EARTHQUAKE HISTORY OF Colorado

Colorado is considered a region of minor earthquake activity, although there are many uncertainties because of the very short time period for which historical data is available. The northwestern and southwestern corners, and the Sangre de Cristo Mountains in the south-central section of the State, have had no activity in historic times. Eastern Colorado is nearly aseismic, with just a few epicenters in the Arkansas and Platte River Valleys. Most shocks in the history of this State have centered west of the Rocky Mountain Front Range.

F.A. Hadsell, writing in the Colorado School of Mines Quarterly (col. 63, No. 1, Jan. 1968), reports the first known reference to an earthquake in Colorado occurred on December 7, 1870. The Colorado Transcript states, “A careful observer at Fort Reynolds, 20 miles east of Pueblo, noted that bottles standing 1 inch apart were knocked together violently.” Hadsell also notes that, although the first seismograph in Colorado was installed by Father Armand W. Forstall at Regis College in 1909, seismographs of sufficient quality and quantity were not available to monitor Colorado earthquakes until about 1962. Thus, between 1870 and 1962, newspaper accounts are the prime source of published data on Colorado shocks.

The most damaging shock in Colorado’s history occurred on August 9, 1967. The magnitude 5.3 earthquake, rated intensity VII on the Modified Mercalli Intensity Scale, caused moderate damage in Northglenn, Commerce City, Denver, and several nearby towns. This is the only intensity VII earthquake listed for Colorado in the NEIC files. Hadsell has assigned an intensity VII to the November 7, 1882, tremor northwest of Denver. The NEIC, however, lists this shock as intensity VI.

The 1882 earthquake, the first ever to cause damage at Denver, probably centered in the Front Range near Rocky Mountain National Park, and is probably the largest known earthquake in the state. The magnitude is estimated to be about 6.2 on the Richter scale. In Boulder County the walls of the depot cracked, and plaster fell from walls at the university at Boulder. The quake was felt as far away as Salina, Kansas and Salt Lake City, Utah. The Longmont Ledger of November 10, 1882, states:

“It is claimed by the oldest settlers in Denver that this is the first known instance of an earthquake having visited Colorado... that this is the first and only instance in the political history of Colorado when a fall election has ever been carried by the ... party. It was probably nature's protest ... uttered at the time of closing the polls Tuesday evening ... when the polls were closed, and it became evident that the ... party was finally to take control of our state government, she could no longer control her feelings, but uttered a groan of anguish which caused the very mountains to tremble. Curious but true.”

An earthquake on November 15, 1901, cracked windows and rolled boulders onto the highway in Buena Vista; the water of Cottonwood Lake was reportedly agitated. Another shock of similar intensity (VI) did not occur until September 8, 1944. During this tremor, bricks fell from chimneys and walls and chimneys cracked at Basalt, about 100 miles west of Denver. Eleven years later, in August 1955, a strong earthquake left cracks in chimneys and ground at Lake City, about 170 miles southwest of Denver. On October 11, 1960, a shock cracked a foundation and loosened cupboards from walls at Montrose. Windows, plaster, and chimneys were
damaged in several towns in southwestern Colorado.

In 1961, a 12,000-foot well was drilled at the Rocky Mountain Arsenal, northeast of Denver, for disposing of waste fluids from Arsenal operations. Injection was commenced March 1962, and an unusual series of earthquakes erupted in the area shortly after.

It was 32 minutes after 4 a.m. on April 24 when the first shock of the Denver series was recorded at the Cecil H. Green Geophysical Observatory at Bergen Park, Colorado. Rated magnitude 1.5, it was not strong enough to be felt by area residents. By the end of December 1962, 190 earthquakes had occurred. Several were felt, but none caused damage until the window breaker that surprised Dupont and Irondale on the night of December 4. The shock shuffled furniture around in homes, and left electrical wall outlets hanging by their wires at Irondale.

Over 1,300 earthquakes were recorded at Bergen Park between January 1963 and August 9, 1967. Three shocks in 1965—February 16, September 29, and November 20—caused intensity VI damage in Commerce City and environs.

The Denver series was forgotten, however temporarily, in October 1966, when a southeast Colorado tremor rocked a 15,000 square-mile area of that State and bordering New Mexico. Minor damage, in the form of broken windows and dishes and cracked walls and plaster, occurred at Aguilar, Segundo, Trinchera, and Trinidad.

