

Geological Society of the Oregon Country: Lewiston Basin Field Trip

Dean L. Garwood
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Staff Report 14-2
August 2014

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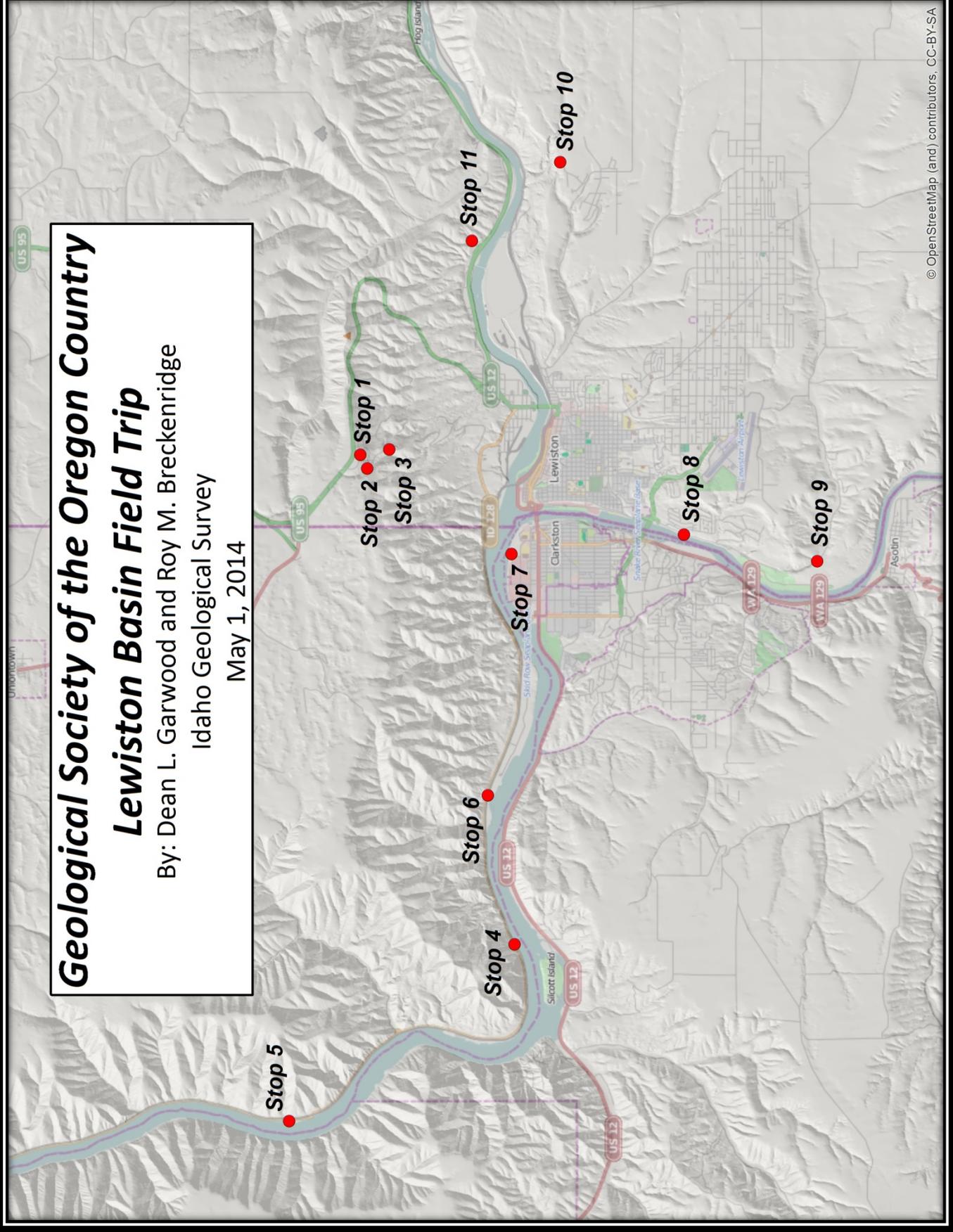
Geological Society of the Oregon Country

Lewiston Basin Field Trip

By: Dean L. Garwood and Roy M. Breckenridge

Idaho Geological Survey

May 1, 2014



Stop 1: Lewiston basin overview

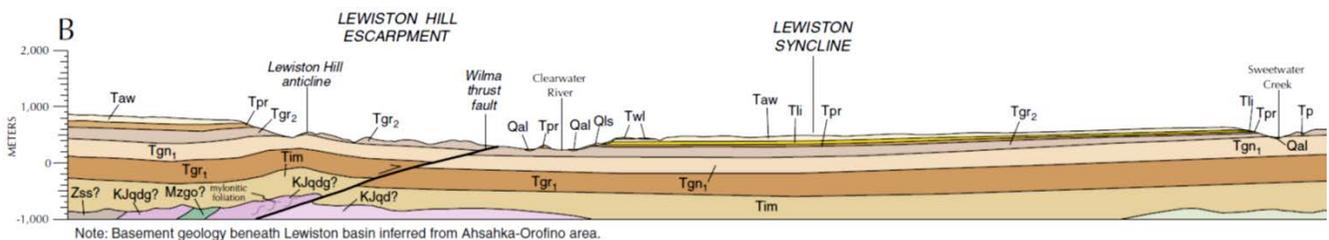
Lewiston, Idaho, and Clarkston, Washington, are at the confluence of the Snake and Clearwater rivers in the Lewiston basin. Hells Canyon stretches to the south of Lewiston on the Snake River. This is the lowest point in Idaho at 720 feet (220 m) elevation. Lewiston is Idaho's seaport, a result of slack water created by several dams and locks on the Columbia- Snake River system.



