

# Glacial Lake Missoula

## Ice Age

During the Pleistocene Epoch, or Ice Age, between 10,000 and 1.6 million years ago, the Earth's climate underwent periods of alternate cooling and warming. During the periods of cooling, vast continental ice sheets grew in size and extended far beyond the polar regions. In southern Canada, the ice sheets periodically thickened and advanced southward, some reaching the northern parts of the United States. Evidence indicates that at least four, and perhaps six or more, major glaciations affected the Spokane–Coeur d'Alene area.

## Ice Age Flood

As the water deepened behind the ice dam (see text box upper right), the glacial ice catastrophically failed, allowing the water in Glacial Lake Missoula to escape in an enormous “outburst” flood. The flood wave swept down the Rathdrum Prairie, through the Spokane Valley and eventually flowed across the Columbia plateau and through the Columbia Gorge to the Pacific Ocean. The Glacial Lake Missoula outburst floods had the largest velocity and flow rate of any documented floods, and they are described on the following page.

## Bonneville Flood

The Bonneville Flood occurred about 15,000 years ago when Lake Bonneville, which covered much of Utah, overtopped and flowed north to the Snake River in Idaho. The Bonneville flood released 1,000 cubic miles of water, about twice the volume of the largest Missoula flood. However, unlike the Missoula ice age floods, the Bonneville Flood occurred only once, and lasted over a period of several weeks.

## Aquifer Facts

**Glacial Lake Missoula Facts:** The ice dam that created the lake was almost one half mile high and as much as 30 miles across. The deepest part of the lake was about 2,000 feet. The lake was approximately 200 miles long and roughly the size of Lake Erie and Lake Ontario combined. It drained and filled often with perhaps 40 to 140 years between floods.

## Glacial Lake Columbia

Glacial Lake Columbia existed during the same period as Glacial lake Missoula. It was created when the Okanogan Ice Lobe advanced south and blocked the Columbia River. Glacial Lake Columbia was about 1,500 square miles at its greatest extent, and it was shallower than Glacial Lake Missoula, perhaps 500 to 700 feet deep. The Rathdrum Prairie and the Spokane Valley were covered at times by Glacial Lake Columbia. Some of the ice age floods from Glacial Lake Missoula flowed into and through Glacial Lake Columbia. Occasionally the Columbia River Ice Lobe would extend south and divide Glacial Lake Columbia, and the eastern portion of the divided lake is called Glacial Lake Spokane.

