

GEO231 – Geoscience Field Methods
March 31, 2011
Introduction to Structural Analysis

Today's exercise will introduce you to the analysis of deformational structures - including folds, faults, and fractures – as they occur in part of the Belt Supergroup near campus. We will use a brunton compass to measure the orientation of various features and plot their distribution using a stereonet.

Part I: Introduction to Stereonets:

Stereonet are used to visualize planar or linear structural data. To hand plot planar or linear data on a stereonet, first set up your stereonet by using a thumbtack and tracing paper to attach the tracing paper to a paper copy of a stereonet. The thumbtack should be located in the dead-center of the stereonet, which you can see through the tracing paper. With due north (0 degrees) oriented at the top of the paper, outline the perimeter of the stereonet in pencil and make tickmarks for each ten degree increment along the outside perimeter of the stereonet.

To plot a plane use the ticks along the perimeter of the stereonet to mark the strike of the plane by placing a separate tick at the appropriate spot. So if your plane strikes 120 degrees, put a tick mark at 120. Next, rotate the tracing paper about the thumb tack so that the tick you just placed is due north. Determine whether the dip of the plane is left (west) or right (east) of the center point and use the marks on the E-W line (i.e., the 'equator') of the stereonet to place a tick on that line at the spot corresponding to the dip magnitude of the bed. Shallow dips should plot close to the perimeter of the stereonet, whereas steep dips should plot closer to the center point. After making the tick mark, carefully use the great circle arcs on the stereonet to draw an arc from the north pole to the south pole, passing through the tick located on the E-W line. Once the arc is drawn, rotate your tracing paper back so that north is at the top again.

To plot a linear feature, you will need trend and plunge. Start by marking a point on the perimeter of the stereonet that corresponds to the trend. So, if the trend is 45 degrees, you should put a tick on the tracing paper at the 45 degree mark. Next, rotate the tracing paper so that the mark you just put is located on the E-W line of the stereonet. Use the increments on the E-W line to count in from the perimeter of the stereonet the number of degrees corresponding to the plunge magnitude and put a dot there. The dot is the representation of the pole on the stereonet. Rotate the tracing paper back to normal with north at the top.

Although plotting planar and linear data by hand is useful, it is more typical to use a computer to plot planar and/or linear data on a stereonet. A very handy free stereonet program is available through Rick Allmendinger at Cornell University. On the computers in CHCB, download a copy of his stereonet software, available at:

<http://www.geo.cornell.edu/geology/faculty/RWA/OldPrograms.html>

Part II: Collecting, plotting, and analyzing structural data in Precambrian Belt Supergroup metasedimentary rock exposed along the Kim Williams Trail. During today's lab, we will walk down the Kim Williams Trail and use the brunton compasses to collect structural data from the Mt. Shields Formation within the Belt Supergroup. Work as a group of 2-3 people (max) to

collect as many bedding attitudes, fracture surfaces, fault planes, and axial surface of folds as you are able. Be sure to record your data carefully and separate each data type.

Back in the lab, hand plot all of your structural data, using the tracing paper method described above. Next, download and use Rick Allmendinger's program to plot the same data. This will involve a little hacking, but the program is quite simple and easy to learn with a little persistence. We will go over the basics in class. Lastly, write a short paragraph summarizing your results, and offer a sentence or two of interpretation. In particular, think about the prominent break in slope corresponding to the base of Mount Sentinel. Although we did not map this as a fault last week, is there anything in the structural data set collected today that might change your mind about this? If you think there is a 'Mount Sentinel Fault' is it active now? What would you do to figure this out?

Due at beginning of class time, Thursday, April 13: please hand in hand plotted and computer plotted versions of the structural data you collected on the Kim Williams Trail, along with your responses to the questions above. Please turn in one response per group of no more than 3 people. If you want to work by yourself on this project, that is fine as well.