The east-west trending trough-shaped Lewiston basin occurs along the northern edge of the Clearwater embayment, a broad swath of Columbia River basalt flows less than 1 km thick that cover much of the accreted Wallowa island arc terrane, suture zone, and outboard plutons of the Idaho batholith. The geology of this region is outlined in Kauffman and others (2006). The basin is strongly structurally controlled. Lewiston Hill below is underlain by an east-west trending asymmetrical anticline that includes a steeply dipping south limb that forms a dip slope along much of the exposed hillsides. One or more reverse faults occur at the bottom of the hill, and exposures include basalt that is thrust over Pliocene Clearwater(?) gravels (Garwood and Bush, 2005). The southern margin of the Lewiston basin is formed by the east-northeast-trending Waha escarpment, a complex monoclinial fold and possibly a reverse fault. The Snake River is entrenched into the plateau to the south of this front, thereby forming Hells Canyon, which beautifully exposes rocks of the Wallowa arc complex. Both the Lewiston Hill and Waha structures began during Columbia River basalt emplacement and may include Pliocene to Recent displacement. In the late Pleistocene both the Clearwater and Snake Rivers were inundated by both the Bonneville and Lake Missoula floods.

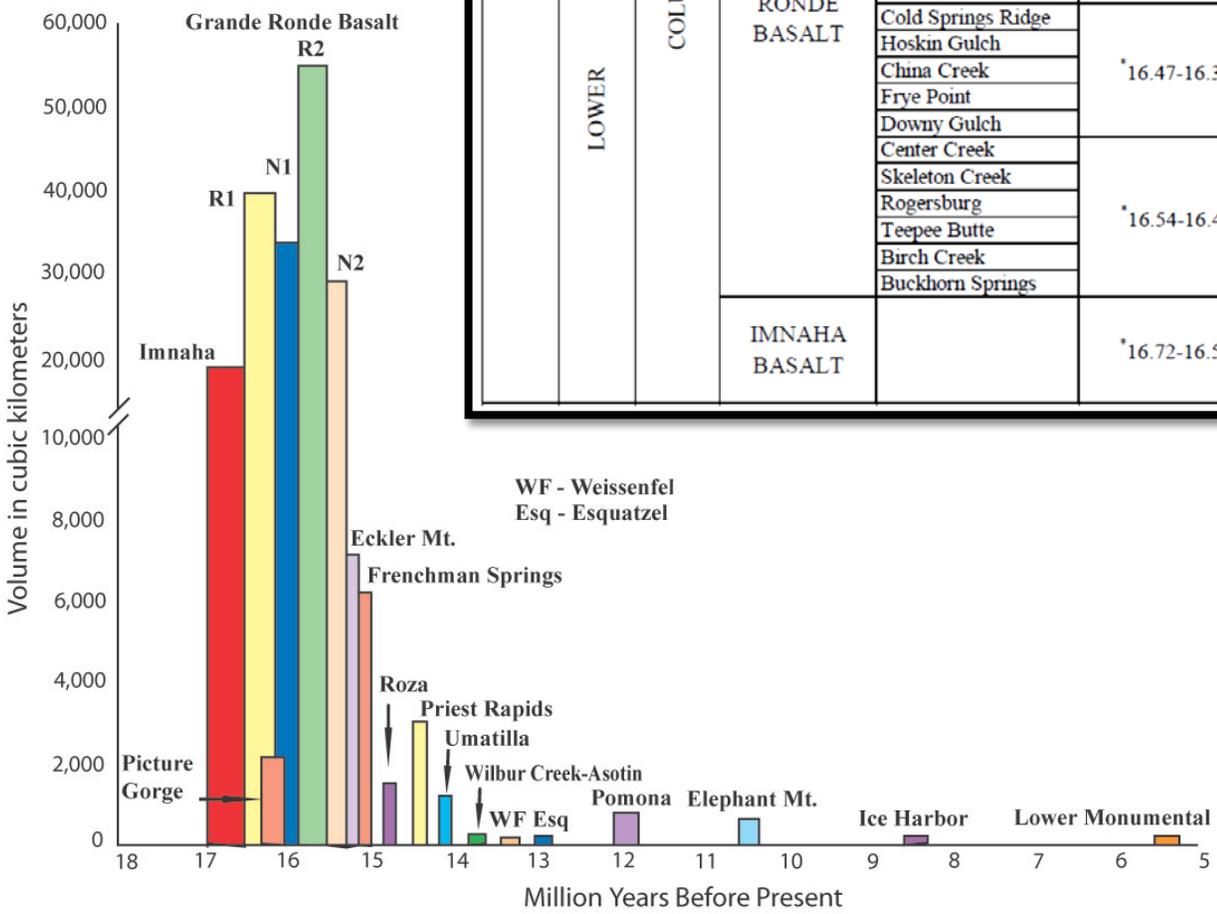
At this stop, we are standing within gently north dipping flows of the Saddle Mountains Basalt of the Columbia River Basalt Group (less than about 13 Ma). On the road directly below is the Priest Rapids Member of the Wanapum Basalt (about 14.5 Ma). The hinge of the asymmetrical anticline occurs on the ridge shoulder just below, and the slopes further below are dip slopes of Grande Ronde Basalt flows (16.5-15.5 Ma). At the bottom of the hill, outcrops of the Priest Rapids Member (nearly horizontal) occur along the Clearwater River next to the bridge leading into Lewiston (mapping by Camp, 1976, and Hooper and others, 1985). Note the region of massive slumping across the Clearwater to the southeast just beyond the paper mill. This slumping is developed within the Sweetwater Creek sedimentary interbed located above the Priest Rapids basalt. The interbed is considerably thicker in the Lewiston basin than in the section just below this stop, high on Lewiston Hill. Puffer Butte, one of the few preserved volcanic edifices in the Columbia River basalts, is in the distance to the south-southwest. Flows of the Roza Member of the Wanapum Basalt were erupted from that area at about 14.5 Ma (Bush and Seward, 1992), but earlier than the Priest Rapids Member. The high region to the southwest is underlain by the Blue Mountains, a broad anticline within basalt strata that forms the southwestern margin of the Lewiston basin.

