

# DOWNLOAD PDF GEOLOGIC HAZARDS IN THE HELLS CANYON REGION OF IDAHO, OREGON, AND WASHINGTON

## Chapter 1 : Hells Canyon Attractions - Go Northwest! A Travel Guide

*u.s. department of the interior u.s. geological survey geologic hazards in the hells canyon region of idaho, oregon, and washington tracy l vallier l.*

Request Library Access Travels in Geology: Hells Canyon forms part of the Oregon-Idaho border. Especially given how hard it is to get there: Few roads and only steep, difficult trails run down into the 2, meter-deep gorge – the deepest canyon in North America – which forms part of the border between Oregon and Idaho. Despite its remote and rugged challenges, however, Hells Canyon has attracted visitors for thousands of years, from the Clovis people and Native Americans to turn-of-the-century gold miners, sheep ranchers and homesteaders. Today, the canyon is popular among whitewater rafters and fishing enthusiasts. A trip through Hells Canyon, with its diverse geologic pedigree involving million years of island arcs, volcanism and catastrophic floods, will also delight geology-minded travelers. Geologists think the canyon began forming only about 6 million years ago. This terrace above the banks of the Snake River was left behind by the catastrophic Bonneville Flood, which roared through Hells Canyon about 15, years ago. Columnar basalt forms when thick lava cools slowly, fracturing along joints to form mostly hexagonal columns. Today, the river flows from Wyoming across southern Idaho before turning north into Hells Canyon, eventually unloading into the Columbia River near Kennewick, Wash. But in its nascent phase millions of years ago, the Snake may have run in the opposite direction: Many of the tributaries of the Snake River flow south. The oldest rocks in Hells Canyon are exposed in the narrower stretches of the canyon, where the river has incised deeper and cut further back in time. These dark basalts originally erupted along an arc of volcanoes situated in the proto-Pacific Ocean. Over millions of years, the chain of volcanoes subsided and were colonized by corals that built massive underwater platforms of limestone, now exposed in the northern end of Hells Canyon, near where the Grande Ronde River tributary meets the Snake. Forest Service and looked after by a caretaker who welcomes visitors to the homestead. These intrusive layers are exposed in Hells Canyon in several locations along both the east and west rims of the canyon. Between million and 17 million years ago, what is now the Pacific Northwest was added to North America through a series of collisions between the continent and offshore landmasses and islands. The accretion was accompanied by copious volcanic activity, including massive flood basalts from the Columbia volcanic province, which created a high plateau. It was into this plateau that the Snake began carving its path about 6 million years ago. One of the most dramatic erosive events in Hells Canyon took place about 15, years ago, when spillover from prehistoric Lake Bonneville, in what is now northwestern Utah, sent a flood through Hells Canyon 1, times greater than present-day maximum river flows. At the peak of the flood, an estimated , cubic meters per second of water gushed over the Snake River Plain at speeds faster than kilometers per hour. Geologists think the floodwaters widened Hells Canyon more than deepened it, transforming the margins of the riverbanks more so than the depths of the riverbed. The most dramatic changes still visible today are the large terraces a hundred meters above the original riverbanks that were deposited as the floodwaters slowed in wider sections of the canyon, dropping loads of debris. A Hell of a Place to Live Big horn sheep descend to the river to drink. These geometric pictographs, painted with red ochre pigments, are thought to be about 2, years old. Hells Canyon was barely glimpsed by the Lewis and Clark expedition in , which followed the Salmon River to its confluence with the Snake in Hells Canyon before turning back to explore another route. In , the Wilson Price Hunt expedition tried to descend the Snake to the Columbia River in wooden canoes, but they too turned back in the vicinity of the present-day Hells Canyon Dam due to hunger and unusually cold conditions. In the s, gold was discovered along river bars at the northern end of Hells Canyon and soon, placer mining operations began spreading upriver, though none were very successful. The most visible legacy in Hells Canyon is from the homestead and sheep-ranching era, which began in the late s and continues today. At first, individual families settled onto hectare homesteads, with more than families living along the river by But the isolation and lack of tillable farmland were

