



West Bar "Megaripples"

Wenatchee Valley Erratics Wenatchee, Washington

The Wenatchee Valley Erratics Chapter is named after the prominent, predominately white-color rocks that were carried to the Wenatchee Valley embedded within icebergs floating in the ice-age floodwaters. After the floodwaters receded and the icebergs melted, these ice-rafted erratics (foreign rocks) were left high on the hillsides and remain today as testaments to the catastrophic Ice Age Floods in Wenatchee Valley.

In the fall of 2000 the Ice Age Floods Institute Board decided to support local chapters, so local geology proponent Charlie Mason seized the opportunity. Over 30 people attended the first meeting where Charlie was elected president, Ken Lacy Vice-President, Susan Lacy Secretary/Treasurer, and Wilf Woods, local newspaper publisher, took the PR position. The name Erratics was enthusiastically approved and the chapter was off and running, becoming the first IAFI chapter in the spring of 2001. For many years, the Erratics were the largest IAFI chapter, with over 125 members, even including some from outside Washington State.

The Wenatchee Valley Erratics Chapter works cooperatively with the Wenatchee Valley Museum and Cultural Center. The chapter meets six times a year (bi-monthly) at the museum, with speakers highlighting the Ice Age Floods story or other geologically related topics. The Erratics and museum also host several field trips exploring the Ice Age Floods and geology of north-central Washington.

The Ice Age Floods Institute is dedicated to educating the public about the astounding Ice Age Floods story and the features associated with the floods within the north-central Washington area.



Steamboat Rock - Upper Grand Coulee

FOLLOWING THE PATHWAY

During the last glacial cycle of the ice-ages some 80,000 to 14,000 years ago, continental glaciers and repeated massive floods carved many of the distinguishing features of the interior Northwest's unique landscape.

This is your local guide to dramatic evidence of those cataclysmic forces, from spectacular canyons and cliffs to waterfalls and vast, flood-eroded scablands, that can be witnessed with a short road trip.

It is our hope that you will use this guide to explore these fascinating geological features in our region and will want to learn more about the dramatic ice-age story of glaciers and floods.

OF THE GREAT FLOODS



Learn more at IAFI.org or facebook.com/IceAgeFloods/

A GUIDE TO THE INCREDIBLE ICE AGE FLOODS IN THE WENATCHEE VALLEY AREA

Our Cataclysmic Floodscape

DETAILED MAP INSIDE

Highlighting Day Trips to prominent ice-age flood features in the Wenatchee Valley area

A regional guide to geological evidence of the GREAT ICE AGE FLOODS that sculpted the Wenatchee area landscape



Moses Coulee - 3 Devil's Cataract

During the largest Ice Age Floods, water level in the Wenatchee vicinity was almost one-thousand feet deep.

Some boulders as large as a small house (40' diameter) were carried as bedload by floodwaters and deposited in East Wenatchee. A good location to see them is along the Apple Capital Loop Trail.

At least five large floods poured through Moses Coulee during the most recent Ice Age. Enormous amounts of gravel and rock debris flooded out the mouth of Moses Coulee south of Rock Island, Washington, and blocked the flow of the Columbia River valley for years at a time, forming large temporary lakes where Wenatchee sits today.

Gigantic, well-defined current dunes (ripple marks) occur at Brays Canyon, north of Orondo, Pangborn Bar in East Wenatchee, and on West Bar across from Trinidad. Some of the current dunes are twenty feet high and as much as 300 feet apart.

Large white, granitic erratic boulders that were carried in on icebergs from distant locations during the floods dot the hillsides within the Wenatchee valley. The rocks represent the "high water" marks of the catastrophic Ice Age floods that filled the valley.

Interesting Flood Facts!

The Story of the Great Ice Age Floods

During the peak of the last Ice Age, a vast Cordilleran continental ice sheet covered southwestern Canada and the northern parts of Washington, Idaho and Montana. An eastern Purcell lobe of the ice sheet descended into the Idaho panhandle, blocking the Clark Fork River with an ice dam thousands of feet thick.

Water rising behind the dam flooded the valleys of Montana creating Glacial Lake Missoula – a great inland lake stretching over 200 miles to the east with a volume of water greater than Lake Erie and Lake Ontario combined.

