

Key Concept Summary of Field Stops – 2014 River Trip

DAY 1

1-1 Natural Science Building

Tectonic setting of western Oregon, Juan de Fuca Plate, North American Plate, Coast Range accretion, Cascade Volcanic Arc, Willamette Valley, Earth Energy sources (gravity, geothermal, solar), watersheds, trip itinerary/overview; introductory video clips: Plate Dynamics, Oregon Field Guide Missoula Floods, Oregon Field Guide Cascadia Seismic Hazards, 1996 Oregon Flood Event, Kayaking Sucks Landslide Video

1-2 North Santiam River State Recreation Area

Tectonic setting of western Oregon, Juan de Fuca Plate, North American Plate, Coast Range accretion, Cascade Volcanic Arc, Earth Energy sources (gravity, geothermal, solar), watersheds, trip itinerary/overview. Geomorphic mapping criteria (landform, material, age, process), bedrock vs. regolith, colluvium alluvium, force, work, mass, gravity, weight, bedload, suspended load, dissolved load, climate history, glacial history of western Cascades, geologic history of western Cascades

1-3 Detroit Dam / Santiam

Dams, anthropogenic, reservoirs, energy vs. load, downstream scour, upstream sedimentation, salmonid habitat, dam census of Pacific Northwest, significance of dams, social factors of dams, dam building history, reasons for dams (flood control, reservoirs, water resources), more on western Cascades geologic history

1-4 Suttle Lake / Mount Washington Overview

Mt. Washington vs. Black Butte, high cascades volcanic arc, history of cascades/high cascades, climate change, glacial vs. interglacial, glacial erosion, roadcut with diamicton, Suttle lake, moraine-dammed lake, glacial valley, soils chronology

Night 1 – Camp at LaPine State Park

DAY 2

2-1 Morning Camp Discussion

Landscape analysis (landform, material, age, process), sediment coring, soil sampling, Mt. Mazama, Crater Lake History, tephra, Mazama Ash, pumiceous sediment, Mazama blast zone, regolith, lava flows, basalt, High Cascades, regional Newberry geology, cinder cone history, Teepee Draw Tuff, Newberry Caldera, fault junction (Brothers, Tumalo, Walker Rim), High Lava plains, rhyolite age progression, Basin and Range extension, bimodal volcanism.

2-2 Paulina Peak / Newberry Caldera

Overview of newberry volcano, cinder cones, big obsidian flow, history of newberry eruptions, Newberry volcanism vs. Cascade arc, overview of caldera / lakes, significance of Newberry with respect to regional tectonics, cinder cone morphology / age relations.

2-3 Paulina Lake Outlet / Paulina Falls Knickpoint Erosion

Paulina lake observations, lake terraces, wave erosion, caldera uplift, Paulina outlet knickpoint, headward erosion, catastrophic outburst floods, knickpoint processes, headward erosion, slope/gradient observations, catastrophic outburst floods, paleoflood hydrology

2-4 Paulina Creek / Ogden Group Camp / Paulina Creek Terrace Analysis / Catastrophic Flood Record

Field hydrology, discharge calculations, terraces, terrace gravels, mazama ash, catastrophic outburst floods, floodplains, high terrace, middle terrace, flood scour, soils chronology, aridisols, clay films, soil development vs. time, landform / geomorphic surfaces.

Night 2 – Camp at Deschutes River State Recreation Area / The Dalles

DAY 3

3-1 Morning Camp Discussion / Hike on Hillslope Trail

Columbia River Basalts, bedrock terrain, hummocky topography, hillslope gradients, formative causes of river rapids, overview of Missoula Floods, Palouse Loess, last glacial advance, Montana Ice Dam Lakes, Clark Fork Idaho Ice Dams, Dam Burst Floods, channeled scablands, slackwater deposits, flood scour landscapes; Missoula flood silts, Missoula flood gravels; colluvium / colluvial aprons, rock fall processes; transport-limited hillslopes, weathering-limited hillslopes, aspect, aspect-controlled hillslope processes, north slope/south slope moisture conditions

3-2 The Dalles Hwy 197 Roadcuts (lower and upper combined)