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disheartening, and by only a handful of ranches remained in operation. Numerous houses and outbuildings remain in Hells Canyon, some in better repair than others. Most of the active ranching operations are located along the Imnaha River, a tributary of the Snake, with the Dug Bar and Johnson ranches still standing in Hells Canyon. Several ranches reverted to federal control and a few of these have been preserved as museums, open to the public, including the Kirkwood Ranch, located at the mouth of Kirkwood Creek. Many of these abandoned places, with their overgrown orchards and gardens, have created prime habitat for black bears, elk, mule deer and bighorn sheep. Cougars and coyotes also call the canyon home, although they are rarely seen. The archaeological district preserves more than prehistoric, mining, homestead and ranching sites, many of which are on the National Register of Historic Places. Small sandy beaches along the river provide camping spots for rafters and jet-boaters alike. The rapids in Hells Canyon were formed when side streams, rock falls and landslides deposited boulders and large debris in the river channel, creating short stretches of turbulent water separated by wide calm pools of deep water, a type of river topography known as pool and drop. The flow rate of the Snake River is controlled entirely by the demand for hydroelectric power, with rates fluctuating throughout the day from 7, to 20, cubic feet per second. Flow rates are usually highest in the heat of the day during the summer, when demand for power is highest. The dam-controlled flow rate means the Snake can be boated year-round, though most commercial trips run in the spring and summer months, when warmer air temperatures make for a more pleasant river experience. Despite the wilderness designation, Hells Canyon is not motor-free. Rafting trips begin below the Hells Canyon Dam and run downstream for three to five days, taking out at either Pittsburg Landing or Heller Bar. Jet-boat trips usually begin at Heller Bar and run upstream as far as the Hells Canyon Dam before returning downriver, a round trip of kilometers. Both rafting and jet-boat trips can be customized for fishermen, families, history and hiking buffs. There is only limited access by car: An unpaved forest road descends to the river at Pittsburg Landing and a narrow, winding road dead ends at the Hells Canyon Dam. A number of hiking and horse trails run down into and through Hells Canyon, with the Snake River Trail offering access from Pittsburg Landing into the Hells Canyon wilderness. However, steep trails, rock slides, rattlesnakes, poison ivy, hot summers and frigid winters can make hiking in the canyon a hellish experience indeed. Better stick to the river, sit back in a raft and enjoy the ride! To date, a total of 15 dams have been built along the Snake for a variety of purposes, from irrigation to flood control to hydroelectricity. Hells Canyon is home to three hydroelectric impoundments: Together they have a maximum capacity of megawatts of power production. If you would like to gain access to the full version of this article, as well as all EARTH content, please subscribe today. If you are connecting using a Library IP-based Subscription, please access full issues of the magazine through our Library Access portal.

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## Chapter 2 : Search Catalog | Idaho Geological Survey

*Geologic hazards in the Hells Canyon region of Idaho, Oregon, and Washington.*

January 1, I flew home to Oregon with a north-facing window seat on a spectacularly clear day. So much incredible landscape! So much incredible geology! Here are nine photos I shot out the plane window, keyed to the geologic map below. Absaroka Range, northern Wyoming and southern Montana. Much of the present topography is the result of glacial erosion during the Pleistocene. Absaroka Range, east edge of Yellowstone Lake on left. Since then, rhyolite lavas, shown in pink, filled in the caldera. Photo and geologic map of Yellowstone National Park. The dashed red line marks the caldera edge. Recent faulting of the Basin and Range Province. In this photo, the Pahsimeroi River flows northwestward to its confluence with the Salmon River, near the left side of the photo – and the Salmon continues flowing northward for about miles before it turns westward and eventually joins the Snake River. But what I think is so cool about this photo is that it so clearly shows the abrupt western edge of the Lemhi Range, which runs diagonally from the right east side of the photo to just above the center. The range literally rises right out of the ground. The fault is a normal fault, caused by crustal extension. Notice the linear nature of the ranges to the northeast upper right – More normal faulting! This is a northern expression of the Basin and Range Province. Mountains of the Idaho Batholith. Granitic rock of the Idaho Batholith underlies a huge area of Idaho, some 14, square miles of it. The rock intruded as a series of plutons during the Late Cretaceous, from about – 65 million years ago. Similar in age and composition to the Sierra Nevada Batholith, the Idaho Batholith was fed by magma created during subduction along the west coast of North America. Mountains of the Idaho Batholith Photo 5. These basalts erupted mostly between In fact, they flowed all the way to the Pacific Ocean. The Imnaha River forms the next deep canyon to the left west. Those basalt flows overlie rock of the Wallowa accreted terrane: It was added accreted to the North American continent during the Mesozoic – probably some million years ago. Glacial valleys and frontal fault zone on the north side of the Wallowa Mountains, Oregon. You can see a bunch of other things in this photo though. First off, the mountains end suddenly in a line: Also, you can see how glaciers carved the landscape. Notice the deep U-shaped valleys, cirques, and knife-edged ridges called aretes. And see the lake in the upper right corner of the photo? Helens on the left west, Mt. Adams in the middle, and Mt. Rainier in the far distant right. Rainier is 90 miles away! Looking north over the Dalles to Mts. St Helens, Rainier, and Adams. And they can awaken at any time. I remember a college friend of mine wanted to climb Mt. It was dormant then, and nobody worried about it. Rainier have erupted many times in the past several thousand years; Mt. Adams though, erupted only twice in that period. From left west to right, the volcanoes are Mt. You can see the Bonneville Landslide along the river on the right side of the photo, directly below the left base of Mt. It detached from the cliffs directly behind it about A. Just downriver from the landslide, you can see the Cascade Locks zig-zagging across the river. The ridges at the bottom of the photo lead up to Mt. Apparently, the view out the south side of the plane was even more ridiculously cool. Columbia River, just below Portland. Right near Portland, the Columbia River turns northward for about 40 miles before it heads west again out towards the Pacific – and it drops only 10 feet in elevation for the whole distance. The northward deflection of the river is probably the result of uplift of the Portland Hills, which likely began as long as 16 million years ago they also deflect 16 million year old lava flows of the Columbia River Basalt. That town along the river in the background is St. View northward, down the Columbia River, Washington on the right, Oregon on the left.