The rising lake waters periodically caused the ice dam to fail, resulting in sudden, cataclysmic floods that rushed across northern Idaho and the Channeled Scablands of eastern and central Washington, through the Columbia River Gorge, and into Oregon's Willamette Valley, before emptying into the Pacific Ocean at the ancient mouth of the Columbia River. Glacial Lake Missoula would have drained in just a few days as a volume of floodwaters greater than all the rivers of the world combined roared across the landscape at up to 60+ mph.

Now imagine this happening not once but dozens, perhaps even hundreds of times as the advancing continental glacier built a new ice dam!

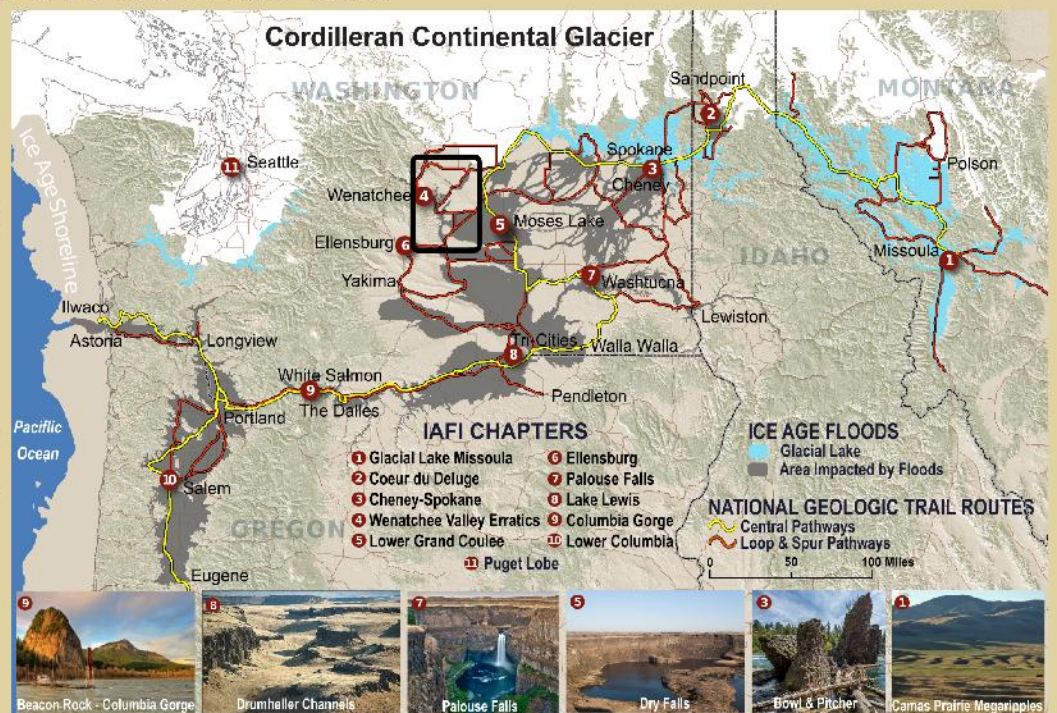


Ice Age Floods National Geologic Trail

Since the 1990's the Ice Age Floods Institute (IAFI) has worked to create and to build support for the Ice Age Floods National Geologic Trail.

The Ice Age Floods National Geologic Trail is essentially a network of marked touring routes extending across parts of Montana, Idaho, Washington, and Oregon, with several special interpretive centers located across the region. Many interested parties are being brought together in a collaborative and effective interpretive program at a remarkably low cost, despite the extraordinary size of the region.

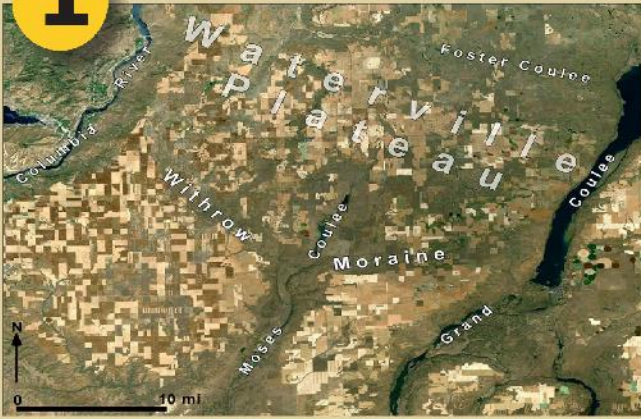
The Trail is being developed under the National Park Service on existing public lands, with no changes in jurisdiction and no threats to private property rights. The role of the National Park Service is to coordinate and manage the planning of the project and the telling of the story, without taking custodianship of public and private lands.