## Ice Dam

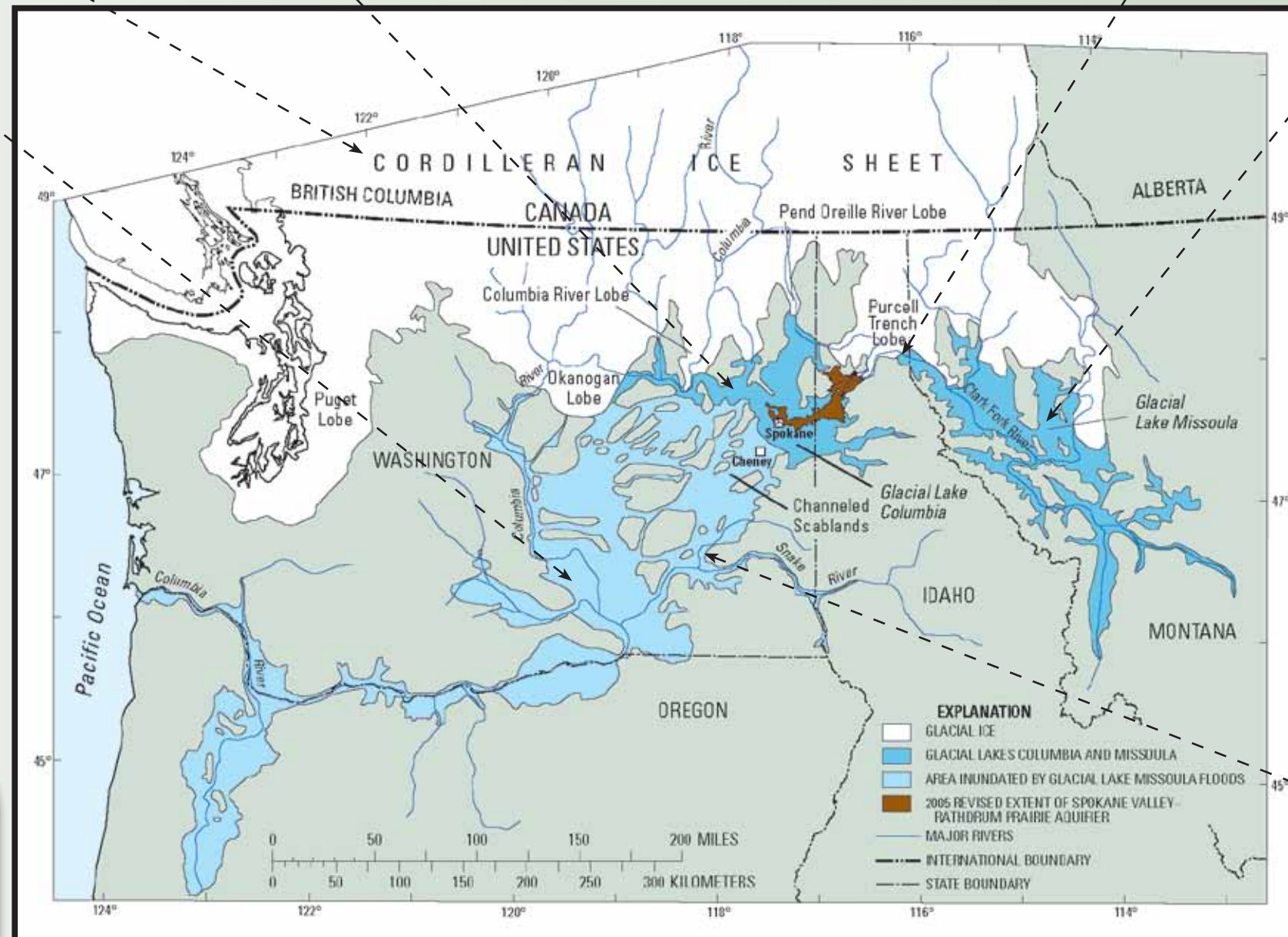
The last of the Ice Age glacial advances occurred between 10,000 and 22,000 years ago and had the most significant effect on the present landscape. Eventually, an ice lobe (a separate tongue of the glacier mass) moved into the valley of the north-flowing Clark Fork River near Sandpoint, Idaho and formed a massive ice dam across the valley, and the Purcell Trench Lobe completely covered the present-day Lake Pend Oreille. At the maximum glacial advance, the ice lobe dam was between 2,150 and 2,500 feet high, and melt water from other glaciers far up the Clark Fork River drainage became ponded behind the ice dam. Eventually the ponded melt water formed a vast lake, Glacial Lake Missoula, which occupied the intricate system of valleys in western Montana.



Joseph T. Pardee (1871-1960) was a U.S. Geological Survey geologist who built on the earlier J Harlen Bretz's theory of eastern Washington cataclysmic floods, tracing the floods' origin to Glacial Lake Missoula and publishing his work in 1942.

## Glacial Lake Missoula

Glacial Lake Missoula existed during the period 13,000 to 15,000 years ago. At its highest level, the glacial lake covered an area of about 2,900 square miles and contained an estimated 500 cubic miles of water. At its maximum elevation, the lake was about 950 feet deep at present-day Missoula, more than 1,100 feet deep at the south end of Flathead Lake, and about 2,000 feet immediately behind the ice dam. At the same time, similar lakes, such as Glacial Lake Columbia, were formed by the melt water from local mountain glaciers and snow fields elsewhere in the valleys and basins of the Northwest interior.



## Palouse Falls

The 200 foot high Palouse Falls is an artifact of the ice age floods originating with the draining of Glacial Lake Missoula. The Palouse River was captured and diverted to its present location by the floods.