M. Helper '96 Modified '00

LAB 1: USING A BRUNTON COMPASS & CONSTRUCTING A PACE AND COMPASS MAP

The compass is a very important tool for the field geologist. Today's lab is designed to familiarize you with its various applications and uses. Please read: p. 16-21 in Chapter 2 of Compton and the appended material entitled "Measurement of Attitude and Location".

<u>Objectives</u>: By the end of lab today you should know:

- 1. How to set the declination on a compass.
- 2. How to measure the strike and dip of a planar surface.
- 3. How to take a bearing and measure the bearing (or trend) and plunge of a lineation.
- 4. Your eye height and pace.
- 5. How to use a clinometer on a compass to measure heights.
- 6. How to apply some of these techniques to map objects using pace and compass measurements.

Procedures:

1. A. Magnetic Declination

Magnetic declination is a measure, in degrees, of the difference in the position of the **magnetic north pole** and the **geographic north pole** (**"true north"**). By convention, True north is the geographic reference for all bearings in map making. Because a compass measures bearings relative to magnetic rather than geographic north, a correction is required. This correction is made on the compass itself. By making this correction, the compass pointer is pointing to true north when the white end of the needle is pointing at 0°. Magnetic declination varies around the globe and changes slowly with time. The proper local declination for setting a compass should be obtained from an isogonic chart or a recent topographic map of the area of interest. The magnetic declination in the Austin area is about 8° east. This means that magnetic north is about 8° east of true north. Verify this by examining the isogonic chart (Fig. 1-17) on page 11, of the appended reading.

B. Setting the Declination on the Compass

The declination is set by adjusting the small screw located to the right of the cover hinge. By turning the screw, the compass card (see Fig. 1-14 in appended reading) is set to the appropriate declination. First, orient the compass so that the white end of the needle (or the yellow dot on some compasses) points at the index pin. In this position, the needle is aligned with the folding sighting arm ("pointer" of Fig. 1-14) and the compass is pointing at magnetic north. Next, turn the whole compass the proper number of degrees (8^o to the west in this case) so that the sighting arm points to true north. Now, adjust the small screw so that zero on the compass card lines up with the compass needle (the index pin should now point at 8^o on the W side of 0°). The declination is now properly set.

2. <u>Strike and Dip</u>: (read p. 34-38 in Compton, p. 5-6 in appended reading).

A. Strike with a Quadrant Compass

To measure the strike of a plane, hold the edge of the compass against the plane to be measured. *Making sure that the edge of the compass stays in contact with the plane you're measuring,* move the compass until the bull's eye level is centered. Read the compass card at the *white end of the needle* (which always points north), noting whether an imaginary center line through the compass (ie. a line connecting sighting arm, index pin and mirror center line) lies to the west or east of the white end of the needle. This is the strike of the plane. If the center line of the compass lies 30^o west of the white end of the needle then the strike is "north 30^o west" and is recorded as **N30W.**

B. Strike with an Azimuth Compass

The procedure is the same as with the Quadrant Compass, except that the reading is recorded as an azimuth, i.e. a number between 0 and 360°. You should get comfortable converting quadrant readings to azimuth and vice-versa, e.g. **N30W** is equivalent to **330**° in azimuth.

C. Measuring Dip

Dip is always measured at right angles to strike, thus we needn't measure the dip direction but only the amount of dip. We use the clinometer for this. Place the compass with the edge flat on the surface, *being sure that the edge is now perpendicular to strike*. Move the clinometer back and forth until the bubble is centered. *Read the 0-90 clinometer scale* (the 0-100 scale is % grade, not degrees!). This is the dip. Note the general direction of dip (ie. N, S, E, W). Record the strike and dip in the following fashion: N30W/20S. This is a plane with a strike of north 30^o west that is dipping southerly (more precisely, to the southwest) at 20^o. The same measurement recorded in azimuth is 330/20S.

For shallowly dipping surfaces (less than about 12°) the raised ring on the back of the compass prevents the edge of the compass from freely contacting the surface to measure strike. For such surfaces, the strike direction can be determined by 1) setting the clinometer to 0°; 2) placing the compass on the surface so that the pointing arrow is horizontal and the glass face is vertical; 3) moving the compass on the surface, making sure the edge stays in contact with the surface, until the clinometer bubble is level; you have now found the strike direction; 4) to measure this direction, tilt the compass about the strike direction until the glass plate is horizontal (bulls eye level is centered) and read the white end of the needle, as directed above.