Another strong shock rumbled through the Denver area on November 14, 1966, causing some damage at Commerce City and Eastlake. Ruth Simon, Research Associate at the Colorado School of Mines, states after this shock:

“No one would venture to say whether the earthquakes in the Denver area are diminishing in frequency or magnitude. The occurrence of a number of small shocks, and the one large shock in November, despite cessation of pumping of the well at the Rocky Mountain Arsenal since February, make any prediction risky.”

Slighter rumblings (below magnitude 3.0) occurred throughout the remainder of 1966, and through the first week of April 1967.

Then, on April 10, the largest since the series began in 1962 occurred; 118 windowpanes were broken in buildings at the Rocky Mountain Arsenal, a crack in an asphalt parking lot was noted in the Derby area, and schools were dismissed in Boulder, where walls sustained cracks. Legislators quickly moved from beneath chandeliers in the Denver Capitol Building, fearing they might fall. The Colorado School of Mines rated this shock magnitude 5.0.

Boulder sustained minor damage to walls and acoustical tile ceilings on April 27, 1967, as result of a magnitude 4.4 earthquake. Then a year and half after the Rocky Mountain Arsenal waste dumping practice stopped, the strongest and most widely felt shock in Denver’s history struck that area on August 9, 1967, at 6:25 in the morning. The magnitude 5.3 tremor caused the most serious damage at Northglenn, where concrete pillar supports to a church roof were weakened, and 20 windows were broken. An acoustical ceiling and light fixtures fell at one school. Many homeowners reported wall, ceiling, floor, patio, sidewalk, and foundation cracks. Several reported basement floors separated from walls. Extremely loud, explosive-like earth noises were heard. Damage on a lesser scale occurred throughout the area.

During November 1967, the Denver region was shaken by five moderate earthquakes. Two early morning shocks occurred November 14. They awakened many residents, but were not widely felt. A similar shock, magnitude 4.1, centered in the Denver area November 15. Residents were generally
shaken, but no damage was sustained. A local shock awakened a few persons in Commerce City November 25. Houses creaked and objects rattled during this magnitude 2.1 earthquake.

The second largest earthquake in the Denver series occurred on November 26, 1967. The magnitude 5.2 event caused widespread minor damage in the suburban areas of northeast Denver. Many residents reported it was the strongest earthquake they had ever experienced. It was felt at Laramie, Wyoming, to the northwest, east to Goodland, Kansas, and south to Pueblo, Colorado. At Commerce City merchandise fell in several supermarkets and walls cracked in larger buildings. Several persons scurried into the streets when buildings started shaking back and forth.

During 1968, ten slight shocks were felt in Colorado. Only one, on July 15, caused minor damage at Commerce City. In September of that year, the Army began removing fluid from the Arsenal well at a very slow rate, in hope that earthquake activity would lessen. The program consisted of four tests between September 3 and October 26. Many slight shocks occurred near the well during this period.

On January 7, 1971, a minor 3.8 earthquake shook the Glenwood Springs area. Most residents were frightened by the tremor, but damage was light, chiefly cracked windows and broken knick-knacks. The sheriff's office received numerous call about the unexpected event. A minor 3.0 earthquake rumbled through the East Denver - Commerce City area on March 11. The early morning tremor caused no damage, but aroused several in the region from their beds. Two earthquakes were felt throughout the Denver area in August 1971. The first at 11:22 p.m. local time on August 7, the second at 1:30 a.m. local time on August 8. The initial shock was assigned a magnitude 4.4; the second, smaller shock was rated at magnitude 3. No damage was reported for either tremor.

A sharp earthquake struck western Colorado January 30, 1975. The magnitude 3.7 earthquake occurred at 7:49 a.m. MST. Police and fire departments received many telephone calls from residents wanting to know what was going on. The quake was felt strongest at Colorado National Monument and in the Fruita area. It was also felt throughout Grand Junction and other adjoining area. Maximum intensity V.

The residents in the northeast Denver area were shaken by a mild earthquake on June 10, 1978 at 2:58 p.m. MDT. The magnitude 2.9 earthquake was centered approximately 10 km northeast of Denver and was felt sharply in the east Denver, Commerce City, Thornton, and Northglenn areas. There were no reports of damage (MM IV).

In 1979, a small but rare earthquake occurred in the central part of the State on January 5 at 6:59 p.m. MST. The magnitude 2.9 tremor was centered about 50 km northwest of Colorado Springs near Florissant and Lake George. Some minor damage (MM VI) was reported at Cripple Creek and Royal Gorge. In March 1979, the northwestern part of the State experienced two earthquakes, one, magnitude 3.4, on March 19 at 8:00 a.m. MST and the other, magnitude 2.6, on March 29 at 3:07 p.m. MST. Both earthquakes were located about 10 km northwest of Rangely and were felt (MM V) in the Rangely area.

