The Montana Traveler

Madison River Canyon Earthquake Area

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The August 17th, 1959, earthquake sent eighty million tons of mountain sliding from the southeast side of the canyon into the Madison River, shoving the water from its bed and killing twenty-eight people at a Forest Service campground. Credit: MHS Photograph Archives, Helena

Great photo -- perhaps we could get permission to use from the Montana Historical Society in Helena

On the evening of August 17th, 1959, the area just west of Yellowstone National Park experienced an earthquake measuring 7.5 on the Richter scale. At the time it was the

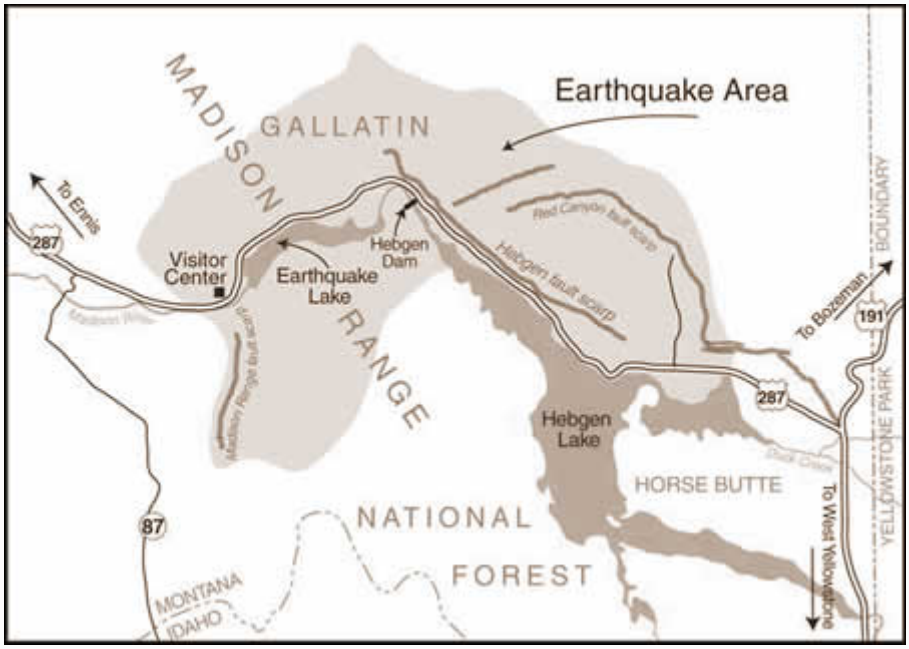
strongest earthquake recorded in the United States. **It killed twenty-eight people**; many were buried beneath the 80 million tons of dolomite that crashed down upon a sleeping Forest Service campground, others drowned when the Madison River, displaced by the slide, engulfed their tents. These deaths, the exodus of nearly eighteen thousand tourists from Yellowstone, an evacuation of downstream residents, and the astounding (and photogenic) property damage are probably known to most readers. Reports of tremors came from as far away as Seattle, Washington, Dickinson, North Dakota, Banff, Alberta, and Provo, Utah.

Indeed, the National Forest Service's Earthquake Lake Visitor Center perched on the scraped mountainside across from the slide area is a shrine to these events. From the windows of the 1960s-modern building, visitors looking eastward can gaze upon the dead trees poking from beneath the surface of Earthquake Lake, the lake that formed behind the rockslide. Slightly to the west, the gray rock guts of the slide area, "the mountain that fell," wink in the sunshine. From the rockslide, the visitor's gaze naturally drops to the concrete spillway and then follows the rock detritus four hundred feet up the near canyon wall to the two-story-tall Memorial Boulder. In 1960, exactly one year to the day after the quake, the United States Department of Agriculture christened the surrounding 38,000 acres the Madison River Canyon Earthquake Area. In 1967 construction crews completed the Earthquake Lake Visitor Center.

Inside and outside, the visitor center encourages its twenty-eight thousand annual visitors to think about the campers' bad luck, the heroism of rescuers, and the ingenuity of engineers who labored to cut a new spillway and repair the cracked dam holding back the waters of Hebgen Lake. But there is also another theme running through both the visitor center exhibits and the many publications describing the event: geologic discovery. For scientists, the Madison earthquake was an unsurpassed opportunity to study earthquakes.

