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Origin of Dry Falls

Some 25 million years ago, at the beginning of the Miocene epoch, the area we now know as the Columbia Plateau was a fairly rough mountainous terrain made up generally of granite in the northern part, metamorphic and granitic rocks in the eastern part, and volcanic and sedimentary rocks in the southern and western parts. The streams that drained this area as well as regions to the west, north, and east had joined on their way to the sea and formed the primeval Columbia River.

Some time during the Miocene epoch, perhaps only slightly more than 10 million years ago, many large deep faults developed in the area of the Columbia Basin. These faults were so deep in fact, that they reached through the crust of the earth (50 miles ±). These deep cracks served two functions; one was that they produced a sudden lowering of pressure at great depths allowing the rocks which were hot enough to melt but were formerly under too great a pressure to do so, to become fluid or molten. The cracks then served as channelways for the molten rock or magma to speed to the surface where it flowed out as a volcanic eruption. Each layer or bed of basalt that can be seen in the cliff walls of the coulee represents a separate volcanic eruption. As the eruptions continued the lava flows began to cover the original terrain until in the Grand Coulee area it was completely buried. During the course of these eruptions, as the molten rock came pouring out on the surface, the earth's crust gradually sank down into the space left by the rising magma. This subsidence of the earth's crust along with the accompanying outflowing of lava produced a large basalt-filled basin. In the center of the basin the basalt is probably more than 10,000 feet thick. This accumulation of lava flows produced one of the largest basalt plateaus in the world.

Just how long the span of time was between the first and last of these eruptions is not known, however, it probably covered 10 to 15 million years. Likewise, the time differential between individual eruptions in the Dry Falls area is not known; it may have been a few hours, days, weeks, years, or thousands of years.

The lava flows, as they came rushing out of the volcanoes and spread over the area, first filled the stream valleys, forming dams that in turn caused enpondments or lakes. As time passed the streams eventually circumvented the lava dams and found new courses only to be redammed and pushed out of their channels by new floods of lava. This constant battle between the streams of water and lava floods continued until eventually the streams were more or less consolidated into one large river, the Columbia, and forced to skirt the north edge of the area of lava flows. The abundant lake deposits of silt, sand, and clay that are found between different basalt flows as well as the ancient lava-filled stream channels that can be seen in many of the coulee walls bear mute witness of the struggle that went on between these two opponents.

The lakes that were formed by the lava dams no doubt served as population centers for plants and animals that existed during that time. It is from the sediments that were deposited in the lakes and sometimes from the lava or palagonite (a yellowish-brown clay-like material formed by the alteration of volcanic glass) beds that immediately overlie them that the evidence of that life is found. Fossil leaf impressions, petrified wood, fossil insects, and bones of vertabrate animals have all been found in, or associated with, these ancient lake beds.

One of the most unusual fossils ever found in the Columbia Plateau is a mold, along with a few bones, of a small rhinoceros. It was located in Jasper Canyon, just below Dry Falls, in 1935 by a group of hikers. This fossil is commonly known as the "Blue Lake Rhino." The mold is perserved in pillow basalt that overlies a thin sand bed. Probably what happened is that the rhino, which was dead and bloated at the time, was lying in a small pond, and as molten lava flowed into the lake the lava was chilled, forming basalt pillows and palagonite that covered the dead rhino as well as several sunken tree trunks, without cremating them. The pillows were light enough that they did not smash the beast but were still able to pack in around the dead body sufficiently well to preserve its shape. Professional paleontologists have made a cast of the mold and reconstructed the rhino.

The basalt flows that make up the Columbia Plateau are in themselves somewhat of a wonder. Most magmas, as they pour out of a volcano, form lava streams that rush down the sides of the volcano, no matter whether it be a strata-cone like Mount Rainier or a shield volcano like Mauna Loa. The lavas of the Columbia Plateau were extremely fluid and spread out in large puddles or lakes. Some geologists who have studied them suggest that several of these lava lakes may have been more than one hundred miles across their longest dimension. As the lava flows cooled and solidified, many of them developed a joint system that produced the large vertical columns that are so noticeable in many of the coulee walls.

As the Miocene epoch drew to a close, the great fissure eruptions became fewer and fewer until at last all volcanic activity in the areas of the Columbia Plateau stopped. Then commenced a period of time when tremendous compressional forces within the earth began to slowly up-fold parts of the plateau into long narrow northwest to east-west trending ridges called anticlines. Some of these ridges are the Horseheaven Hills, Rattlesnake Hills, Yakima Ridge, Untanum Ridge, Saddle Mountains, and Frenchman Hills. During this time there was pushed up a great monoclinal fold whose trend was east-west through the Beesley Hills to Ephrata, where its trend became northeast to about Hartline. Simultaneously a small asymmetrical east-west trending anticline was pushed up in the Soap Lake area. During this period of folding the whole plateau was tilted slightly to the south by the general uplift of the mountainous area to the north.

