Excerpt from “The Night the Earth Shook” (Forest Service Publication), 1962
2004.48.494

THE EARTHQUAKE

At about 11:37 pm on the night of August 17, 1959, geologic history was repeated and the two blocks in the Hebgen Lake area dropped and tilted toward the north. At the same time the Missouri Flats block, west of the Madison Range, dropped, but not so far. And it is possible that a part of the Madison Range between the Hebgen Lake area and the Missouri Flats basin was also bowed down somewhat. As the masses of rock scraped past one another a major earthquake resulted, and fresh scarps facing valley ward appeared either along or parallel to the concealed faults.

In the Hebgen Lake area, the scarps face southward and reflect renewed movement on the Red Canyon and Hebgen Faults (sites 1 and 4 of the Earthquake Area). West of the Madison Range, two small scarps, facing westward, resulted from movement on the Madison Range Fault.

The downward movement along the faults probably occurred as a rapid grating of one rock mass past the other, rather than as a smooth swift
sliding.

THE SEICHE

The backward and forward sloshing of the lake, known as a seiche (pronounced "saysh,") continued for about 11 1/2 hours. The cycle (or period) of the seiche-the time needed for the water to wash onto one shore, withdraw, and then return-was about 17 minutes. The first surges were so strong that they flowed over Hebgen Dam.

NORTHWARD DISPLACEMENT OF HEBGEN LAKE

When the lake quieted, it became apparent that the northerly tilt of the Hebgen Lake block had displaced the lake northward. The north shore was flooded; jetties, docks, and beaches were submerged. By contrast, the south shore emerged, so that stranded boats and docks were common sights and immense areas of bay and lake bottom were exposed (p. II).

When the lake was displaced northward, it occupied a changed reservoir whose capacity exceeded that of the former lake basin. Consequently, the water level dropped about 0.7 foot as soon as the lake quieted. Water gages downstream showed that the drop was not due to water that had sloshed over the dam as a result of the seiche, and soundings failed to disclose any concealed fault in the lake bottom that might have increased its capacity. So the greater capacity of the new basin must be the result of the warping of the Hebgen Lake block.

THE FAULT SCARPS

Typical fault scarps can be seen at the following sites in the Earthquake Area (index map: Site I-Red Canyon Fault scarp in Red Canyon Site 5-Hebgen Fault scarp at mouth of Cabin Creek.

A fault is a break in the rocks along which there has been movement. Faults in the Earthquake Area are simply identified as faults and named after geographic features, as for example "Red Canyon Fault" and "Hebgen Fault." It is clear that they are fairly old because they are partly concealed by debris and foliage. In this publication, fault scarp refers to a fresh cliff-like break in the ground which appeared on the night of August 17, 1959. Generally the fault scarps coincide with or are parallel to the old faults (indicating that the fault scarps resulted from renewed movement on the faults; therefore, the new fault scarps bear the same names. The Red Canyon Fault scarp thus coincides with or is parallel to the Red Canyon Fault.

Many new fault scarps were formed during the earthquake; the larger ones are all north of Hebgen Lake, where four well-defined scarps appeared overnight. Two of these, the Red Canyon and the Hebgen Fault scarps, extend for miles; the other two are shorter.

These cliff-like fault scarps face valley ward, which is always southward. From a distance the scarps appear as bright wavy lines that continue un- broken across mountains, valleys, and broad flats (p. 20).

The Red Canyon Fault scarp extends westward for about 14 miles from near the "Y" formed by highways U.S. 191 and State 287 to its end in Kirkwood Creek far to the west (index map). The Hebgen Fault scarp is about 8 miles long, and extends from near the Hebgen Lake Lodge to the east valley wall of Beaver Creek.

Everything along the fault scarps was damaged-trees were downed, trails and roads were offset, dwellings were ruined. New waterfalls were formed where streams crossed the scarps.

On the night of the earthquake, the southerly facing Red Canyon Fault scarp proved most hazardous, especially for those drivers who were traveling south, unaware that the scarp had cut across and offset route 19I.

One family in a motel near the junction of routes 191 and 287 was violently awakened by the major shock. Alarmed and bewildered, they hurriedly dressed and got into their car to flee to West Yellowstone. They were hardly settled in their seats when the car hurtled across the fresh Red Canyon Fault scarp, fell 6 feet, turned over, and crashed. Amazingly, no one was badly hurt. The family crawled out of the wreckage and walked back to the cabin they had left.

THE MADISON SLIDE
The Madison Slide can be seen best from selected site 7 in the Earthquake Area

The Madison Slide is one of the more awe-inspiring features in the Earthquake Area. Its immense size coupled with the huge volume of water it impounds is enough to command respect. These feelings are strengthened by the realization that this vast pile of rock was emplaced in a few moments, burying several camp areas and their occupants.

The slide is composed of three dominant rock types: (I) dolomite, a white to pale-red crystalline rock, (2) schist, a green finely laminated rock, and (3) gneiss, a gray faintly banded granular rock.

The dolomite, which once acted as a buttress (p. IS), now appears as a jumble of boulders along the north edge of the slide. Remnants of the once continuous dolomite buttress can still be seen as light brown jagged ridges along the lower slopes of the south valley wall (p. 15), almost directly opposite the parking area.

The remaining rocks in the slide consist of schist and gneiss, schist being the more common. The parking area and most of the footpaths are constructed on this rock.

Shortly after the slide was emplaced it became apparent that the water ponding behind it would soon drown the toe of Hebgen Dam, some 512 miles upstream. (If this had happened, Hebgen Dam would have been a most unusual dam, with standing water on both sides!) Also, the slide might suddenly wash out, releasing the waters of Earthquake Lake as a devastating flood on the residents downstream. A spillway had to be cut across the slide, and this was undertaken by the Corps of Engineers, U.S. Army. They soon discovered that, although the surface of the slide was formed by large boulders, the material beneath was much smaller. Fearful that this smaller material would be easily eroded, the Engineers decided to surface the spillway with dolomite boulders. Many of the roads visible on the slide are merely work routes used to bring the dolomite boulders to the spillway.

Once the spillway was completed, and waters released through it, the downstream edge of the spillway began to fray and erode back-a clear indication that the grade of the spillway was too steep. The broad deposits of gray rock that fringe the west edge of the slide (near the entrance to the slide) were formed at this time. The fraying was halted by cutting a new spillway at a lesser grade along the centerline of the old spillway. This new spillway, some 50 feet deep, now carries the waters of Earthquake Lake across the slide. After the cutting of this new spillway, the lake level dropped 50 feet, leaving dead branches and trees as reminders of the former waterline.

The volume of water that flows through the Madison Slide spillway is controlled by the spillway at Hebgen Dam upstream!