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## Chapter 3 : Hells Canyon | geologictimepics

*Geologic hazards in the Hells Canyon region of Idaho, Oregon, and Washington. in the Hells Canyon region of Idaho, Oregon, and Washington " Geologic hazards.*

Bureau of Land Management and the U. The area that is administered by the Forest Service consists of portions of in descending order of acreage the Wallowa , Nez Perce , Payette , and Whitman National Forests. These are separated by a benchland at mid-elevation between the river and canyon rim between Saddle Creek and Dug Bar. The dominant vegetation is native bunchgrasses and shrubs. Trees are scattered throughout the Oregon side of the Wilderness, but concentrated on north-facing slopes and in stream bottoms - primarily ponderosa pine and Douglas fir. The three topographic provinces are dissected by many drainages including Saddle, Temperance, Salt, and Sluice Creeks. The upper areas are alpine and subalpine with several lakes and geologic formations of glacial origin. Vegetation is sparse and broken by large areas of rock. The middle portions contain dense forests of larch , lodgepole pine , and true firs. Lower elevations are characterized by dry, rocky, barren, steep slopes breaking into the Snake River and its major tributaries. Trees are sparse, consisting mostly of ponderosa pine and Douglas fir. Human history Humans have historically used the Hells Canyon Wilderness area for farming, ranching and mining activities. Historically sheep and cattle have grazed this area of Northeastern Oregon since the s as the Nez Perce grazed horses and cattle in the main canyons. By the s homesteaders on the Oregon benchland were grazing sheep, cattle, and horses throughout the valley and canyons. Cattle grazing continues today in a small portion of the Wilderness, as permitted in the Wilderness Act, which allows some traditional activities to continue as long as wilderness values are not compromised. Some mining has also occurred, primarily on the Idaho side of the Wilderness. A variety of vegetation grows in Hells Canyon Wilderness. Sagebrush and bunchgrass grow in lower parts of the canyon with deciduous bushes and trees along the numerous streams that run into Hells Canyon. Engelmann spruce and sub-alpine fir grow at the highest levels of the Wilderness, with western larch , Douglas fir , and ponderosa pine found between the two extremes. Prickly pear cactus and poison ivy are fairly common as well. Black bear , cougar , elk , deer , mountain goat , chukar , and bighorn sheep are common. There have been reports, documented as recently as the late s by local Forest Service and agriculture workers, of grizzly bear in the Wilderness. The designation comprises the main stem from the confluence of the North and South Forks of the Imnaha River to its mouth, and the South Fork from its headwaters to the confluence with the main stem. Many routes follow ridges and traverse moderate slopes and benchlands, while others climb steep slopes. These trails are extreme in difficulty, and any water sites should be viewed with skepticism, especially in mid summer to mid fall. Wilderness Areas do not allow motorized or mechanized vehicles, including bicycles. Although camping , hunting , and fishing are allowed with proper permit, no roads or buildings are constructed and there is no logging or mining , in compliance with the Wilderness Act.

