Geology 202
Lab 2
Fluvial Erosion of Bedrock
Fall, 2006

Name:_____

Tools Needed:
- field notebooks
- tape measure
- meter stick
- flow meter
- measuring tape
- rock hammer
- altimeter (downstream elev. 322.5')

General

Last week we examined evidence along a bed-load dominated stream (The Plotterkill) that reflects the way that streams move large boulders and cobbles. As these clasts move downstream they can have a big effect on the underlying bedrock. Water by itself is unable to erode solid rock, but water carrying sand particles or rolling large clasts can cut into solid bed rock at rates that can be as high as 1-10 cm yr^{-1}. These are some of the highest erosion rates by any geological process. Tell tale signs of recent fluvial erosion are the sculpting of underlying bedrock into streamline channel forms, and, occasionally the occurrence of pot holes.

Today we will be examining the long term effect of bed load transport on underlying bedrock. First we will look at the bed of Canajoharie Creek to see what a modern stream is doing. Our second stop will be near Little Falls, NY to examine the effects of past flow conditions of the Mohawk River that were controlled by a very different set of factors than those in effect today.

Stop 1: Canajoharie Creek

The Canajoharie Creek is a north-flowing tributary to the Mohawk River that has been downcutting to keep up with a falling base level. In short, the Creek is rapidly cutting into its soft bedrock, and this has produced some excellent examples of fluvial potholes. These features form by differential erosion of bedrock by rock to rock abrasion and percussion (Fig. 1). Questions to address in your lab report are:

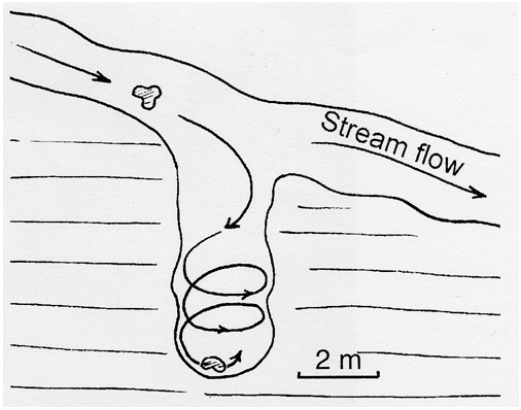

Figure 1. Schematic diagram of pothole formation from Martini et al. 2001.

A. What lithologies present at this location?

B. How do the rock characteristics affect the type of bedrock erosion and the cross valley profile of Canjoharie Creek?

C. Is there any relationship between the width and depth of the potholes here? What does this relationship tell you about the process of pothole formation and/or the physical properties of the underlying bedrock? To answer this, you will need to measure the width and depth of at least 12 potholes, and record your data in your notebooks.

D. Other than mechanical erosion, how else does the bedrock here erode. Sketch in your field notebooks the features that are indicative of this process.

Stop 2: Potholes on Moss Island, Little Falls

Here we will see a spectacular example of fluvial bedrock erosion that occurred under very different conditions than we saw at Stop 1. During the waning stages of the last Ice Age, the Mohawk River was the principal meltwater channel for the sector of the Laurentide Ice Sheet that covered the Great Lakes (Fig. 2). At this time, the Mohawk River would have had a discharge and sediment load that was many times greater than the present Mohawk. At this stop we can see the effects of that higher discharge.

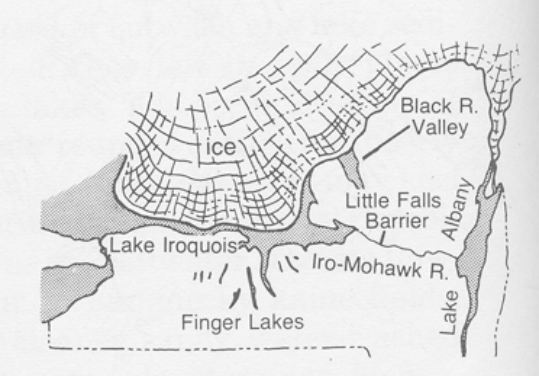

Figure 2. Laurentide Ice Sheet extent when meltwater drained through the Ancestral Mohawk River (from Van Diver 1985).

A. Take a few minutes to describe the lithology of the rock here. What kind of rock is this? Is this unusual for the Mohawk Valley?

B. This outcrop was the bed of the Mohawk River with tremendous volumes of turbulent water flowing over it. Why did potholes form rather than just wearing down or removing parts of the ledge?

C. Field measurements: Describe the potholes. This would be a good place for a sketch. What is the range of pothole diameters and depths exposed on Moss Island? Measure and record the depth and widths of at least a dozen potholes. How does the relationship between width and depth of potholes differ from what you found at Stop 1? Explain the origin of this difference.

D. What is the relationship between elevation and the abundance of potholes? What is the significance of this relationship?

E. What is the relationship between the abundance of potholes and the side of Moss Island that you are on? What is the significance of this relationship?

References

Martini, I. P., M. E. Brookfield, and S. Sadura, 2001, **Principles of Glacial Geomorphology and Geology**, Prentice Hall, Upper Saddle River, p. 79.

Van Diver, B., 1985, **Roadside Geology of New York**, Mountain Press.

Reports

You will not be doing a full-fledged lab report for this week's lab. Instead, I want you to answer each of the questions posed above and include the following figures and tables.

Figures to include:

- one Excel x-y scatter graph that plots the width (x axis) and depth (y axis) of your pothole data from Stops 1 and 2. The data from the two stops should be entered as separate columns but plotted on the same graph—we will go over graph construction in class. Graphs must have a detailed caption that explains what is plotted and what the main point(s) are that should be evident to the reader.

Table to include:

- the raw data that you collected in the field. Table must be complete with a caption