Explore Ice Age Floods Features in the Wenatchee Valley

Discover why our region is like nowhere else. Jump into the Ice Age Floods story with a **DRIVE/HIKE/LEARN** day tour

1 Waterville Plateau

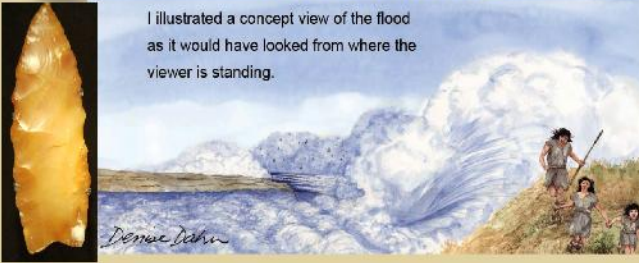


The advancing Okanogan Lobe of the Cordilleran Ice Sheet flowed south from the Okanogan region, filled the Columbia River valley and radiated across the northern **Waterville Plateau**, leaving behind fascinating glacial landforms. Near the mouth of the Okanogan Valley the ice sheet was over 2,000 feet thick. The ice dammed the Columbia River, creating Glacial Lake Columbia and forcing the giant floods from Glacial Lake Missoula to erode Grand Coulee. Moving ice molded bedrock and sediment into elongated, streamlined ridges called drumlins. The Okanogan Lobe also left accumulated debris as a terminal moraine known as the Withrow Moraine, north of the town of Withrow, Washington.

Erratic boulders, including exceptionally large ones called "haystack rocks," mark the Withrow Moraine. Although some smaller erratics were derived from bedrock in the mountains to the north, the huge haystack rocks are entirely Columbia River basalt, plucked out of the local bedrock and repositioned by the moving ice. Hundreds of haystack rocks are clustered at Boulder Park.

As the Okanogan Lobe became stagnant and melted in place toward the end of the last ice age, it left behind its entrained debris as rolling topography. Sediment-covered ice blocks melted to produce closed depressions (kettles) on the Plateau, some containing shallow lakes and ponds. Streams deposited layers of sand, gravel, and silt next to the melting ice, forming isolated hills and mounds of stratified sediment called kames. Subglacial streams flowing in tunnels beneath the disintegrating glacier produced streambed deposits which became the serpentine ridges known as eskers. Excellent examples of these features occur in the Sims Corner area.

2 Early Man – Clovis Points East Wenatchee



Did early man experience the catastrophic Pleistocene Ice-Age flooding? During the installation of an irrigation line in East Wenatchee on May 27, 1987, orchard workers uncovered a cache of enormous spear points and knives subsequently identified as **Clovis points**, named after the first fluted projectile point site, discovered near Clovis, New Mexico. To date, the East Wenatchee Richey Clovis Cache has yielded one of the largest fluted stone tools ever found (9.25 inches, compared to earlier discoveries measuring 6 inches). The East Wenatchee site also contained more artifacts in situ (undisturbed and in place) within a contained area than any site previously discovered. Sixty-nine stone and bone artifacts were recovered.

An ash layer was documented just below one of the large fluted stone tools. The ash layer was likely from an eruption of Glacier Peak, a composite volcano located in the Cascade Range about 60 miles northwest of the site. The Glacier Peak ash is dated at 11,250 year before present. This suggests the Clovis people occupied the area shortly after the ash fall. No one knows why the Clovis people didn't return to their cache of tools. Perhaps they were caught by one of two Columbia River drainage ice-age floods that came after the ash fall?

