

Not My Fault: The night the mountain moved: remembering the 1959 Lake Hebgen earthquake

Lori Dengler/For the Times-Standard
Posted August 22, 2019

A little before midnight sixty years ago, my oldest brother was in a truck near West Yellowstone. He was 21 and his summer job was providing logistical support for a bicycle tour of National Parks in the Western U.S. He had parked where he could get a weak broadcast of a Giants game on the radio. Suddenly the truck began hopping up and down and he could barely keep his seat in the cab. The trees were violently swaying. He was about 10 miles away from the epicenter of the largest earthquake to hit Montana in historic times.

The August 17th Lake Hebgen Earthquake, located near the reservoir that gave the earthquake its name, comes in at a magnitude between 7.2 and 7.5 depending on the scale you use. The USGS catalog estimates it at a M7.3. The earthquake was relatively shallow, it occurred on a normal fault, killed 28 people, \$11 million in damages (1959\$) and caused more than 100 significant injuries.

The earthquake is worth remembering. We tend to focus on California seismic hazards, but Montana and other parts of the intermountain region are no strangers to earthquakes. Seismic hazard maps of the United States show the entire western half of the country at an elevated risk compared to most of the Midwest and East Coast.

The reason is related to tectonics. Plate tectonic maps usually show the boundary between the North American plate and the Pacific plate as a simple line along the San Andreas fault. But the San Andreas system doesn't account for all of the relative motion. The rest is taken up by faults stretching as far east as Colorado. The movement of the Yellowstone hotspot further complicates the tectonics of the Yellowstone area.

Large normal fault earthquakes like 1959 have spectacular effects on the landscape. The Lake Hebgen earthquake caused surface fault ruptures on two faults, one side of the fault to moving down relative to the other by as much as 15 feet. The rupture disrupted roads, fields and structures. During my teaching years, I almost always included a photo of the Hebgen rupture on exams, asking "what kind of fault is this?"

The shaking from the earthquake had many impacts. It caused liquefaction, subsidence, and numerous landslides. The most significant earth movement was an 80-million ton landslide caused by the collapse of a mountainside on the south bank of the Madison River. The material fell into the narrow gorge of the Madison River Canyon six miles downstream of Hebgen dam. Tragically, August is the height of the tourist season and this was a favorite area for vacationers. The slide buried 19 campers, and killed five more near the base. Two others died from another slide a few miles away.

The slide dammed the Madison River and water immediately began to back up. By mid September, the volume of the new lake had grown to 82,000 acre-feet, nearly twice as large as Ruth Lake. There was concern that the continued rise could fail catastrophically and flood areas downstream. The U.S. Army Corps of Engineers lowered the natural dam crest and created a spillway to stabilize the lake level. Earthquake Lake remains a permanent feature of the landscape today.

Lake Hebgen was also impacted by the earthquake. The fault movement tilted and distorted the reservoir causing the water level to lower on one side and rise on the other. Slumping caused many sections of U.S. Route 287 to fall into the lake impacting access. The shaking triggered water oscillations within the reservoir, producing surges as high as three feet that overtopped the dam at least four times. This oscillation, or seiche, continued for at least 11 hours and flooded a number of vacation homes on the banks of the lake. The dam suffered serious damage to its core as well. After the earthquake, it had to be emptied and repaired level before it could become fully operational again.

The shaking produced more conventional damage as well. My brother walked through West Yellowstone the morning after the earthquake and saw collapsed walls and roofs, widespread debris and broken windows. The bicycles my brother was tending had been stacked on one side of a storage building. After the earthquake, all twenty were in a jumble about 12 feet away on the other side.

Damage was also widespread in Yellowstone National Park where many structures were unusable. Stress changes following the earthquake affect the hydrothermal systems in the Park as well. Old Faithful remained faithful, but at a slower pace. The intervals between eruptions increased by about 25 minutes and the duration doubled. 160 dormant geysers burst into life

and Clepsydra Geyser, which used to erupt every few minutes, has been constantly erupting ever since.

The Lake Hebgen earthquake is a reminder that Mother Nature might not be resting while you are on vacation. Include preparedness as part of your holiday planning.

Find out more about the Lake Hebgen earthquake at <http://seismo.berkeley.edu/blog/index.html> and at <https://www.krtv.com/news/the-night-the-world-shook-remembering-the-1959-hebgen-lake-earthquake>

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