**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

# Jordan Formation Project

In class last week we came up with the following outline for the Jordan Project. Recall also that I suggested you look over the paper on the Wheeler Gorge Conglomerate (Walker, 1985) and use it as a guideline for writing up the Jordan Formation Project. You do not have to use the precise outline below, but you should follow the spirit of it. Also, recall that there are figures that should be associated with some portions of this outline and that must appear in your write-up.

**Outline**

I. Introduction
- A. Problem
- B. Location
- C. Age
- D. General description of Jordan Outcrops (Homer and Stockton)

II. Observation
- A. Lithologies
- B. Bedding
  1. Contacts
  2. Lateral pinch-outs
- C. Grain size
- D. Primary sedimentary structures
  1. HCS
  2. cross strat
  3. Other lamination
  4. Other?
- E. Secondary structures
  1. Trace fossils
  2. Laminated sst clasts as breccia at Stockton
- F. Fossils?

III. Lithofacies: description and interpretation
- A. Lithofacies 1
  1. Description
  2. Interpretation
- B. Lithofacies 2, etc.

IV. Discussion/Interpretation
- A. Interpretation of depositional environment
- B. Supporting literature
- C. Time sequential history of deposition (evolution of the depositional system)

## Project deliverables

- A project write-up that follows the outline we developed

## Project milestones

- October 23: Individual measured sections due at beginning of class, in Adobe Illustrator format
- October 30: Draft of Introduction, Observations, and Lithofacies descriptions section due at beginning of class, ***with figures.***
- November 6: Draft of final write-up due at beginning of class (bring 3 copies)
- Thursday, November 13: Final write-up due at beginning of class.

**Interpreting your individual strat columns in terms of primary and secondary sedimentary structures**

**You and your field partner should submit a write-up by the end of class today that includes the following:**

- A written description of your individual measured section (this will be given to everyone in the class to accompany the overall measured section that I will compile from your individual sections). This should be a written description of your observations and *must* include a description of primary and secondary sedimentary structures, and their variation over your section (if any).
- An interpretation of the primary and secondary sedimentary structures in your measured section, based on our discussions of cross stratification in class, your textbook, and the Rubin bedforms site.
- In your interpretation, make sure that you address the following:
    - What kinds of bedforms made the cross strat you see? 2D or 3D? Unidirectional, oscillatory, or combined flow? What are reasonable depth and velocity conditions for these bedforms?
    - If you have trace fossils: what *trace fossil assemblage* do they belong to (see Boggs, pp114-123) and what is the significance of this assemblage?

This write-up should be done in Word, following the usual guidelines (12-point, Times font, double-spaced, 1.25" right and left margins and 1" top and bottom margins).

**The group's measured section**

While you are working on the above, I will attempt to piece together your individual measured sections in Adobe Illustrator, then make this section available on the course website. Once I have completed this (hopefully before the end of lab today), I will make hard copies of it for you. However, for your final copy, you will want to modify this section to make patterns, fonts, etc. consistent.

**Basin-scale stratigraphy and stratigraphic architecture: using Jurassic Tank to understand large-scale stratigraphic controls (DUE: 12/11, end of lab)**

