RECLAMATION
Managing Water in the West

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 located, approximately, on the boundary between the Okanogan Highlands to the north and east, and the Columbia Plateau to the south and west. The Okanogan Highlands consist of north and south-trending mountains and valleys of the Colville batholith. The rocks consist of igneous and metamorphic types of rock: granite, granodiorite, quartz monzonite, quartz diorite, and diorite. The mountains originated as islands and were stuck onto the prehistoric coastline by a plate tectonic force called subduction. Very few fossils are found in the rocks but many metals and minerals including gold, silver, copper, and molybdenite are present. The rock types under the Columbia River Basalt and what happened to them are a mystery.

Tertiary Geology: 65 million to 2.5 million years ago

During the Miocene epoch, periodic eruptions from fissures in northeast Oregon and southeast Washington released large flows of highly fluid lava called basalt. These lava flows inundated more than 100,000 square miles in Washington, Idaho, and Oregon covering the older rocks, plants, and animals. The Columbia River was eventually pushed into its present channel, which trends to the north at the dam site. The basalt can be seen along portions of the reservoir valley rim but were not encountered during the construction of the dam. The dam is sitting on granite and granodiorite. Idaho and Montana were seeing a tropical climate while southeast Oregon was the site of giant meteorite impacts

Pleistocene Geology: 2.5 million to the Present

Glaciers played a very important part in sculpting the landscape we see today around Grand Coulee Dam and the Pacific Northwest. The Corilleran Ice Sheet in particular played the largest role. It consisted of three lobes; the Puget Lobe (located at Puget Sound), The Okanogan Lobe (which dammed up the Columbia River at the current location of Grand Coulee Dam), and the Purcell Lobe (located on the Idaho / Montana boarder). The Okanogan Lobe pushed into the Columbia River valley from the north. The advancing glacier blocked the Columbia River forming Lake Columbia (where Lake Roosevelt is today). Only this Lake Columbia was much larger and deeper than Lake Roosevelt. The glacial lake

had a surface elevation of approximately 2300 feet above sea level. By comparison, Lake Roosevelt has a maximum surface elevation of 1290 above sea level. Lake Columbia deposited large amounts of sand, clay, and gravel with some deposits reaching 740 feet thick. The gravel would be used later to build Grand Coulee Dam.

Lake Missoula was also formed in Montana when the Cordilleran Ice Sheet blocked the Clark Fork River near the Idaho Panhandle. Lake Missoula was huge, containing more water than Lake Erie and Lake Ontario combined. It was 2000 feet deep and contained over 500 cubic miles of water. Lake Missoula was held in place by the Purcell Lobe, which was a 2,500 foot wall of ice. When the lake reached its maximum height it burst through the ice dam and the resulting rush of water reached speeds of up to 65 miles per hour. 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 canyon of the Grand Coulee, two cascades cut deep into the landscape. The larger one flowed over an 800 foot waterfall which eroded away as it cut through the valley where Grand Coulee Dam sits. The second cascade, now known as Dry Falls, eroded the southern end of the Grand Coulee. Dry Falls (which is located just south Coulee City) is 3.5 miles wide and 400 feet high - five times the width of Niagara Falls.

It is estimated up to 70 floods occurred during the last Ice Age.

The geology of eastern Washington and the landscape created by the floods is the cornerstone for power production, irrigation, flood control, wildlife habitat and recreation in the area. The sound granite bedrock provides an excellent foundation for Grand Coulee Dam. 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 the geology of eastern Washington.

For More Information

Bureau of Reclamation
Grand Coulee Dam Visitor Center
PO Box 620
Grand Coulee, WA 99133-0620
(509) 633-9265
http://www.usbr.gov/pn/grandcoulee/

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