Columbia river basalts, CRB stratigraphy, Wanapum Basalt, pillow basalts; The Dalles Formation, diamictite, pyroclastic flows, debris flows, volcanoclastic deposits, stratigraphic layering / interpretation, Missoula floods, loess history, paleosols, aridisols, carbonate development; Overview of Columbia Plateau / Loess Hills of North-Central Oregon; Loess, glacial history of PNW, climate change, catabatic winds, history of Columbia basin, Columbia river basalts, Pleistocene history

3-3 Petersburg Bar (spill-over delta)

Missoula floods, gravel bars, flood deltas, spill-over deltas, pebble imbrication, flood gravels, cross-stratification, foresets, paleocurrents, deposition vs. erosion evidence of flooding

3-4 Fairbanks divide (Missoula Flood overflow notch)

Missoula floods, gravel bars, flood deltas, spill-over deltas, pebble imbrication, flood gravels, cross-stratification, foresets, paleocurrents, deposition vs. erosion evidence of flooding

3-5 Celilo Falls Overlook (Butte and Basin Scabland Topography)

Missoula Floods, erosional landscape records, paleoflood history, big water; Overview of Columbia Plateau / Loess Hills of North-Central Oregon Loess, glacial history of PNW, climate change, catabatic winds, history of Columbia basin, Columbia river basalts, Pleistocene history

Night 3 – Camp at Trout Creek; meet river guides

DAY 4

4-1 Trout Creek road cut / hillslope cut

Stratigraphic layering and analysis, geomorphic mapping, floodplains, hillslopes, terraces, colluvium, alluvium, diamicton, sediment sorting, clast roundness, pumice layers, Mt. Jefferson eruptive history, soils development, soils chronology, lacustrine deposition, hillslope vs. valley bottoms, bedrock geology and history of middle Deschutes River, Clarno Formation, John Day Formation, Columbia River Basalts, landslides, terraces, canyon rim

4-2 Warm Springs river /Railroad Cut

Stratigraphic layering and analysis, geomorphic mapping, floodplains, hillslopes, terraces, colluvium, alluvium, diamicton, sediment sorting, clast roundness, pumice layers, Mt. Jefferson eruptive history, soils development, soils chronology, terrace chronology, middle Deschutes geomorphic history

4-3 Whiskey Dick Camp (Deschutes hydrology/dinner lecture)

Ground water, hydrogeology, regional geology of Deschutes basin, influence of groundwater on Deschutes River discharge, flood history of Deschutes river, regional hydrologic analysis, climatology, water resources, river hydrology, river discharge, fluvial landforms (active channel, floodplain, terraces, hillslopes).

Night 4 – Camp at Whiskey Dick

DAY 5

5-1 Morning Camp Discussion/Exercise: Middle Deschutes Hydrology and Landscape Analysis

Aerial photography, landscape change, landform analysis, spatial and temporal scaling, map scaling, photo scaling, channel change, land-use change, irrigation practice, river hydrology, paleoflood hydrology, Deschutes basin hydrology, water budgets, regional geologic setting, Whitehorse Rapids, landslide analysis. rock-block slides, colluvium, active vs. inactive hillslopes, bedrock vs. regolith, large-scale landslides, hummocky topography, knob-and-kettle topography, chaotic landscape development, relative dating, landforms analysis, co-seismic mass wasting, landslide dams, catastrophic outburst floods.

5-2 Lunch Stop (entrance to Clarno Fm landscape)

Regional geology of Deschutes basin, whitewater hydraulics, fluvial mechanics, sediment transport processes, Clarno Formation landscape characteristics.

5-3 Dant Campground Evening Lecture

Deschutes river fisheries, steelhead-coho-trout, continuum concept, shredders, decomposers, grazers, food chain, caddis flies, may flies, dry fly, nymphs, redds, spawning cycles, gravel size / spawning gravels, anadromous vs. resident fish, steelhead vs. rainbow trout.

Night 5 – Camp at “Dant”

DAY 6

6-1 Dant Camp Morning Discussion

Flood recurrence intervals, flood history, regional flood geography, statistical analysis of historic hydrologic data, hydrometeorology, rain-on-snow history.

6-2 Hike to Dant Debris Flow / Buckskin Mary hillslope observations

Recurrence intervals, flood frequency-magnitude, debris flow, flooding,

6-3 Outhouse flood bar

Deschutes flood history, flood records, landscape analysis, paleoflood hydrology, depositional vs. erosional landscape records, carbon dating, flood chronology, landslide dams, catastrophic outburst floods, geology vs. meteorologic flood processes.