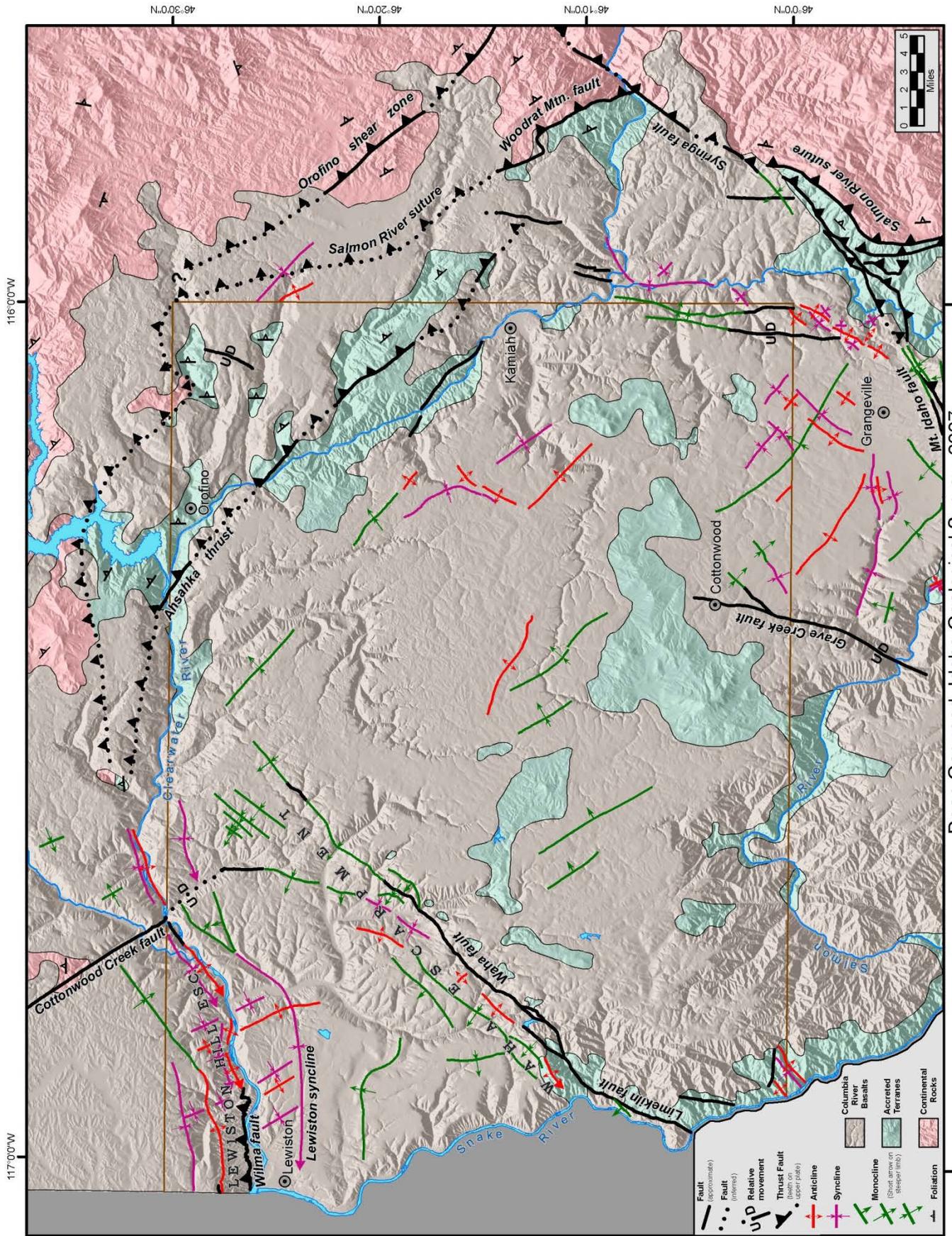
Historical Interest: Lewis and Clark reached the confluence of the Snake and Clearwater rivers in their dugout canoes on October 10, 1805. Clark noted that “the water of the South fork [Snake] is a greenish blue, the north [Clearwater] as clear as cristial.”





| Series | Group | Formation | Member | Isotopic Ages (Ma) | Magnetic Polarity | | |
|----------------|-----------------|--------------------------|--------------------------|---------------------------|-------------------|--------------------------|----------------|
| | | | | | | | |
| MIOCENE | UPPER | SADDLE MOUNTAINS BASALT | Lower Monumental | 6.0 | N | | |
| | | | Ice-Harbor | 8.5 | N, R, N | | |
| | | | Buford | | R | | |
| | | | Elephant Mountain | 10.5 | N, T | | |
| | | | Pomona | 12.0 | R | | |
| | | | Esquatzel | | N | | |
| | | | Weissenfels Ridge | | N | | |
| | | | Asotin | 13.0 | N | | |
| | | | Wilbur Creek | | N | | |
| | | | Umatilla | | N | | |
| | MIDDLE | WANAPUM BASALT | Priest Rapids | 14.5 | R | | |
| | | | Roza | | T, R | | |
| | | | Shumaker Creek | | N | | |
| | | | Frenchman Springs | [*] 15.12 ± 0.38 | N, E | | |
| | | | Eckler Mountain | [*] 15.70 ± 0.34 | N | | |
| | | | LOWER | GRANDE RONDE BASALT | Sentinel Bluffs | [*] 16.27-15.98 | N ₂ |
| | | | | | Winter Water | | |
| | | | | | Umtanum | | |
| | | | | | Fields Spring | | |
| | | | | | Kendall Monument | | |
| | Ortley | [*] 16.30-16.27 | | | R ₂ | | |
| | Slack Canyon | | | | | | |
| | Meyer Ridge | | | | | | |
| | Grouse Creek | | | | | | |
| | Wapshilla Ridge | | | | | | |
| | LOWER | GRANDE RONDE BASALT | Mt. Horrible | [*] 16.47-16.30 | N ₁ | | |
| | | | Cold Springs Ridge | | | | |
| | | | Hoskin Gulch | | | | |
| | | | China Creek | | | | |
| | | | Frye Point | | | | |
| Downy Gulch | | | [*] 16.54-16.47 | R ₁ | | | |
| Center Creek | | | | | | | |
| Skeleton Creek | | | | | | | |
| Rogersburg | | | | | | | |
| Teepee Butte | | | | | | | |
| LOWER | IMNAHA BASALT | Birch Creek | [*] 16.72-16.54 | N ₀ | | | |
| | | Buckhorn Springs | | | | | |