The pits were back-filled and covered with a concrete slab after the excavation, and the site reverted to orchard. This exciting discovery is highlighted in an exhibit at Wenatchee Valley Museum and Cultural Center, one of the participants in the excavation, interpreting the geology and archaeological discoveries of the region, and displaying materials from the Clovis site in East Wenatchee, Washington.

Find an interactive map and additional details online about these and other Ice Age features in the area, at <https://iafi.org/>



3 Wenatchee Floods Pangborn Bar and Erratics



Ice-age flood depths at Wenatchee/East Wenatchee reached almost 1,000 feet above the modern Columbia River. **Pangborn Bar** formed as floodwaters rounded the river bend, creating a large, crescent-shaped point bar on the inside edge of the torrential current. This bar underlies most of East Wenatchee. Large dunes of water-laid sediment, also called "giant current ripples," with crests up to twenty feet tall and spaced 300 feet apart, mark the surface of the bar. 2nd and 4th Streets in East Wenatchee go up and down over the dunes.

Erratics, rocks foreign to the area, were deposited in two ways. As floodwaters left the restrictive confines of the Columbia Valley and entered Wenatchee the speed of the floodwaters slowed. Enormous boulder erratics that bounced along as bed load settled out on the local bedrock. A good place to see these large boulders (some 40' in diameter) is along the Apple Capital Loop Trail in East Wenatchee.

Numerous icebergs carrying encased rocks, some from as far away as Canada and NW Montana, also floated on the floodwaters. As the floodwaters retreated the icebergs were left high on the hillsides, then melted, leaving the erratics to record the temporary water level.



Moses Coulee, second only in grandeur to Grand Coulee, was excavated by the Ice Age Floods. After the Okanogan Lobe blocked the Columbia River at Brewster, but before it reached Bridgeport, floods channeled into Moses Coulee. Later, as the ice lobe advanced further south, it covered the northern end of Moses Coulee and forced the floodwaters to veer into Grand Coulee, carving it into a more efficient outlet. Glacial sediments deposited by the Okanogan Lobe are preserved in upper Moses Coulee, north of Highway 2.

Moses Coulee is carved from a thick sequence of basalt flows of the Columbia River Basalt Group that are Miocene in age (15-16 million years old). The "colonnade" layers of the bedrock consist of columns of basalt that were easily plucked out and removed by the turbulent ice age floods, allowing formation of the high, vertical walls of the coulee. Near Palisades, the cliffs that form the walls of the coulee reach 800 feet high.

