**Notes from Geology 102 field trip**

Stop #1: Harvard-Deary cutoff outcrop
These rocks show the boundary between the granite (part of the ID batholith emplaced ~60-80 Mya) and the sedimentary Belt Rocks (PreCambrian deposition ~1.7-0.8 Ga) into which the magma was intruded (and cooled to granite). The Belt Rocks were metamorphosed to schists at the contact boundary and were uplifted and deformed (schists were the vertically situated rocks to the left of the outcrop; granites were more on the right side). During intrusion of the magma, hot mineral-rich water was shunted through cracks in the Belt Rocks, cooled very slowly, and formed very large mineral crystals; the slower cooling and the chemistry of the mineral rich fluids allowed for minerals to grow much larger than normal—these large crystals are called pegmatites.

Stop #2: Laird Park
These rocks are the Revett formation of the Belt Rocks (different than at stop 1). Features of sedimentary deposition environments are preserved in these slightly metamorphosed rocks. Recall the "striped" pattern of dark and light alternating layers; those layers represent beds of different grain sized materials. For example, the whitish-gray layer is quartzite (sand grains) while the darker green-black layers are mudstones (mud grains). Features of note included ripple marks and cross-beds. Also of note was the fault to the left of the formation.

Stop #3: White Pine Campground

Stop #4: Stromatolites
These rocks are part of the Wallace Formation and are ~1.6 billion yrs old. Rocks contain a segment of a stromatolite reef. Stromatolites are biogenic formations composed of alternating layers of phototrophic microorganisms and sediments that formed in relatively shallow marine environments. Fossilized stromatolites show very thin laminations representative of the layers. Stromatolites are significant because they are believed to be responsible for the generation of oxygen (during photosynthesis) on early Earth.

Stop #5: Basalt dam forming Clarkia Lake
These rocks are part of the Columbia River flood basalts (CRBs) that formed the dam that resulted in Clarkia Lake. Approximately 16 Mya, rifts or fissures formed in the crust near the WA-OR-ID border and large volumes of molten magma poured onto the surface covering everything in its path. The fact that some of the lava reached this far north gives you an idea of how much volume of magma came out of the earth. The lava filled in valleys and low areas and blocked the flow of rivers and streams. Pillow basalts form when hot lava contacts cold water; the outer edge of the lava turns glassy because the lava cools so quickly that no mineral crystals form (glass has no crystallinity; it is amorphous), whereas the inner part cools slower and forms typically looking basalt. Because the hot lava will continue to push out the cool surface, the surface cracks and lava blebs push out creating 'pillows'. The orange/yellow/red coloring of the rocks is where iron is leaching from the glassy layer because of weathering processes. This site is the location of the basalt dam that generated Clarkia Lake.

Stop #6: Clarkia fossil beds (Bill Rember's place)

The area around Emerald Creek is known for the presence of garnets and there is a working garnet mill in operation (one of the largest!). Garnets are complex silicates (Ca, Mg, Al, Fe, Cr, Mn, Ti) formed by high-grade metamorphism. Garnet sand is a good abrasive and is used in sandblasting and cutting steel. Gem quality garnets are also found here, and here is one of two places in the world where star garnets are found.

Clarkia fossils provide a record of life 15 Mya. Because Clarkia lake was cold, anoxic and had a high sedimentation rate, organic material was exceptionally well-preserved. In the unoxidized material, you can even find fossils that still have their original colors at the time of deposition. Clarkia fossils reveal that the climate in northern Idaho ~15 Mya was more like that in present day southeastern US. Plants are typical of humid, temperate climates that have short, mild winters and longer, wet summers like you find in the southeast.