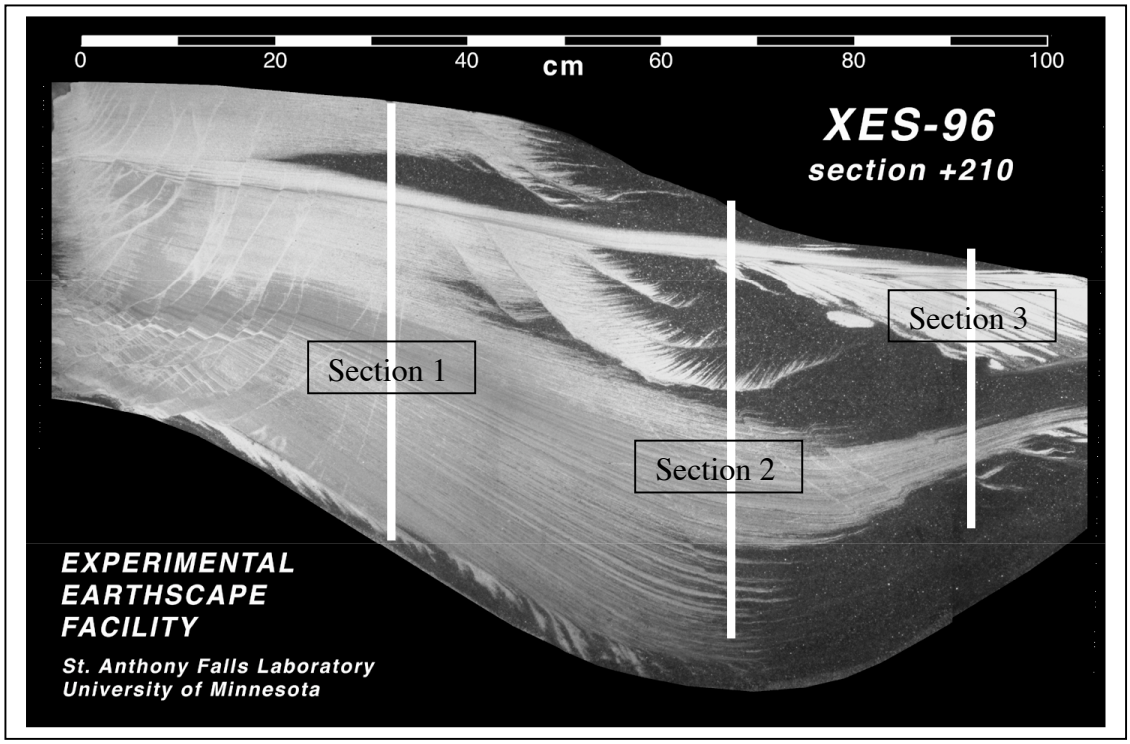


Figure 1. Dip section (cut parallel to flow) of the Jurassic Tank 96 run stratigraphy, taken about mid-way through the experimental deposit. Flow is from left to right. White material is fine sand (that behaves like the coarse fraction) and the dark material is crushed anthracite coal (that has a lower density than quartz sand and behaves like the fine, mud fraction).

**Goals**

By the end of this project, you should be able to:

- explain how Jurassic Tank works, why it was built, and how it can be used to link the real world (outcrops and subsurface, well data) with numerical models of basin-scale sedimentation.
- interpret a cross section diagram, like figure 1, in terms of changes in base level, subsidence, or sediment supply.
- link specific, real-world depositional environments to parts of figure 1 and understand how they respond to changes in base level, subsidence, or sediment supply.
- apply sequence stratigraphic concepts and terminology to the cross section diagram (figure 1).

**The project**

By now you have traveled to the St. Anthony Falls Lab, seen how Jurassic Tank works, and you understand how images like figure 1 were made. For this project, you should consider figure 1 as your outcrop or analogous to a seismic line. You can find a very high resolution version of figure 1 on the course website. For this project, you should place all of your interpretations on this high resolution version (not the one above), using Adobe Illustrator. No line drawings overlain on a paper copy will be accepted; you must make your interpretations and other illustrations using Adobe Illustrator.

The final product for this project is a poster, created in Adobe Illustrator, with the following dimensions: 32" tall by 50" wide. We will not print these posters out at full scale. You will save them as Adobe Acrobat .pdf files and make a small (11" X 17") print out to hand in along with the digital .pdf document. Poster specifications will be outlined below. The poster will be an integrated interpretation of the cross section above.

**Parts of the poster:**

*Interpreting depositional environments*

What real-world depositional environments might JT effectively emulate? In other words, JT can be viewed as an analog for several different, real-world environments (laterally linked and vertically stacked *via* Walther's Law); on a digital version of figure 1, label these different environments by outlining their deposits in different colors and provide images of these environments (you can download images from the web or scan them in using the scanner in the back of the room) so that the viewer has an idea of what these analogous environments look like in the real world.

*Stratigraphic sections*

On figure 1 you will see the location of three measured sections (sections 1 through 3). What would measured sections look like at these locations and what would a correlation diagram look like? Your measured sections should embody the real-world depositional environments you outlined above. What this means is that your stratigraphic sections shouldn't just be coal and sand, but should take into account the *actual* features you might expect to find in the depositional environments that they cross. You should also think about coarsening and fining upward trends and how this would be reflected in the details of the stratigraphic section(s). The correlation diagram should show how different lithologic units are correlated laterally, based on what you know about the cross section.

*Interpreting the overall architecture of figure 1*

As you know, one of the great advantages of Jurassic Tank is that we can precisely control the main parameters that affect the geometry (architecture) of a stratigraphic section or sedimentary basin fill. In a well-designed experiment, we would only change one parameter and see how this one parameter affects the stratigraphic architecture. This is what was done to produce the stratigraphy you see in figure 1. One parameter was changed and all else remained constant. The final part of your poster should be an interpretation of figure 1 that answers the following question: "what parameter was changed to create the stratigraphy of figure 1 and how was that parameter changed through time?" This interpretation should follow a sequence stratigraphic framework (ch. 15 in Boggs), looking for sequence boundaries, maximum flooding surfaces, etc. You should incorporate a short write-up that explains your interpretation. Although in reality only one thing was changed, there is more than one right answer and interpretation here; you just need to support your interpretation effectively.

**Poster format**

- 32” tall by 50” wide (template available from course web site)
- Font:  36 point minimum
- The poster should have a descriptive title (144 pt) and your name
- All figures should be readable from a distance of 5 feet (view at 100% zoom and see if you can read the screen from 5 feet away)
- The final poster should be saved as a .pdf file and uploaded to my computer by the last official day of class (December 11) at the end of lab time.