On April 2, 1981 at 9:10 a.m. MST, a sharp earthquake, magnitude 4.1, occurred that was centered approximately 20 km north of downtown Denver in the Thornton area. Some slight damage (MM VI) was observed at Commerce City and Thornton. The quake was felt in other parts of Adams County and in parts of Arapahoe, Boulder, Clear Creek, Denver, Douglas, Jefferson, Gilpin, and Weld Counties. This was the last magnitude 4.0
or greater earthquake located in the Denver area to date (May 1993). This earthquake was preceded by a small tremor located in the same area on March 24 at 6:04 a.m. MST with magnitude 2.8. It was felt in the Commerce City and Northglenn-Thornton area. The north-central part of Colorado experienced a small earthquake on September 16, 1981 at 1:59 p.m. MDT. The magnitude 2.1 tremor was located in the Commerce City-Thornton area and was felt by a few people in that area. A minor but alarming earthquake occurred in the north-central part of Colorado on November 1, 1981, at 8:03 p.m. MST. The magnitude 3.1 tremor was centered in the Evergreen area about 22 miles southwest of Denver. The effects registered MM V, and were experienced in the Conifer, Evergreen, and Pine Junction areas. It was also felt in other parts of Jefferson County and in parts of Clear Creek and Park Counties.

Several earthquakes occurred in 1982. On March 11 at 4:55 p.m. MST a very minor 2.8 earthquake occurred. It was located about 12 miles north of downtown Denver in the Thornton area. It was felt in the Commerce City, Northglenn, and Thornton areas. MM III effects were experienced in the Thornton area. On September 18 at 10:12 a.m. MDT, a small part of the north-central part of Colorado was shaken by a very minor earthquake. The magnitude 2.8 tremor was located about 12 miles north of downtown Denver in the Thornton area. MM III effects were noted at Thornton; it was also felt at Commerce City and Northglenn. A very minor earthquake occurred in the northwestern part of Colorado on November 22 at 3:09 a.m. MST. The magnitude 2.9 quake was located about 18 miles northeast of Rifle and was felt at a fish hatchery in the area.

A minor earthquake occurred in western Colorado on August 14, 1983, at 1:09 p.m. MDT. This shock was located about 28 miles southeast of Montrose in a sparsely populated area. It was felt lightly at Cimarron. The northwestern corner of Colorado was shaken by a light earthquake on September 24 at 10:58 a.m. MDT. It was a magnitude of 4.0 and was located about 25 miles north of Dinosaur National Monument. MM III effects were experienced at Maybell and Rangely; it was also felt at Point Rocks, Wyoming.

In 1984, a very minor earthquake occurred in the Denver metropolitan area on February 25 at 2:18 a.m. MDT. This magnitude 2.5 tremor was located about 13 miles north of downtown Denver in the Thornton area where it was felt lightly. The western part of the State experience a series of earthquakes beginning with a magnitude 2.4 on April 12 at 1:17 p.m. MST. These quakes were located about 5 miles south of Carbondale. The largest quake located in the area occurred on April 22 at 10:31 MST and had a magnitude of 3.1 which was felt in the Carbondale and Glenwood Springs area. Of the hundreds of earthquakes that occurred in the Carbondale area, 12 were reported as felt. This series of earthquakes continued during the month of May. The largest to occur in May were a magnitude 3.1 on May 3 at 12:29 p.m. MDT and a 3.2 on May 14 at 4:14 a.m. MDT. Both earthquakes were felt in the Carbondale area.

A minor earthquake occurred in the south-central part of the State on March 16, 1985, at 2:55 p.m. MST. The magnitude 3.3 earthquake was located about 15 km northeast of Salida and was felt in the Salida-Nathrop area.

