U.S. Department of the Interior
Bureau of Reclamation

# Geology of the Grand Coulee Dam Area

## Pre-Cenozoic Geology: Creation to 65 million years ago

Grand Coulee Dam is near the boundary between the Okanogan Highlands to the northeast, and the Columbia Plateau to the southwest. The mountains and valleys of the Colville batholith align north–south to form the Okanogan Highlands. Highlands igneous rocks, having solidified from lava or magma include granite, granodiorite, quartz monzonite, quartz diorite, and diorite, with metamorphic types as well.

A plate tectonic force called subduction moved islands onto the prehistoric coastline forming the Colville mountains. Very few fossils are found in the rocks, but many metals and minerals including gold, silver, copper, and molybdenum are present. The rock types under the Columbia River basalt have not been studied.

## Tertiary Geology: 65 million to 2.5 million years ago

During the Miocene epoch, periodic eruptions from fissures in northeastern Oregon and southeastern Washington released large flows of highly fluid lava which quickly cooled to form basalt. These lava flows inundated more than 100,000 square miles in present–day Washington, Idaho and Oregon, covering the older rocks, plants and animals. The lava flows eventually pushed the Columbia River into its present channel, flowing to the west at the dam site. The basalt from the lava flows can be seen along portions of the reservoir valley rim, but were not encountered during construction of the dam, which rests on a granite and granodiorite foundation.

Other geologic features (or characteristics) in the Miocene Epoch included the tropical climate in what is now Idaho and Montana, and a series of giant meteor impacts in southeastern Oregon.

## Pleistocene Geology: 2.5 million to the Present

Glaciers, particularly the Cordilleran ice sheet, played a very important part in sculpting the landscape

we see today around Grand Coulee Dam and the Pacific Northwest. Three lobes, the Puget (which carved out Puget Sound), Okanogan (which pushed from the north, damming up the Columbia River at the current location of Grand Coulee Dam), and Purcell (located on the Idaho/Montana border), made up the Cordilleran ice sheet. The advancing glacier blocked the Columbia River, forming Lake Columbia, which was much larger and deeper than today's Lake Roosevelt. Lake Columbia's elevation was approximately 2,300 feet above sea level, while Lake Roosevelt's maximum is only 1,290 feet. Deposits of Lake Columbia sand, clay and gravel reached 740 feet thick. The gravel would later be used to build Grand Coulee dam.

Lake Missoula was formed in Montana when the Cordilleran ice sheet blocked the Clark Fork River near the Idaho Panhandle. Lake Missoula was huge - 2,000 feet deep and containing over 500 cubic miles of water. Which is more than Lake Erie and Lake Ontario combined. When the lake burst through the 2,500 foot Purcell wall of ice, the resulting rush of water reached speeds of up to 65 mph. The torrent of water traveled through northern Idaho, into eastern Washington and western Oregon. Over the course of time it stripped away soil and created canyons (also known as coulees). Today the areas carved out by the floods are collectively known as the Channeled Scablands.

In forming the canyons of the Grand Coulee, two cascades cut deep into the landscape. The larger one flowed over an 800-foot waterfall which eroded the rocks away as it cut through the valley where Grand Coulee Dam now sits. The second cascade eroded the southern end of the Grand Coulee, forming Dry Falls. Located just south of Coulee City, Dry Falls is 400 feet high and 3.5 miles wide – five times the width of Niagara Falls. At least 70 different floods occurred during the last ice age.

Eastern Washington's geology, and the landscape created by the floods, are the cornerstones of many regional features. The sound granite bedrock provides an excellent foundation for Grand Coulee Dam, and the upper reaches of the Columbia River within Washington provide water storage (Lake Roosevelt) for irrigation, power production, flood control, wildlife habitat, and recreation. In addition, the canyon of the upper Grand Coulee is used as a stabilizing reservoir, now called Banks Lake. Water from Banks Lake provides irrigation for over 670,000 acres to grow over 90 different crops and provide jobs to many farms and related businesses throughout the Columbia Basin. Today, people in the Pacific Northwest and beyond enjoy many benefits of eastern Washington's unique geology.

## For More Information

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