The climate during Miocene (25-10 million years ago) and Pliocene (10-1 million years ago) times was temperate. Such trees as the bald cypress, chestnut, beech, fig, sycamore, tulip tree, magnolia, sassafras, hickory, poplar, birch, elm, and maple all flourished in the coulee area. Toward the last part of the Pliocene the climate began to cool and what we call the "Ice Age" began. During this period vast continental ice sheets slowly pushed their way down from the north country, overwhelming everything in their path except the highest mountain tops. These peaks stuck above the surface of the ice like islands from the sea.

The ice sheet pushed down out of Canada, across the Okanogan Highlands and into the northern part of the plateau. One lobe advanced as far south as Coulee City forming an ice dam across the Columbia River at the present site of the Grand Coulee Dam. At this position the ice remained stagnant, that is, the rate of melt was equal to the rate of advance for many years as evidenced by the large terminal moraine (a more or less sinuous ridge of boulders, gravel, sand, and mud) that formed at the ice front. This moraine stretches south-eastward from the lower end of the Lake Chelan across the Big Bend country almost to Coulee City, then turns to the northeast and parallels the west rim of the Upper Coulee to the site of Grand Coulee Dam, then turns eastward. As the great ice sheet lay stagnant and as it began to retreat, tremendous meltwater streams poured down from its icy surface. These streams quickly filled the lake behind the Grand Coulee ice dam to overflowing, the water spilled over the valley rim to the south, and the stage was set for the excavation of the Upper and Lower Coulees of the Grand Coulee.

The waters that overflowed the Columbia Valley at the present site of Grand Coulee Dam formed a river that flowed along the edge of the glacier, picking up additional water from the many meltwater streams that were pouring off the ice lobe to as far south as Coulee City. Here it roared down the steep south-sloping Coulee monocline forming a wild cascade 800 feet from top to bottom. The folding of the monocline had spread open the joint system of the columnar basalt flows at the crest of the fold and now the tremendous meltwater river began to attack this weakness. The surging torrent began to pluck columnar chunks of basalt from the face of the fold and a cataract developed that would dwarf any presently existing waterfall. This waterfall retreated some 20 miles back to the site of Grand Coulee Dam and into the Columbia River valley before the ice dam broke, allowing the Columbia River to return to its old course, and drying up the flow in the coulee.

At the same time Upper Grand Coulee was being excavated by the diverted Columbia River flowing over its retreating waterfall, the river spread out below the Coulee monocline and ran along the toe of the fold to about Soap Lake where it went raging over the brink of the Soap Lake anticline, forming another foaming torrent. Here again the folding had produced a weakness in the basalt which the turbulent river was quick to take advantage of, and soon a roaring cataract 400 feet high developed. This cataract retreated back upstream to the present site of site of Dry Falls before the original channel of the Columbia River was freed of ice, allowing the river to return to its normal stream course. When this happened the once magnificent falls became a series of sheer cliffs with small lakes, such as Dry Falls Lake, Alkali Lake, and Deep Lake, filling the plunge pools at their base (a plunge pool is the large deep pool that developes at the base of a falls). When the river abandoned the Grand Coulee stream course it left a series of lakes — Park Lake, Blue Lake, Lenore Lake, and Soap Lake — in the Lower Coulee. An interesting feature of these lakes is that they become increasingly more saline down the coulee, and Soap Lake, which is at the lower end, is world famous for the medicinal benefits of its salts.

One of the most interesting features of the Grand Coulee, geologically speaking, is how rapidly it was gouged out. This great channelway was dug in just a few thousand years. There are four factors that probably had a tremendous influence on the speed at which the coulees were cut. They are the large amount of water, the columnar nature of the basalt, the soft sedimentary beds between some of the basalt flows, and lastly the two big folds in the basalt — the Coulee monocline and the Soap Lake anticline.

The large volume of water pouring off the ice sheet formed a river that had enormous eroding power. The steep gradients that existed on the faces of the two folds helped the water reach a velocity great enough to pluck blocks of basalt from the bedrock and carry them down stream. The folds also broke up the basalt and opened up the joints so the water could work faster. The thin sedimentary beds between some of the flows helped speed the retreat of the falls inasmuch as these soft beds were very easily eroded. The churning waters actually undercut the basalt by washing away the sedimentary material. This under-cutting coupled with the inherent weakness imparted to the basalt by the columnar jointing caused vast sections of the falls to collapse and retreat, just as Niagara Falls is doing today.

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