Dean Garwood, Idaho Geological Survey, 2007

Stop 2: Grande Ronde/Wanapum contact - weathered saprolite

Tpr—Priest Rapids Member (Miocene)—Medium to dark gray, fine- to coarse-grained basalt with common plagioclase phenocrysts 2-8 mm long and common olivine grains 1-2 mm in diameter. Coarser grained varieties tend to have the larger phenocrysts of both plagioclase and olivine. Reverse magnetic polarity. Consists of one to two flows of Lolo chemical type (Wright and others, 1973). Sand, pebbles, and cobbles of the Sweetwater Creek interbed (included in Tli unit) are common above the Priest Rapids Member in the Lewiston basin. Age is generally reported as 14.5 Ma (e.g., Tolan and others, 1989).



Tgr2—Grande Ronde Basalt, R2 magnetostratigraphic unit (Miocene)—Medium to dark gray, fine grained basalt, commonly with a sugary texture. Some flows have uncommon to common 1-2 mm plagioclase phenocrysts. Reverse magnetic polarity, although field magnetometer readings commonly give weak normal or conflicting results, particularly near the top of the R2 section. Consists of four to six flows in the western part of the map with a maximum thickness of about 210 m (700 feet). Most flows have a blocky colonnade jointing character, but a few have well-developed hackly entablatures. Chemical analyses indicate at least four chemical types that are likely equivalent to the Meyer Ridge, Grouse Creek, Wapshilla Ridge, and Mt. Horrible units of Reidel and others (1989). There also appear to be three chemical variants of the Meyer Ridge unit, although no relative stratigraphic position of the three is implied. We suspect flows may have repeatedly erupted from different sources, allowing them to interfinger and perhaps inject into and inflate nearby flows, as Reidel (2005) has documented for the N2 Cohasset flow, Sentinel Bluffs Member.

The thickest R2 sequences are in the Lewiston basin, where the unit consists of at least four to six flows totaling 150-210 m (500-700 feet), and on Craig Mountain where it consists of four to six flows totaling 120-150 m (400-500 feet). Eastward from Craig Mountain and the Lewiston basin, the R2 thins in total thickness, and the number of flows decreases. A few isolated reverse field magnetometer readings in the eastern part of the map indicate possible R2 remnants, although these are generally included in the N1 map unit because of their sporadic occurrence and uncertain polarity readings.

One dike, previously mapped as Grande Ronde (Swanson and others, 1980), is included on the map on the Idaho side of the Snake River across from the mouth of the Grande Ronde River, although we were unable to locate the dike during a brief reconnaissance. Reidel and others (1992) map a probable extension of this dike on the Washington side of the Snake River as R2 Grande Ronde Basalt.

Stop 4: Tilted Imnaha basalt and Chief Timothy flood gravels

Tim—Imnaha Basalt (Miocene)—Medium- to coarse-grained, sparsely to abundantly plagioclase-phyric basalt; olivine common; plagioclase phenocrysts generally 0.5-2 cm, but some are as large as 3 cm. Flows examined in the field have normal polarity. Outcrops commonly deeply weathered or degraded forming granular detritus. Outcrops of fresh basalt are characterized by well-formed, commonly fanning or radiating columns 0.25-1 m (1-3 feet) in diameter. Best exposures are in the canyons of the Clearwater, Snake, and Salmon rivers and their incised tributaries. At least ten flows with a total thickness of over 460 m (1,500 feet) are exposed in the Eagle Creek drainage. Contact with prebasalt rocks is unconformable and very irregular. Partly indurated sand and silt interbeds, a few of which contain plant fossils, occur locally near contact with basement rocks. These interbeds are not laterally extensive and commonly pinch out within 0.8 km (0.5 mile) of the basalt-basement rock contact. Several plagioclase-phyric basalt dikes cut the Martin Bridge Limestone near Limekiln Rapids. These dikes, which in places weather as negative-relief features, are mapped as queried Imnaha Basalt. Extensions of these dikes across the Limekiln fault were not found. Some or all of these dikes may possibly be Columbia River basalt other than Imnaha, or they may be pre-Columbia River basalt in age.

