authigenic matrix; matrix composition; cements.

Reading assignments from Boggs

- Classification of clastic lithologies
- Bedding and the nature of contacts
- Representation of strat sections in strat columns.
- Something on sst petrography
- Sedimentary textures
- Sed transport by sgfs
- What is a depositional environment and a sedimentary facies?

Project 1:
Sedimentology of the Jackfork Group, DeGray spillway near Caddo Gap, Arkansas
Due: September 30, 2003

Over the next month or so, we will use the Pennsylvanian age Jackfork Group (JFG) to get some initial practice at interpreting sequences of sedimentary strata. I chose the JFG for a couple of reasons:

- I did my dissertation research there, which means that…
- I have an excellent data set for these rocks and…
- I am very familiar with these rocks and…
- the sequence is, at first blush, relatively straightforward to understand.

I have created a website that serves as a "virtual field trip" to the JFG units. This web site provides background information, images, and data that you will use in this project. You can get there from the course Blackboard site (Click on the "course web site" button on the left) or go to:

http://webcampus3.stthomas.edu/tahickson/sedstrat/

Then go to the "Links supporting the course projects" link.

Project goal

To answer the basic question: "How were the DeGray spillway units deposited and in what type of environment did they form?"

How will we attack the problem?

Over the next few weeks we will work in and out of class to address the material you'll need to know to interpret these rocks. First, we will spend some time thinking about the meaning of different lithologies (rock types) found in the JFG. You'll look at some actual rocks from the JFG, both in hand specimen and in thin section. Second, we will focus on the general style of deposition of some of the JFG units, mainly looking at the nature of bedding and contacts. Finally, we'll dig into the issue of grain size, how we measure it, how we analyze it, how we plot it, how we interpret it.

I will assign some specific readings to help address these issues. More likely, I will ask *you* to delve into your textbook and other sources on your own to answer some of the questions that will certainly arise.

Project deliverables

- A four to five page project write-up that follows the format outlined below
- A separate analysis of grain size for selected beds from the outcrop that accompanies the write-up

Project milestones

- September 12: Submit description of rock types of the JFG by 5:00 p.m.
- September 18: Submit description of bedding styles (1 to 2 paragraphs) at beginning of class
- September __: Graph *du jour* due (plot of sieved grain size data from St. Peter sandstone)
- September __: Graph *du jour* due (plot of grain size trend data from JFG)
- September __: Analysis of JFG grain size data
- September 30: Final write-up due.

Project write-up

- 12-point, Times font, double-spaced, 1.25" right and left margins and 1" top and bottom margins.
- Four to five pages, text only, not including figures.
- If used, figures should be attached to the end of the text, with sequential figure numbers and appropriately descriptive captions. Figures should be labeled "Figure 1," "Figure 2," etc. and all figures should have captions.
- The write-up should follow the outline below:
    - Introduction to the Jackfork Group and a statement of the research problem
    - Observations and description of JFG units
        - Lithology
        - Bedding
        - Grain size
    - Interpretation of JFG units
        - Individual interpretation of the significance of differences in lithology, bedding, and grain size trends
        - Integrated interpretation of lithology, bedding, and grain size trends