In our study of the geology of the national parks, as we move into the second unit we will progress from the predominately sedimentary rock sequences of the southwestern United States to the more chaotic terranes of the Pacific Northwest to volcanism of Hawaii. The geology will be as different as the scenery in these two parts of western North America.

In the southwestern United States, layers of rock and formations could be traced laterally for hundreds of miles. This is not possible in the Pacific Northwest, in part due to the density of vegetation, but more importantly because in the northwest the rock units are restricted to smaller regions. In the Pacific Northwest, we have no formation equivalent to the Kaibab limestone or the Navajo sandstone formations. In some cases there are units of rocks that are as small as a part of one of the San Juan Islands, west of Mt. Vernon.

The geologists who started working on the geology of the northwest at first used the same member, formation, and group designations as the geologists used in the southwest. However, the chaotic nature of the rocks led geologists to invent a new way of organizing the geology. We will use the word “terrane” to designate rocks that have a common history (we will list specific characteristics of terranes in class). Note that this word is different than the term “terrain”, which is used to describe a series of landforms, such as a “glaciated terrain.”

In class we will list three defining characteristics of a terrane. List these three characteristics and briefly explain them:

1) 

2) 

3) 

Before discussing the geology of the North Cascades, we need to review metamorphism and metamorphic rocks. As you recall from your introductory class, metamorphism of rocks means that the rock has been subjected to a change in temperatures and pressures. One of the keys to understanding the geology of the North Cascades is that not all of the
metamorphic rocks of the North Cascades have been metamorphosed to the same level. The terms slate, phyllite, schist, and gneiss are ____________________ of metamorphic rocks. In general, slates are formed at _______________ temperatures and pressures, while gneisses are formed at _______________ temperatures and pressures.

In introductory classes we only consider what happens to the most common sedimentary rocks (such as shale and sandstone) during metamorphism. An important parent material for the metamorphic rocks of the North Cascades is basalt. The metamorphic rocks formed from basalt are not the typical ones given in Geology 101.

When basalt metamorphoses, the recrystallization of the rock forms very small minerals that are greenish in color and this forms a rock we call a ____________________. Many times the original structure of the rock is preserved, such as pillow structures at this level of metamorphism.

If basalt is subjected to higher levels of temperature and pressure, it may become a ________________ and eventually may transform into an ________________.

Although the differences in texture of metamorphic rocks (slate to gneiss) is generally helpful in determining the level of metamorphism, the minerals in the rocks are much better geo-thermometers and geo-barometers. Minerals are chemically stable in certain ranges of temperature and pressure. So, if we see a specific mineral in a metamorphic rock, we have a much better idea of the conditions that existed when that specific mineral formed.

When there are a specific grouping (or we term “assemblage” of minerals), we say the rock is a specific metamorphic ________________.

In class, I will show a chart that graphically illustrates various metamorphic facies in terms of pressure and temperature. Copy that chart into this handout in the space below.
In general, what facies are the rocks of the North Cascades?

Our text for Geology 200 presents a general overview of the geology of the North Cascades, but there is a more complete, easier to understand book (Geology of the North Cascades) by Tabor and Haugerud. There will be several copies of this book that you may check out for a day or two or you may read the same information from the US Geological Survey web site: (Read pages 7-49)

http://www.nature.nps.gov/geology/usgsnps/noca/nocageol1.html

(This link is on the Geology 200 web page.)

Take notes while you read this book and include your notes with your notebook.

Briefly describe the terranes the Western Domain:
Draw a generalized cross-section of the Western Domain. What separates the terranes in the Western Domain? Be as specific as possible.

What structure separates the Western Domain and the Metamorphic Core Domain?

What metamorphic facies is the Metamorphic Core Domain?

What is the relationship of the Chelan Mountains terrane and the Skagit gneiss?

What is a migmatite?

What structure separates the Metamorphic Core Domain and the Methow Domain?
In general, what types of rocks are found in the Methow Domain?

When did the Ross Lake and Straight Creek faults happen? What is the evidence of these dates?

What has happened along the Ross Lake fault since the time it was active?

When did the North Cascade Range uplift? When did Mt. Baker start to erupt?