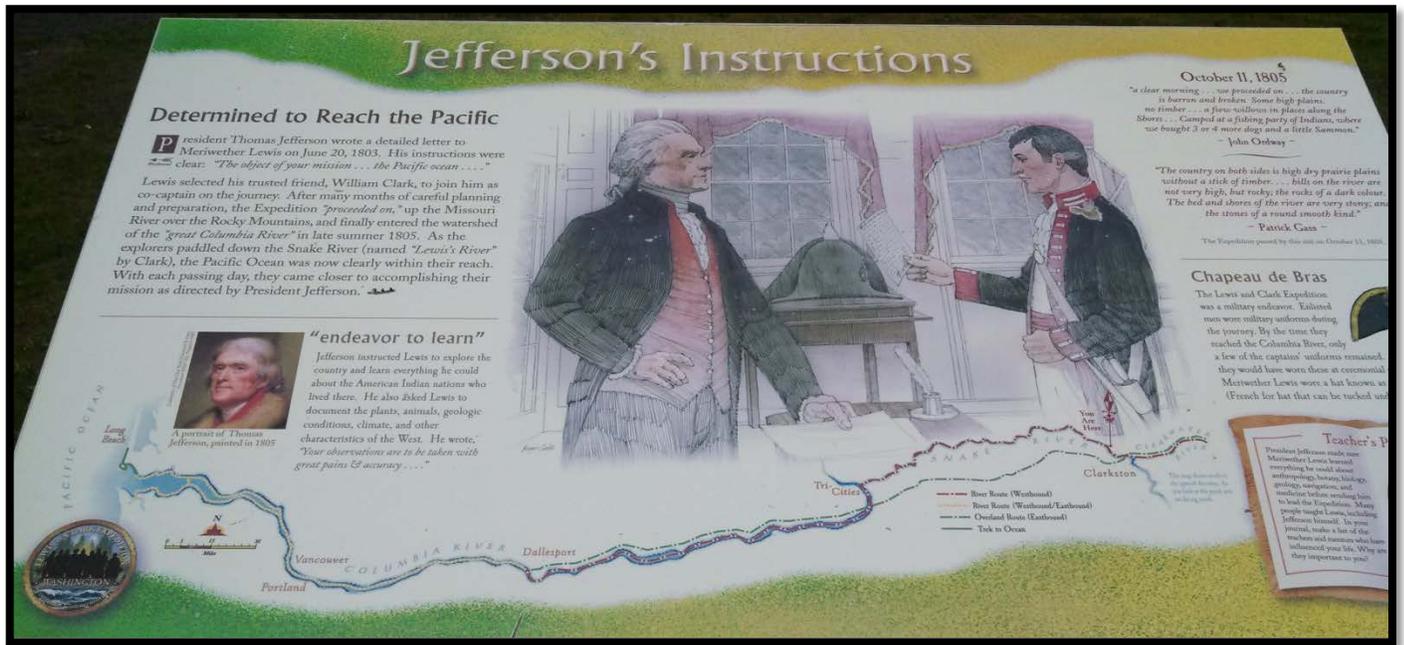


From Webster and others 1982: Numerous gravel bars along the Snake River canyon below Clarkston including Wilma Bar, opposite Clarkston, are probably equivalent to the restricted Clarkston Gravel as suggested by Lupper (1945). These downstream equivalents were mapped by Hammatt (1976) in the Lower Granite Reservoir area, as “Scabland flood bar gravel” following the suggestion of Bretz (1929). A sedimentologic study of four of these bars by Wheeler (1980) showed that they are point, lateral, and expansion bars with the concordant upper limits between 120 and 140 feet (37 and 43 meters) above the pre-dam river level. Furthermore, he demonstrated that they were deposited by



down canyon currents, proving that they are not reworked traction gravels deposited by an up canyon surge of the Missoula backwater flooding. Wheeler’s (1980) cobble lithologies are also primarily Salmon River-derived. If all of these bars are of the same origin, they require a major fill or aggradation within the ancestral Salmon River canyon preceding the diversion of the Snake River to the north. Basalt and granitic clasts, although deeply weathered, are not as intensely weathered as those in the Clearwater Gravel and Clarkston Heights Gravel. This would imply a younger age and support the suggestion that the Clarkston Gravel at Clarkston is a point bar deposited as the ancestral Salmon River migrated eastward eroding Clearwater gravels.