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## Chapter 4 : Hells Canyon Wilderness (Oregon and Idaho) | Revolv

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Geology[ edit ] The geologic history of the rocks of Hells Canyon began million years ago with an arc of volcanoes that emerged from the waters of the Pacific Ocean. Over millions of years, the volcanoes subsided and limestone built up on the underwater platforms. The basins between them were filled with sedimentary rock. Between and 17 million years ago, the ocean plate carrying the volcanoes collided with and became part of the North American continent. A period of volcanic activity followed, and much of the area was covered with floods of basalt lava , which smoothed the topography into a high plateau. The Snake River began carving Hells Canyon out of the plateau about 6 million years ago. Significant canyon-shaping events occurred as recently as 15, years ago during a massive outburst flood from Glacial Lake Bonneville in Utah. The mild winters, and ample plant and wildlife attracted human habitation. Pictographs and petroglyphs on the walls of the canyon are a record of the Indian settlements. They turned back without seeing the deep parts of the canyon. There remains no evidence in the canyon of their attempts; their expedition journals are the only documentation. The early miners were next to follow. In the s gold was discovered in river bars near present-day Hells Canyon National Recreation Area, and miners soon penetrated Hells Canyon. Gold mining was not profitable here. Evidence of their endeavors remains visible along the corridor of the Snake River. Later efforts concentrated on hard-rock mining, requiring complex facilities. Evidence of these developments is visible today, especially near the mouth of the Imnaha River. Much of these activities rely on the mighty Snake River , which is the main factor in the creation of Hells Canyon. The Snake River is home to numerous fish species, an abundance of class I-IV rapids some of largest in the Pacific Northwest , diverse wildlife and miles of trail systems. These key components make Hells Canyon an outdoor recreation mecca that brings in tourists from around the world. Hells canyon offers tours year round, while most of the whitewater activities peak in summer months. To participate in these recreational activities one can utilize commercial charters or private trips.

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## Chapter 5 : Hells Canyon - Go Northwest! A Travel Guide

*Geologic hazards in the Hells Canyon region of Idaho, Oregon, and Washington / by Tracy L. Vallier.*

Topography[ edit ] The Oregon portion of Hells Canyon Wilderness is characterized by two steep breakland areas in excess of 60 percent paralleling the Snake River. These are separated by a benchland at mid-elevation between the river and canyon rim between Saddle Creek and Dug Bar. The dominant vegetation is native bunchgrasses and shrubs. Trees are scattered throughout the Oregon side of the Wilderness, but concentrated on north-facing slopes and in stream bottoms - primarily ponderosa pine and Douglas fir. The three topographic provinces are dissected by many drainages including Saddle, Temperance, Salt, and Sluice Creeks. The upper areas are alpine and subalpine with several lakes and geologic formations of glacial origin. Vegetation is sparse and broken by large areas of rock. The middle portions contain dense forests of larch , lodgepole pine , and true firs. Lower elevations are characterized by dry, rocky, barren, steep slopes breaking into the Snake River and its major tributaries. Trees are sparse, consisting mostly of ponderosa pine and Douglas fir. Human history[ edit ] Humans have historically used the Hells Canyon Wilderness area for farming, ranching and mining activities. Historically sheep and cattle have grazed this area of Northeastern Oregon since the s as the Nez Perce grazed horses and cattle in the main canyons. By the s homesteaders on the Oregon benchland were grazing sheep, cattle, and horses throughout the valley and canyons. Cattle grazing continues today in a small portion of the Wilderness, as permitted in the Wilderness Act, which allows some traditional activities to continue as long as wilderness values are not compromised. Some mining has also occurred, primarily on the Idaho side of the Wilderness. A variety of vegetation grows in Hells Canyon Wilderness. Sagebrush and bunchgrass grow in lower parts of the canyon with deciduous bushes and trees along the numerous streams that run into Hells Canyon. Engelmann spruce and sub-alpine fir grow at the highest levels of the Wilderness, with western larch , Douglas fir , and ponderosa pine found between the two extremes. Prickly pear cactus and poison ivy are fairly common as well. Black bear , cougar , elk , deer , mountain goat , chukar , and bighorn sheep are common. There have been reports, documented as recently as the late s by local Forest Service and agriculture workers, of grizzly bear in the Wilderness. Snake River[ edit ] The designation comprises the main stem from the confluence of the North and South Forks of the Imnaha River to its mouth, and the South Fork from its headwaters to the confluence with the main stem. Many routes follow ridges and traverse moderate slopes and benchlands, while others climb steep slopes. These trails are extreme in difficulty, and any water sites should be viewed with skepticism, especially in mid summer to mid fall. Wilderness Areas do not allow motorized or mechanized vehicles, including bicycles. Although camping , hunting , and fishing are allowed with proper permit, no roads or buildings are constructed and there is no logging or mining , in compliance with the Wilderness Act.

