

## Geol 101 Field Trip: Fall 2007

### Stop 1: Palouse Hills Overlook

What are the four main elements of the geology? (from oldest to youngest)

1. Belt rocks (Precambrian) - inland lake and stream deposits. Only small remnants here.
2. Idaho batholith granite (~80-65 million years old - Cretaceous) - intruded into Belt rocks.
3. Columbia River basalts (~16 million years old - Tertiary)- covered the granite. ~3,000 ft thick.
4. Loess deposits (<1.6 million years old - Quaternary)- glacial silt blew in from the north (controversial?) during and after the Pleistocene glaciation.

Draw a cross section view across the Palouse region:

### Stop 2: Granite Point

Identify the type of rock that makes up Granite Point: gneiss

What minerals do you see? quartz, feldspar, biotite

Did this rock form at the Earth's surface? If not, how did it get here?

*Metamorphic rock so formed deep in the crust. Was then lifted to the surface by tectonic forces.*

What type of contact exists between the Columbia River basalt and the underlying rocks? nonconformity (because underlying rocks are metamorphic)

What do we call the ancient soil horizon? paleosol

What does this ancient soil horizon tell us about what was happening here 16 million years ago?

*The basalt flowed over the ancient soil that was sitting on top of the gneiss. Soil only forms at the Earth's surface so the gneiss must have formed the surface here 16 million years ago. It was then covered over by basalt for millions of years and has now been exposed again by erosion by the Snake River.*

### Stop 3: Basalt, basalt everywhere!

*Talk about the history of lava emplacement. Happens over millions of years, commonly with periods of 1000s of years of inactivity like the Snake River Plain today. Size of flows – very wide. Point out horizontal attitude of flows. This will change to the south.*

What does the layering of the basalt across the river indicate? *Lots of different lava flows on top of each other.*

The boundary between lava flows is marked by basalt with lots of gas bubble holes in it. What do we call this type of basalt? *vesicular basalt*

What other type of feature is visible in the lava flow? pillows

What does this feature tell us about the environment in which these basalts were extruded?

*Must have been extruded underwater, such as in a lake, river, or pond.*

(point out the non-basaltic debris on the surrounding slopes. Get them thinking)

### Stop 4: Somethin' funky is goin' on here!

What do we call basalt with lots of vertical fractures in it? *columnar basalt*

How do these fractures form? **by cooling and shrinking of the basalt**

What other type of geologic feature forms in a similar way? **mudcracks**

What has happened to the basalt lava flows along the Snake River here that is different to further downstream?  
**The basalt flows are no longer horizontal but have been tilted by tectonic forces so they are dipping down into the river valley.**

What do we call this type of structure? **anticline**

When must have the Lewiston fold have formed? **less than 16 million years ago because that's when the lava flows formed and the basalt has been folded**

Stop 5: Whence the mysterious white layer??

What is the white layer exposed across the gulch? **volcanic ash**

How was the white layer produced and when did this happen? **eruption of Mount Mazama (Crater Lake) about 6800 years ago.**

Stop 6: Lewiston is goin' DOWN!!

What evidence is there to indicate that there is a landslide across the river?  
**Headwall scarp and the fact that the buildings are getting cracked and damaged.**

What do we call this type of landslide? slump

Stop 7: The Riddle of the Snake River Island

What evidence supports the idea that the island in the Snake River was formed by an unusually large flood?  
**The island sits much higher than the water in the Snake River ever reaches at flood stage. The sediment size is very large (pebbles to boulders) and the rock type comes from much further upstream (100s of km).**

What was this flood called? **Bonneville flood**

When did the flood occur? **14,000 years ago (near the end of the Ice Age)**

Why did the flood occur? **Lake Bonneville burst to the south**

When did the Missoula flood occur? **about 10,000 years ago**

What caused the Missoula flood? **Glacial Lake Missoula burst to the north into the Columbia R. valley and flooded across eastern Washington**

What was unusual about the Missoula flood water when it flowed along this canyon?  
**The floodwater flowed upstream along the Snake River canyon.**

Stop 8: Anyone got an ark?

What deposited these sediments way above the river valley? **Missoula flood**

What type of sediment is it (look at the grain size)? **silt, sand and gravel**

What type of sedimentary structures can you see?  
**cross-beds (no prominent flow direction – water was swashing back and forth)**

How can we tell that the Missoula flood must have happened AFTER the Bonneville flood?

The Missoula flood deposits sit stratigraphically on top of the Bonneville deposits. By the principle of superposition, the Bonneville deposits came first.

### Stop 9: Once upon a time....

Describe the geological development of this region, from oldest to youngest events.

- (1) Development of Belt rocks about 1.5 - 2 billion years ago (inland lake and river deposits?)
- (2) This was the edge of the N. American continent until the Cretaceous period.
- (3) It was an active continental margin, with oceanic crust being subducted under the N. American continent.
- (4) The subduction caused volcanism and the development of granite plutons that intruded into the Belt rocks, forming the Idaho batholith.
- (5) Exotic terranes or "microcontinents" began "docking" onto N. America in the Cretaceous. These were island arcs that were sitting on oceanic crust. When the microcontinents collided with N. America, they could not subduct so the subduction zones jumped progressively westwards.
- (6) N. America then grew westwards, forming Oregon and Washington.
- (7) In the Miocene epoch of the Tertiary period, tensional stresses began pulling the continent apart. Fissures opened up and basalt lava poured out, forming the Columbia River flood basalts.
- (8) After the basalts cooled, the Lewiston fold was formed, which bent and folded all the basalt flows above what is now Lewiston.
- (9) During the last ice age in the Pleistocene, winds blew fine silt in from the glacial till deposits to the northwest, forming loess deposits all over the Palouse.
- (10) Lake Bonneville (at the site of today's Great Salt Lake in Utah), broke through into the Snake River 14,000 years ago (near the end of the ice age) sending a wave of water downstream. Later, Glacial Lake Missoula, at the edge of the Pleistocene ice sheets, broke through its ice dam 10s of times, sending floods across E. Washington, forming the scablands, and causing the flood water to flow upstream along the Snake River.
- (11) People came and planted lentils.