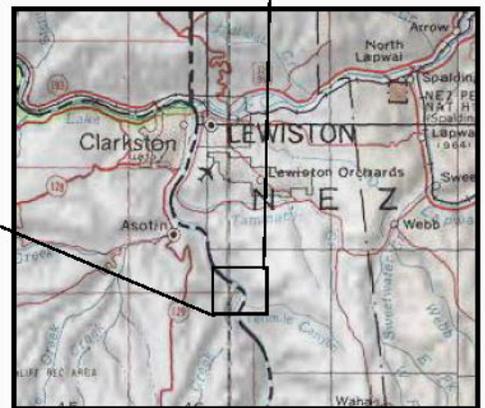
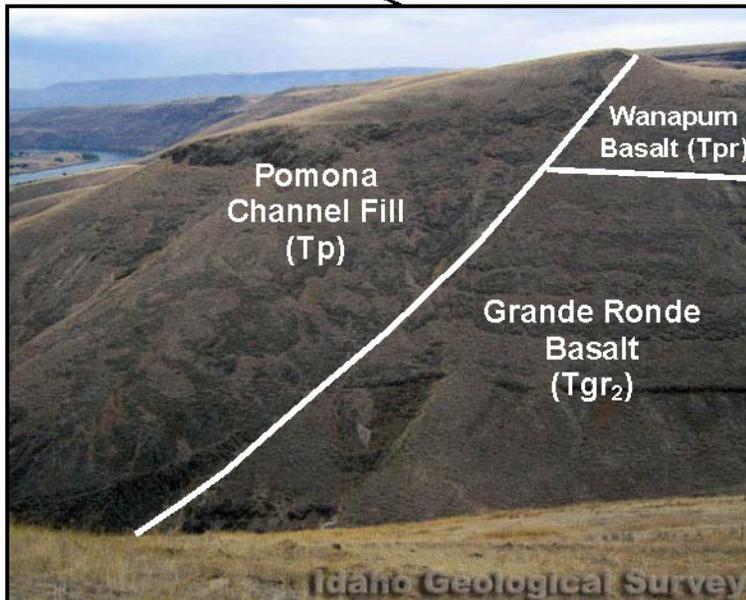
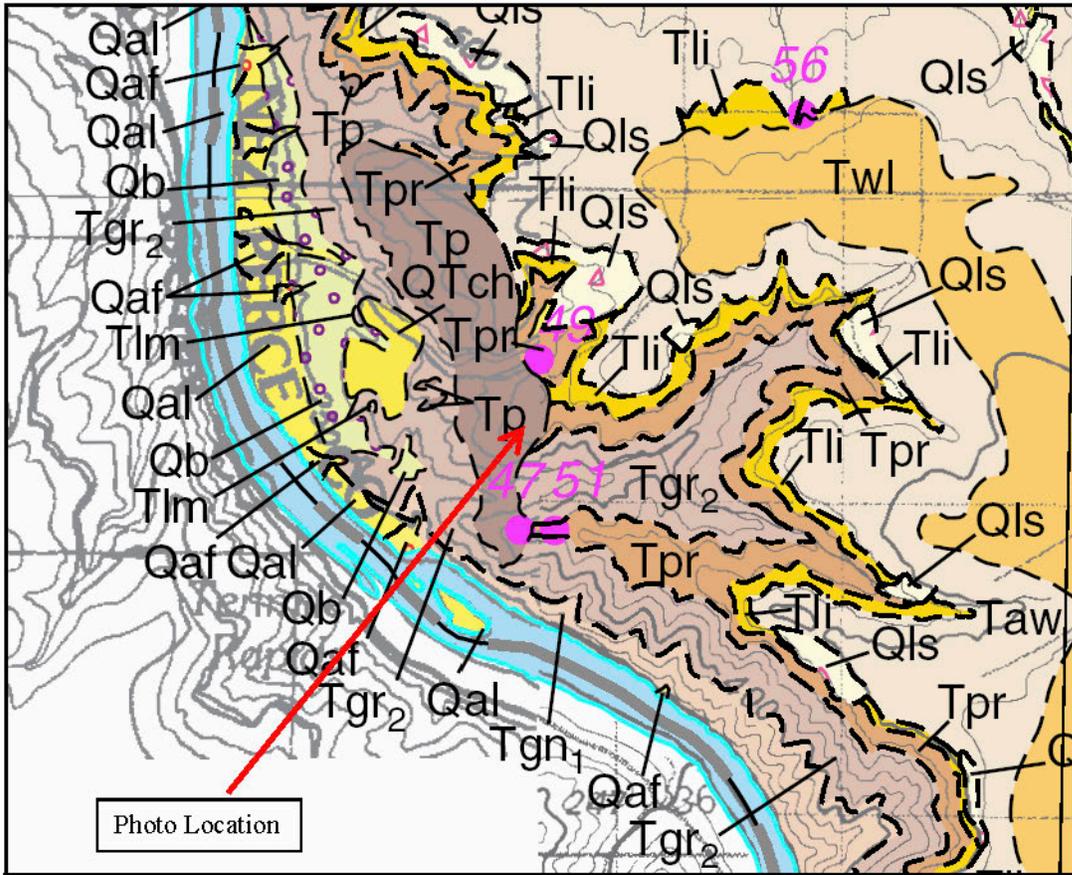
Stop 5: Nisqually John - lunch and restroom break



Stop 6: Pomona channel fill

Tip—Pomona Member (Miocene)—Fine- to medium-grained basalt with small plagioclase phenocrysts 2-4 mm long and common olivine grains as large as 1 mm. Reverse magnetic polarity (Choiniere and Swanson, 1979). Occurs as canyon-filling flows in the Lewiston area. Has well-developed, commonly radiating or fanning columns that formed perpendicular to the walls of ancestral Salmon River (what is now the Snake River) and Clearwater River canyons. A thick outcrop of welded spatter, hyaloclastite, and associated columnar Pomona Member basalt along Sweetwater Creek, the easternmost known occurrence, has some characteristics of a source vent, although pebbles and sand that underlie this exposure indicate it may be a channel fill rather than a vent. Date reported about 12 Ma (McKee and others, 1977).