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## Chapter 6 : Travels in Geology: Rafting the Pacific Northwest's heavenly Hells Canyon | EARTH Magazine

*Welcome to Hells Canyon Geology Hells Canyon is a ten-mile wide canyon located along the border of eastern Oregon and western Idaho in the United States. It is North America's deepest river gorge at 7, feet ( m).*

Then between and 16 million years ago the ocean plate carrying the volcanoes actually collided with North America, and thus became part of the continent of North America. Then a period of heavy volcanic activity occurred, covering a vast majority of the area with basalt lava, which created a very flat high plateau approximately 6 million years ago. The Snake River then began to cut through the basalt rock, and carved what we see today in Hells Canyon. Surprisingly, as recently as 15, years ago, there was significant carving of Hells Canyon during a tremendous flood from an outburst of Glacier Lake Bonneville in Utah. Seven Devils Mountain Range Hells Canyon National Recreation Area is among some of the wildest and remote areas in the nation, where its visitors will be exposed to everything from barren, dry, steep slopes to high country alpine country of the Seven Devils Mountain Range. These towering mountains were named for a vision of seven dancing devils that appeared to a Native American who was lost in this rugged area. We highly recommend that you bring your binoculars for your Hells Canyon visit, whether you are taking a guided jet boat tour or driving along the Hells Canyon Scenic Byway. They were just off the highway and added greatly to our wonderful day in this fantastic area. Trailheads For Hikers There is an extensive hiking trail system along the Idaho side of Hells Canyon that mainly follows old Forest Service access routes. Some traverses are very steep and extreme caution needs to be used by its visitors. The scenery the entire way is breathtaking, as the road winds along the east side of Hells Canyon Reservoir, which is the Idaho side of the canyon. Towering cliffs of green, brown and black basalt loom on each side of the canyon as this narrow and winding road takes you deeper and deeper into the canyon. There are several very nice campgrounds and boat launches found along the Hells Canyon Scenic Byway for visitors interested in spending more time along the Hells Canyon Reservoir. Each of these parks also provide boat landings. This concrete gravity dam is located on the Snake River at river mile , and is the third and final dam in the Hells Canyon Project of the Idaho Power Company. The other two dams are the Oxbow Dam and Brownlee Dam. The Hells Canyon Scenic Byway crosses the top of the dam as it heads from the east side to the west side of Hells Canyon. Just about a mile further the Hells Canyon Creek Visitor Center marks the end of the road and the beginning of the extremely remote and wild section of Hells Canyon. Only boats and rafts can continue on further into Hells Canyon. The Hells Canyon Creek Visitor Center provides very nice indoor interpretive exhibits and programs, and is open from Spring through late Summer. The outdoor displays are available to visitors all year round. There are also picnic tables, toilets, parking area and the Hells Canyon Boat Launch, which is one of the main boat launches in the entire Hells Canyon National Recreation Area. From the Hells Canyon Creek Visitor Center, you will be able to watch jet boats entering and leaving Hells Canyon, as well as watching river rafters leaving the boat launch as they embark on their wilderness journey down this incredibly remote and wild section of Hells Canyon. These folks started out at Lewiston Idaho, nearly river miles from this spot! These popular river tours utilize powerful jet boats that fight their way upstream to reach Hells Canyon, Hells Canyon Creek Visitor Center and Hells Canyon Dam, which is a mile round trip river excursion. There are several tour companies based out of Lewiston Idaho and the surrounding area, and most provide either half day or full day river adventures. Campground The campground provides 51 full service and 29 standard campsites, and eight cabins. Flush toilets, showers, dump station and electricity is available at the Hells Gate State Park Campground as well.

## Chapter 7 : Hells Canyon Geology

*ARTICLES, BOOKS and ABSTRACTS. Vallier, Tracy Lowell, , The Geology of part of the Snake River Canyon and adjacent areas in northeastern Oregon and western Idaho: Oregon State University, Corvallis, Ph.D. Dissertation, p.*

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## Chapter 8 : Hells Canyon National Recreation Area Idaho

*Hells Canyon is a mile (16 km) wide canyon located along the border of eastern Oregon, eastern Washington and western Idaho in the United States. [www.nxgvision.com](http://www.nxgvision.com) is part of the Hells Canyon National Recreation Area and is North America's deepest river gorge at 7,000 feet (2,134 m).*

## Chapter 9 : Geologic hazards in the Hells Canyon region of Idaho, Oregon, and Washington - Evergreen In

*From Hells Canyon Dam upriver nearly to Weiser, Idaho, the floor of the canyon is flooded by water impounded by three dams recently constructed by the Idaho Power & Light Co.*