According to plate tectonic theory, the earth's crust is broken into several large pieces, plates that "float" on the earth's molten core. Over geologic time these plates move, creating zones where plates collide. One such place is the Pacific Coast of North America, where the North American plate is being subsumed under the Pacific plate. Earthquakes occur when the force of tectonic movement becomes greater than the strength of surrounding rocks and the rock suddenly gives way. Quakes radiate along fault lines, which often are existing fractures in the rock but can also be created by a new line of breakage.

The Madison earthquake area is located in the Intermountain Seismic Belt, a region of young fault lines that runs southwestward from northwest Montana to the Wasatch Mountains of Utah. Although the entire area is on the North American plate, it is on a soft edge that experiences "warping" as a result of the plate's movement. As the plate moves, it stretches the earth's crust, which then breaks along the fault lines. This type of faulting is called basin and range because the fracture of the rock results in large "blocks" moving upward and the land between sinking. Such faulting has produced the short north-south mountain ranges separated by wide valleys that are characteristic of the western United States north of the Great Basin.



The Madison Range is a typical example of a mountain range created by this process, and it is laced with active faults-including the Hebgen Lake, Red Canyon, and Madison Range faults along which the August 1959 earthquake occurred. The Madison earthquake was actually a complicated event in which two faults slipped within two seconds of each other. As a result, three great blocks of earth and rock dropped; two of these tipped, causing Hebgen Lake to roll nineteen feet to the north.

Part of the Madison earthquake's value for research is the fact that it produced effects not common to all quakes. First, the earthquake occurred near the earth's surface, at a depth of approximately eleven kilometers. Its epicenter, the location on the earth's surface directly above the quake, was at Duck Creek. The quake's shallowness resulted in many visible signs on the landscape, particularly in the scarps that mark the fault lines. Along these scarps, the earth stood between nine and twenty-one feet higher on one side than on the other. In Red Canyon a scarp following the contours of the mountainside is visible for some fourteen miles. Sand spouts, slumping, and minor landslides also appeared. By measuring, charting, and comparing the data with prequake measurements, United States Geologic Survey (usgs) geologists developed theories about why this earthquake, and others, occurred. It was their first opportunity to study range-front faulting in the Northern Rockies.

The second uncommon event produced by the earthquake was the giant wave, known to geologists as a seiche, that formed when Hebgen Lake tipped and water began to slosh from one lake shore to the other and back again. Eventually, waves twenty feet high overtopped earth-filled Hebgen Dam, built by the Montana Power Company in 1915, and rushed downstream. This water and the lake's normal outflow formed Earthquake Lake (commonly known as Quake Lake). Although the dam held, it sustained damage to its concrete core and spillway. When the wave action subsided nearly twelve hours later, cabins on the lake's north shore stood underwater while on the south, muddy expanses lay exposed, boats and docks

stranded far from the water's edge.

The quake's proximity to Yellowstone Park, long a crucible for scientific research, also enhanced its educational value. One boon was a new awareness of the extent to which seismic activity affects Yellowstone's geothermal features. In Yellowstone some two hundred geysers erupted and new ones sprang to life. Many of the park's hot springs changed temperature. The springs' colors changed, too, as minute particles of broken rock muddied the waters. In the northwestern corner of the park large cracks emitted hot steam. usgs-maintained gauges monitoring flow into Hebgen Lake revealed that the amount of water in the Madison River increased from 350 cubic feet per second a day approximately two weeks before the quake to 1,100 during the last ten days of August.

The Madison Earthquake Area is both a monument and a classroom for geological research, and many parts of it are easily accessible to visitors. The Earthquake Lake Visitor Center, located on Highway 287 approximately twenty-seven miles northwest of West Yellowstone, Montana, is open 8:30 a.m. to 6:00 p.m. seven days a week from mid-May through mid-September. The admission charge is three dollars per car and one dollar per bicycle or hiker. Other sights-the Red Canyon and Canyon Creek scarps, Hebgen Dam, submerged cabins and highway, and the Memorial Boulder-are accessible all year. These locations are marked along Highway 287 between its junction with Highway 191 and the Madison Slide area. Call the Hebgen Lake Ranger District at (406) 823-6961 for more information.