Glacial Lake Missoula and the Great Floods

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Today the waters of the Flathead River and its tributaries flow into Flathead Lake near Bigfork and leave at Polson on their way southwesterly to join the Clark Fork River near Paradise. From this junction, the Clark Fork flows westerly to cross into Idaho, emptying into Lake Pend d'Oreille near the small town of Clark Fork.

While there is much study and interpretation yet to be done, it is clear that near the end of the last major period of glaciation—the Wisconsin—the Flathead lobe of the Cordilleran Ice Sheet extended into the Flathead Valley across the area now occupied by Flathead Lake, and a similar lobe extended into northern Idaho through the Purcell Trench across what is today Lake Pend d'Oreille.

During a period extending from about 17,000 to 12,000 years before the present, the Purcell lobe blocked the flow of the Clark Fork River just east of the Montana-Idaho border. This damming action caused the river's flow, swollen by continuous melting of the glaciers, to progressively fill the valleys of the Clark Fork, Flathead, Bitterroot and Blackfoot Rivers, creating what is now known as Glacial Lake Missoula with a surface area twice the size of Rhode Island.

At its maximum depth at the ice dam near the Montana-Idaho line, Glacial Lake Missoula was over 2000 feet deep and covered 3000 square miles of western Montana. Eventual rupture of the dam by overtopping and/or undercutting released the contained 500 cubic miles of water, equal to about half the volume of Lake Michigan, within a matter of days. The pent-up waters surged westerly across central Washington at up to 65 miles per hour and a flow rate equal to 10 times the combined flow of all earth's rivers today. Confined to the narrow Columbia Gorge, the waters backed up the Snake River to the Idaho line, flooded the Willamette Valley and the site of Portland to a depth of 300 feet, and gushed into the Pacific Ocean, carrying rock debris plucked from Montana and along the entire route.

Source: Tom Foster, 2009

Glacial Lake Missoula and the channeled Scablands 15,000 years ago

Incredible erosional and depositional features were created, both within the lake area and across Idaho and Washington to the Pacific Ocean. Geologists believe that in this several-thousand-year period Glacial Lake Missoula may have been dammed, emptied and refilled between 40-100 times and that in previous glacial periods of the approximately 2 million-year-long Pleistocene Epoch or "Ice Age," this process may have been repeated many hundreds of times.

Within the Flathead Watershed today there are numerous relic features formed by Glacial Lake Missoula. High on hillsides above many of the valleys are long horizontal ridges, known as strand lines, that mark the ancestral shore lines of the lake. The highest of these are at 4250 feet elevation, indicating that Missoula would have been under approximately 950 feet of water at the maximum filling.

Glacial meltwaters carried fine clay and silt sediment into Lake Missoula, which settled out as multiple layers of tan sediment, known as varves (layers of sediment), which tell us a great deal about the history of the lake and conditions in the surrounding region.

Possibly the most spectacular features in the Flathead Watershed are a series of immense ripples in Camas Prairie formed during the emptying of the lake. Fast moving waters carrying rock fragments carved from the nearby mountain passes formed these features, which are as much as 30 feet high and 100 feet from crest to crest, so widespread and immense that they are easily visible on satellite images.

Less notable features in the glacial lake area are huge piles of sediment deposited by the emptying water in areas where flow rates diminished, similar to the formation of sand and gravel bars in modern river channels. These are notable west of Missoula and Plains. Similar hydrodynamics have left sediment terraces perched high in the side channels of tributaries to the main river gorge. These are particularly notable along the Flathead River from Perma to Paradise.

While there were several other significant glacial lakes in the Pacific Northwest during the Pleistocene, Glacial Lake Missoula and the area scoured by the huge floods which came from the lake have left the most impressive legacy across today's landscape of northwest Montana and the Pacific Northwest.