Several earthquakes occurred in 1986. A very minor earthquake occurred in the central part of the State on April 10 at 11:17 p.m. MST. The magnitude 2.9 earthquake was located about 15 km southwest of Aspen. This quake produced MM III
intensities at Basalt and Snowmass Village and was also felt in the Aspen area. Another minor earthquake occurred on May 9 at 3:55 p.m. MDT. The magnitude 2.7 tremor was located about 25 miles southwest of Aspen and was felt in the Aspen area. This series of small earthquakes continued during August and September. These earthquakes were located about 13 km northwest of Crested Butte and about 25 km southwest of Aspen. During August, 14 earthquakes were located in the area. The series began on August 12 with a magnitude 2.6 earthquake at 8:43 p.m. MDT. The largest was a magnitude 3.0 on August 17 at 7:15 p.m. MDT and a magnitude 3.1 on August 25 at 8:06 p.m. MDT. Many of these earthquakes have been felt in the Aspen-Snowmass Village-Crested Butte-Redstone area. The quake on August 17 was also felt at Carbondale. A magnitude 3.5 occurred on September 3 at 20 minutes after midnight about 13 km northwest of Crested Butte. Intensity MM V effects were noted at Aspen and Crested Butte; it was also felt at Gunnison. Other quakes in the series included a magnitude 3.2 on September 17 at 10:53 p.m. MDT and a magnitude 3.4 on September 18 at 3:27 a.m. MDT. Both of these earthquakes were felt in the Aspen-Crested Butte-Snowmass Village area. Additional smaller earthquakes were not reported felt. A very minor earthquake, magnitude 2.5, occurred on September 21 at 3:21 a.m. MDT, about 35 km west of downtown Denver in the Conifer area; it was felt at Conifer and Tiny Town.

A small earthquake occurred in the western part of Colorado on September 14, 1987, at 2:32 p.m. MDT. The magnitude 2.5 earthquake was located 20 km southeast of Aspen and was felt in the Aspen area.

A minor earthquake occurred in the southern part of the State on January 15, 1988, at 33 minutes after midnight. The magnitude 3.1 earthquake was located about 60 km west of Alamosa near Summitville where it was felt. On February 14 at 11:33 a.m. MST a minor earthquake took place in the northwest corner of the State. The quake had a magnitude of 3.3 and was located about 80 km west of Craig. It produced MM IV effects at Maybell.

In 1989, a very minor earthquake occurred in the northwestern part of Colorado on June 30 at 6:53 a.m. MDT. The magnitude 2.2 earthquake was located about 120 km northeast of Grand Junction near Meeker. It was felt at Meeker. A minor earthquake occurred in the north-central part of the State on November 7 at 11:14 p.m. MST. The magnitude 2.5 earthquake was located about 10 km north of downtown Denver. Intensity MM III effects were noted at Eastlake, Montbello, Northglenn, Thornton, and in parts of Denver. The earthquake was also felt at Commerce City.

The western part of Colorado experienced four earthquakes during September and October of 1990. The first, on September 12 at 3:39 p.m. MDT, had a magnitude of 3.0 and was located about 40 km southwest of Fraser near Frisco and Vail. Intensity MM V effects were produced at Vail and intensity MM IV effects at Frisco and Minturn. The quake was also felt at Avon, Dillon, Copper Mountain and Silverthorne. On October 18, two earthquakes occurred, the first at 6:32 p.m. MDT and the second at 6:43 p.m. MDT. Both earthquakes were located about 35 km west of Glenwood Springs in the vicinity of New Castle. The earthquakes had magnitude of 2.3 and 2.1 respectively, and both were felt at New Castle. On December 12 at 24 minutes after midnight, another very minor earthquake occurred in the western part of Colorado. This magnitude 2.7 tremor was located about 35 km west of Glenwood Springs near New Castle. It was felt in the New Castle area.
On April 21, 1991 at 6:46 a.m. MDT, a very minor earthquake occurred in the western part of Colorado. The magnitude 2.0 earthquake was located about 10 km south of Aspen. The tremor was felt in the Aspen area. On May 10, residents of the southwestern part of Colorado felt four small earthquakes. The first, at 6:16 a.m. MDT, had a magnitude of 3.4 and was located about 40 km northeast of Pagosa Springs in the Summerville area. This earthquake was felt strongly at Summerville. Intensity MM III effects were experienced at Chromo and Pagosa Springs. The first quake was followed by three aftershocks: a magnitude 2.4 at 6:22 a.m., a magnitude 2.0 at 7:24 a.m., and a magnitude 2.4 at 8:21 a.m. MDT. These aftershocks were also felt at Summerville.

The last earthquake NEIC located in the State was on April 19, 1993, located about 20 miles northwest of Steamboat Springs, having a magnitude of 2.5.

The state of Colorado continues to have a number of small earthquakes in a given year, but few cause damage.
Seismicity of COLORADO and Surrounding Areas
1800 - 1993

- M = <3.0
- M = 3.0-3.9
- M = 4.0-4.9
- M = 5.0-5.9
- M = 6.0-6.9