Geology 202
Lab 1
Clast Fabric
Fall, 2006

Name:__________________________

Tools Needed:

- field notebooks
- Brunton Compasses

General

In this lab, we will focus on the orientation of clasts along the Plotterkill and in deposits that underlie terraces in the Plotterkill Preserve. *Clast fabric* refers to the preferred orientation of clasts that are contained in deposits of loose unlithified sediment or lithified into conglometrates. Clast fabric can yield important clues as to the mode of deposition of a deposit. Fluvial deposits generally have a fabric that distinguishes them from debris-flow deposits, and these in turn have fabrics that are different from till (a type of glacial deposit). A well-developed fabric indicates that that individual clasts have moved freely with respect to each other and have assumed an orientation imposed by the flow (Harms et al., 1982). Strong fabric is usually found in deposits that are dominated by clasts of a single dominant grain size (termed unimodal); these deposits are referred to as *clast supported*. The clasts in a clast-supported deposit are typically touching one another. In contrast, *matrix supported* deposits are those in which the clasts are separated form one another by particles of a much finer grain size (the matrix); matrix supported deposits generally have a weaker fabric, except in the case of some types of till.

To document fabric, one must first determine the 3 main axes of a clasts. The a-axis is the longest axis, the b-axis is the intermediate axis and the c-axis is the shortest axis. Thus, a perfectly spherical clast has no axes and cannot have fabric. Fortunately, most clasts are not perfect spheres, and *can* have fabric. However, it is important to note that not all depositional processes produce clasts with a strong fabric. For additional background information on clast fabric, read the handouts provided with this lab. To assess the fabric of a deposit one must measure the orientation of a *randomly-chosen* representative number of clasts in a deposit and process this data either statistically, graphically, or both. The simplest measurement of clast fabric is accomplished by measuring the *direction of dip* of the a-b plane. This is the plane containing the a and b axes, as defined above. These data are then plotted on a circular histogram, which is called a *Rose Diagram*.

Objectives

1) to document the fabric of clasts along the bed of a gravel-dominated streams in the Plotterkill Preserve
2) to compare the preferred orientation of clasts from (1) with the known modern flow direction of the stream
3) to explain the origin of the fabric noted
4) to measure the fabric of clasts in late Quaternary deposits of unknown origin that underlie stream terraces along the Plotterkill, and to compare the fabric measured in the deposits with that noted along the stream bed.
5) to hypothesize as to why or why not the fabric in the deposits differs from that noted along the stream bed

Part I. Data Acquisition

Stop 1: Gravel Bars along the lower Plotterkill

After reviewing the use of a Brunton compass and the process of measuring fabric using the *right-hand rule* you will measure the fabric of representative clasts for approximately 30 minutes. You will need to record the strike of the a-b plane of clasts in your field note books. Take careful measurements and measure a *representative sample* using *the right-hand rule,* and be sure to measure the orientation of the stream bed in which you measured your clasts.

Stop 2: Deposits of unknown origin along the Plotterkill

Here you will measure the fabric of as many clasts as possible along the exposures to the south and north of the Plotterkill. To measure the fabric of clasts in a deposit, you will need to use your notebooks to "extend" the a-b planes out of the outcrop face. In some cases you might need to carefully extract the clast and then measure the strike of its a-b plane. Measure as many clasts as possible until 3:50 PM, when we will need to begin hiking back to the van.

Part II. Data Processing:

Data processing for this lab will involve plotting your data into 2 Rose Diagrams (one for each stop), using ROSY™. Procedures for doing this will be reviewed in class and in the software handout for ROSY™.

Part III. Report:

Write a report with all of the standard headings (see *Lab Report Guidelines*) in which you address the following questions directly:

1. what is the relationship between the clast fabric noted at Stops 1 and 2 and the direction of flow of the streams at these localities? Consult the Rotterdam Junction, NY 1:24,000 topographic map, which will be available in OLIN 307.
2. if you noted a fabric what is the origin of this fabric? Consult the handouts given with this lab (Harms et al., 1982; Pettijohn, 1975; Boggs, 1987)
3. if you found a deposit of stream gravel with no stream nearby, do you think that clast fabric would enable you to determine the direction paleoflow? Explain. What are some of the limitations of using clast fabric as a paleoflow indicator?
4. How does the fabric from Stop 2 compare with that noted in Stop 1. Explain what this might tell you about the origin of the deposits at Stop 2.

Figures to Include:

- Rose Diagrams from Stops 1 and 2. Both rose diagrams must be incorporated into your text immediately below their first citation, and both figures must have a **caption immediately below them** as described in the *Lab Report Guidelines*. Also, make a big arrow to indicate the direction of flow of the Plotterkill on both of your Rose Diagrams (consult the Rotterdam Junction 1:24,000 topographic map).

Tables to Include:

- An EXCEL™ table with two columns: one of the raw data (strike of a-b plane) and one of the dip direction (1st column + 90°). This table must have a title at the **top** of the page as described in the *Lab Report Guidelines*.

References Cited

Boggs, S. J., 1987, *Principles of Sedimentology and Stratigraphy*: Columbus, Merrill, 784 p.

Harms, J. C., Southard, J. B., and Walker, R. G., 1982, *Structures and Sequences in Clastic Rocks, Lecture notes for short course No. 9*: Tulsa, Society of Economic Paleontologists and Mineralogists.

Pettijohn, F. J., 1975, *Sedimentary Rocks*: New York, Harper & Row, 628 p.