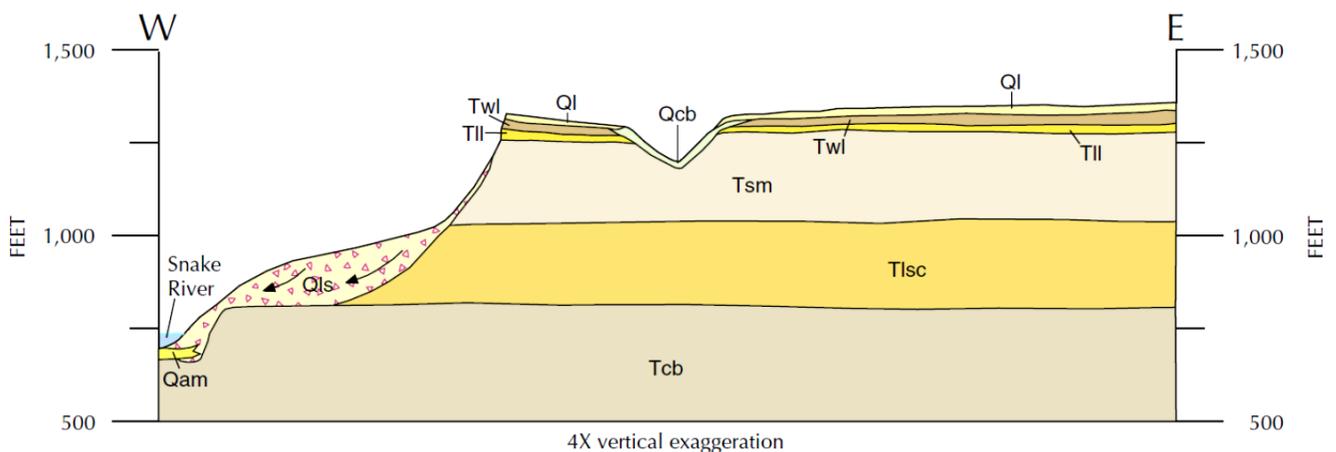


Stop 7: Granite Lake Park – Restroom and Lewiston Hill escarpment view



Stop 8: Elks Lodge Landslide

Qls—Landslide deposits (Holocene and Pleistocene)—Poorly sorted and poorly stratified angular rock fragments mixed with silt and clay. Landslides include slumps, slides, and debris flows. Slump blocks primarily composed of intact to broken sections of basalt and Latah Formation sediments. Debris flows mainly composed of unstratified, unsorted gravel rubble in a clayey matrix derived from liquefied fine-grained sediment or weathered basement rock. Scarp and headwall area of landslide is not included because those features provide some of the best exposures of basalt units. Landslides range in age from relatively stable features of Pleistocene age to those that have been active within the past few years. Landslides are most prevalent along Latah Formation interbeds (Tli). Landslide debris is highly unstable when modified through either natural variations in precipitation or artificial means such as cuts, fills, and changes in surface drainage and groundwater infiltration. Even small landslide activity on the upper parts of canyon slopes can transform into high energy debris flows that endanger roads, property, and inhabitants below.



Stop 9: Tammany Creek

Lake Missoula Floods backwater deposits

(Pleistocene)—Rhythmites deposited when Lake Missoula Floods backwaters inundated the Clearwater River and Snake River valleys. Similar depositional environment, sedimentology, and age as Lake Missoula Floods rhythmites of eastern Washington (Smith, 1993; Waitt, 1980, 1985). In eastern Washington, Mount St. Helens tephra forms a 13,000-year time line in Missoula Floods rhythmites. Primarily alternating thin beds of gray sands and pale brown silts. Cross-bedded, dark gray, basalt-rich granule gravel and coarse sands common at the base. Includes cut and fill structures and sandy clastic dikes. The clastic dikes are common features in the deposits and may follow coarser, sand and gravel facies. Where rhythmites mantle Clearwater Gravel and basalt, the clastic dikes are cut deep into the gravel and follow joints and normal faults down into the basalt. Rhythmites are typically capped by 0.3-0.9 m (1-3 feet) of loess and commonly reworked into sandy, silty colluvium. Found locally as high as 360 m (1,200 feet) in elevation, the approximate maximum flood level. In the Snake River valley, a veneer of Lake Missoula Floods backwater deposits overlie Bonneville Flood gravel (Qb) and in the Clearwater River, Lake Missoula Floods rhythmites mantle Pleistocene alluvial gravel (Qag).

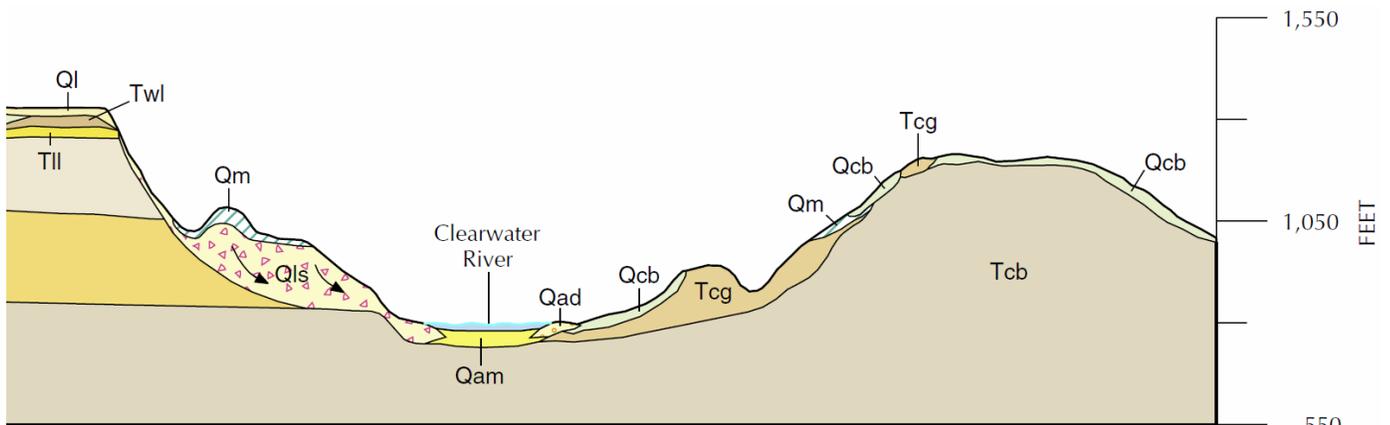


Bonneville Flood deposits (Pleistocene)—Gravel and sandy gravel deposits of the Bonneville Flood that form giant expansion bars and point bars in the Lewiston basin and Snake River canyon. The giant expansion- and point-bar deposits are poorly sorted with bedding consisting of large cross-beds and crude layers of alternating bouldery gravel and sand. Minor calcium-carbonate cementation minimizes erosion in steep exposures. The sand and fine gravel clasts are predominantly very angular basalt fragments probably derived from the Snake River canyon just upstream. Non-basalt pebbles and cobbles are generally well rounded and reflect a Hells Canyon source; most are granitoids and greenschist facies volcanic and volcanoclastic rocks. The deposits also contain clasts of Sweetwater Creek interbed silt, probably associated with upstream exposures where large landslides are located. Bonneville Flood deposits have not been recognized in the Clearwater River drainage east of Lewiston.