Measure and record the strike and dip of the following surfaces:

Planar surface	Strike/Dip
 Inclined surface near steps in Geology courtyard Cover of the Daily Texan box near Geology 	
 Ramp outside Taylor Hall Polished inclined Granite slab in courtvard 	

3. <u>Bearing/Trend and Plunge</u>: (read p. 38-40 in Compton, page 7-8 in appended reading)

A bearing is a direction from one point to another. As opposed to strike, a bearing always has a unidirectional sense. Thus when making a bearing (or trend) measurement of an inclined linear feature ("lineation"), align the sighting arm *in the direction of plunge* and the white end of the needle will indicate the proper bearing. The measurement is read the same way as strike. Bearings are always taken with the compass horizontal; *the bull's eye must be level*. Four methods of measuring a bearing are given in the appended reading, page 13.

The plunge of a linear feature is the angle the feature makes with a horizontal surface. Plunge is measured like dip angle; as with the dip angle the plunge should be accompanied by a direction, usually given as the direction toward which the line is plunging. If the bearing is always recorded in the direction of plunge then a separate plunge direction isn't required. Bearing and plunge are recorded with a shorthand notion like that for strike and dip, eg. N45W/30 means a lineation bears 45^o west of north and plunges 30^o toward the northwest. The same reading in azimuth would be 315/30.

Measure the bearing and plunge of the three features below.

Linear feature	Bearing/Plunge
1. Line on Ramp outside Geo.100	
2. Railing outside Geo. 100	
3. Line on polished inclined Granite slab	

4. Eye Height and Pace:

Measure your eye height (in the lab using the scale drawn on the blackboard) and your pace (on the course set up outside).

 Eye Height
 m.
 Pace
 m.

 ______ft.
 ______ft.
 ______ft.

5. <u>Measuring heights using the clinometer</u>: (Compton, p. 19)

Using the procedure outlined on page 19, Compton, measure the height of the flagpole in front of the ROTC building.

Recall: Height = (horizontal distance) x (tangent of vertical angle) + Eye height

Horizontal Distance	ft. m
Vertical angle: Tangent Vertical Angle	0
Height of the flagpole	ft m

6. Pace and Compass Map:

Equipment: Brunton Compass, protractor, ruler, calculator and clipboard. Graph paper provided.

<u>Exercise</u>: This exercise will help you develop skills in pacing and measuring bearings. Such skill are needed when mapping traverses, or the geology of an area in detail (see Compton, p.75-80). When performing an actual traverse in the field, all geologic information (strike and dip of formations, locations of contacts, etc.) is recorded in a field book. Distances and bearings of the traverse are plotted on graph paper at the time that they are measured.

The pace and compass course on the East mall consists of five numbered and flagged stations that you will plot on the graph paper provided.

Directions for completing a traverse (from Compton p. 76)

- Start at station 0 and sight to station 1. Record the bearing in your notes. Pace the distance to Station 1. Record this distance. After reaching Station 1, take a reciprocal bearing on Station 0 to check your original bearing. For example, if the bearing to station 1 from 0 was N45E, the reciprocal should be S45W. You may want to repace the distance to check yourself.
- Plot this information on your graph paper. All bearings should be plotted with respect to the North Arrow on the graph paper. Use your protractor to plot the bearing. Next, using the correct scale (1:500 or 1 cm = 5 m in this exercise) plot the distance you paced.
- 3. Continue until you return to station 0. Note the discrepancy between where you started and where you ended. This is referred to as the "closure error".

END

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Date	- 42	



Pace and Compass Map, East Mall, UT Campus



420k Lab #1

Reading:

1) Measurement of Attitude and Location, p. 3-14. Appended to lab.

2) Compton, p. 16-21, 34-40, 75-80.

3) Web resources: see Lab 1 under <u>www.geo.utexas.edu/420k</u>

Equipment:

Compass Field notebook Ruler with 10, 20 or 40 scale Protractor Calculator or tangent table Clipboard

Lab Is Conducted Outdoors