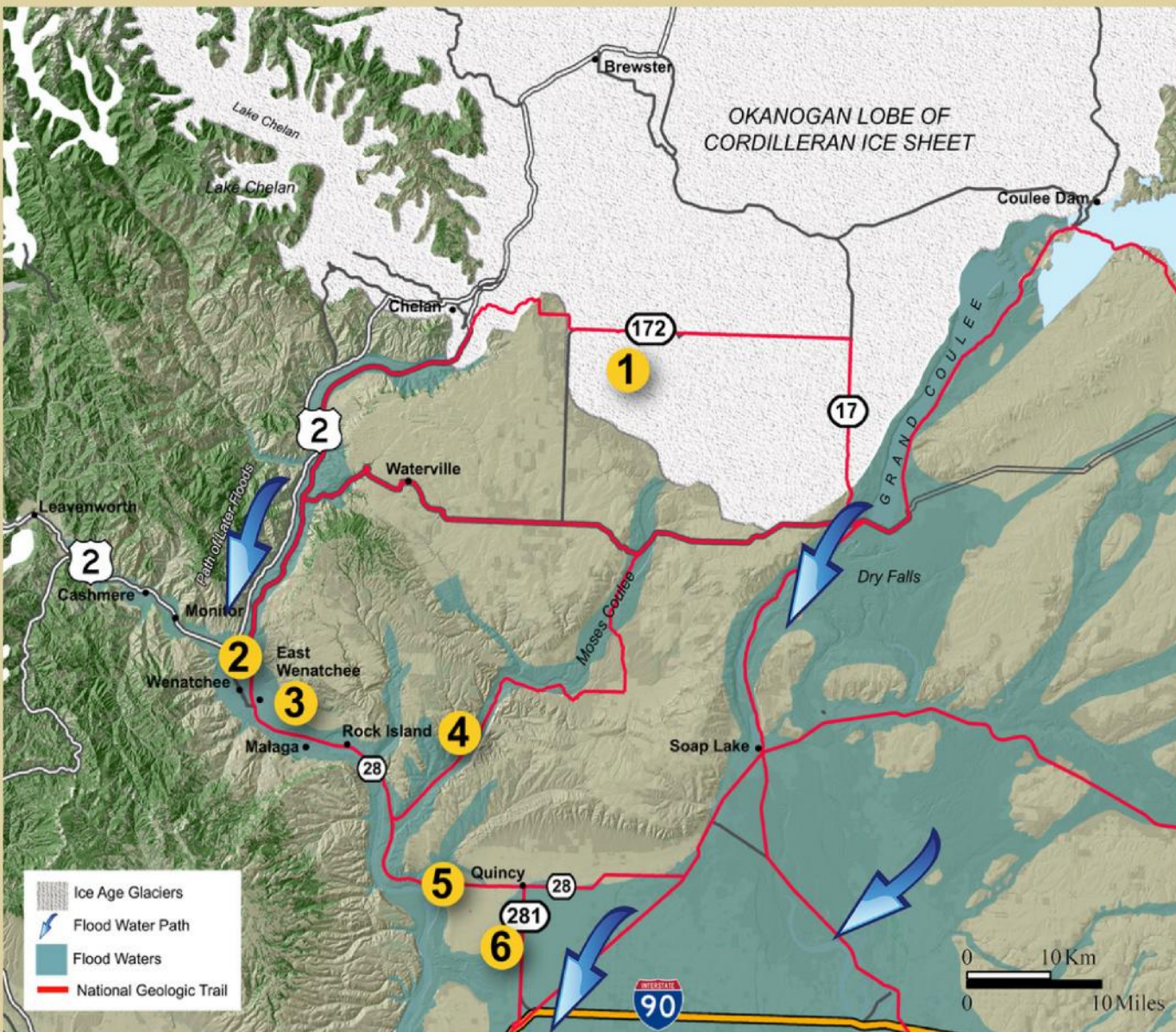
Ice-age floods carried large volumes of eroded rock down the coulee and deposited it in a huge gravel bar fanning out from the coulee mouth. The bar expanded across the Columbia River valley, damming it from Rock Island nearly ten miles downstream to Trinidad, and backing up a temporary lake in the Wenatchee area. The impounded lake waters eventually eroded down through the fan deposits, draining the lake and leaving behind layers of silty lake deposits and stranded deltas that had formed where side-streams deposited their sediment load into the lake. These deposits can still be seen today near Wenatchee.

5 Babcock Bench/West Bar Basin & Butte Topography, Flood Bars



Babcock Bench is a 20-mile long, relatively flat bedrock feature along the east side of the Columbia River from Trinidad, WA to I-90 that is bisected by Potholes and Frenchman Coulees. Babcock Bench has excellent examples of "basin and butte topography" where floodwaters carved out basins (eroded depressions) and left isolated basalt buttes on a flood-resistant layer of Columbia River Basalt.

West Bar, a large crescent-shaped "point" bar with well-preserved asymmetric current dunes or ripples, represents one of the most dramatic flood features found in the Ice Age floods path. Much of the sediment in West Bar was likely deposited by back-flooding from early Glacial Lake Missoula floods that left the Quincy Basin via Potholes Coulee to the south. Later floodwaters from Glacial Lake Columbia and meltwater floods from the retreating continental ice sheet re-worked much of the surface of West Bar into its present form.



6 Potholes Coulee



Potholes Coulee consists of two elongate alcoves separated by a relatively thin "rock blade," similar to Dry Falls in Grand Coulee. It even has plunge pools, now filled with lakes, beneath the arcuate cataract cliffs that mark the upstream end of each alcove. Ancient Lakes are in the northern alcove while Dusty Lake is in the southern alcove.

Spotting it on a new topographic map in the early 1900s, Potholes Coulee was the first feature that J Harlen Bretz realized was likely a result of massive flooding. His insights and dedicated research, despite criticism by the geological elite and against the geologic 'uniformitarianism' dogma of the day, eventually led to the incredible Ice Age Floods 'catastrophism' story we recognize today.