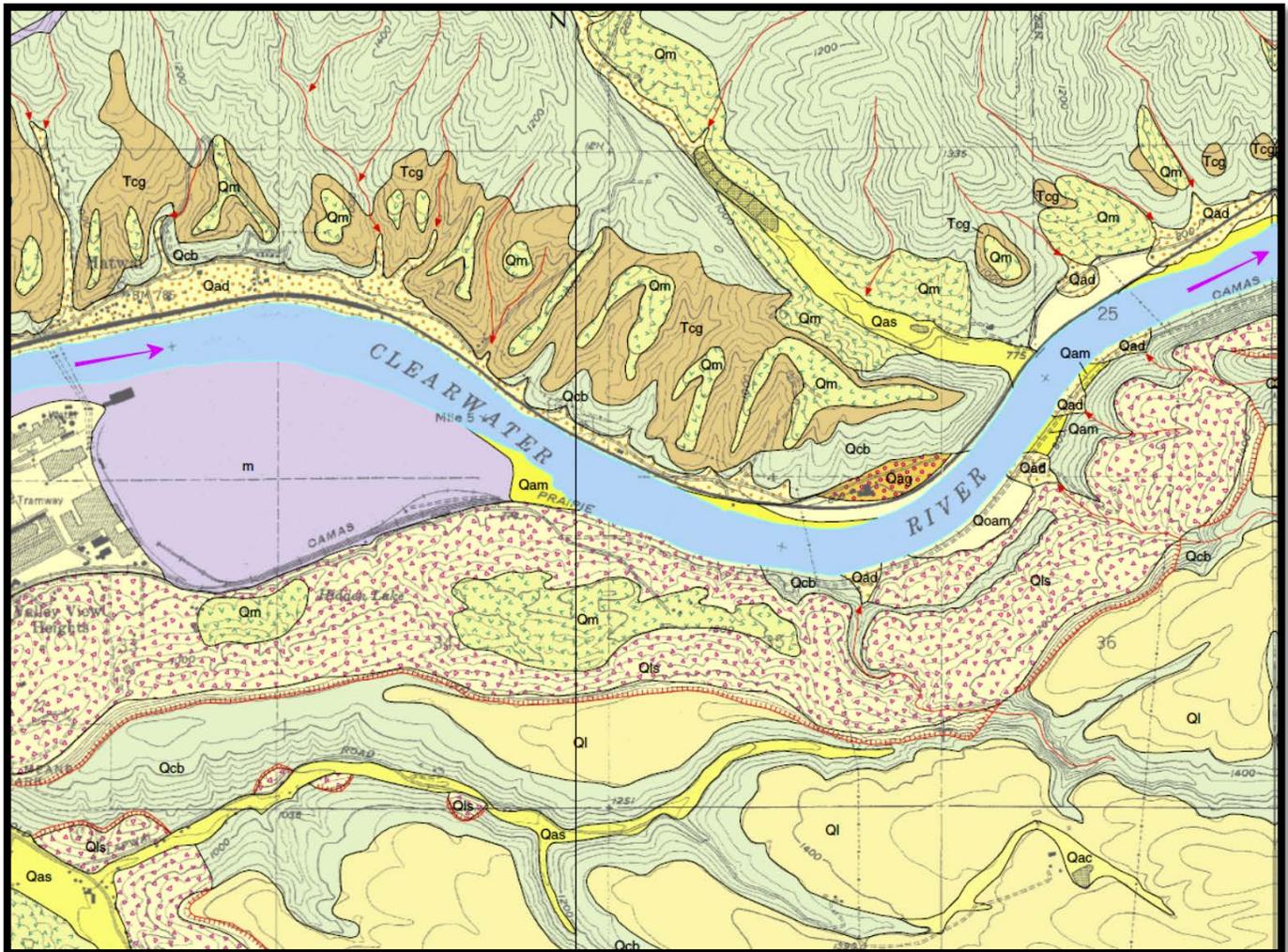


Stop 10: Eagles Point – Landslide, Clearwater Gravels, and Wilma Fault

Tc1g—Clearwater gravel (late Pliocene?)—Primarily mainstream channel gravel and sand deposits that form a highly dissected terrace. Terrace surface remnants, from east to west, range from 325 to 315 m (1,080-1,050 feet) in elevation; an alluvial fan facies forms remnant slopes graded to the terrace. Gravel clast lithologies, forest cross-bedding, and cobble imbrication indicate a source and current direction similar to the present Clearwater River (Hooper and others, 1985; Othberg and others, 2003). Gravel clasts include Columbia River basalt, nonbasalt igneous rocks (commonly Idaho batholith), and older metamorphic rocks (Webster and others, 1982). The gravels and sands are more weathered than typical Quaternary deposits, showing yellow to brown iron oxides in the matrix, local cementation, and softening of some gravel clasts. Recent field observations by Othberg and others (2003) suggest a complex facies in this unit, reflecting an interaction of mainstream and tributary sources. These deposits and their stratigraphic relationships are exposed in two locations: (1) uphill from the site described by Kuhns (1980) in the POE Asphalt gravel pit in North Lewiston (sec. 29, T. 36 N., R. 5 W.), and (2) 5 km (3 miles) to the east in a gravel pit adjacent to Groundcovers, Inc. (Othberg and others, 2003; sec. 26, T. 36 N., R. 5 W.).



Stop 11: Central Grade –Clearwater Gravels and Lake Missoula Flood deposits



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