= 1968 Illinois earthquake =

The 1968 Illinois earthquake (a " New Madrid event ") was the largest recorded earthquake in the U.S. Midwestern state of Illinois . Striking at 11 : 02 a.m. on November 9 , it measured 5 @.@ 4 on the Richter scale . Although there were no fatalities , the event caused considerable structural damage to buildings , including the toppling of chimneys and shaking in Chicago , the region 's largest city . The earthquake was one of the most widely felt in U.S. history , affecting 23 states over an area of 580 @,@ 000 square miles (1 @,@ 500 @,@ 000 km2) . In studying its cause , scientists discovered the Cottage Grove Fault in the Southern Illinois Basin .

Within the region , millions felt the rupture . Reactions to the earthquake varied : some people near the epicenter did not react to the shaking , while others panicked . A future earthquake in the region is extremely likely ; in 2005 , seismologists and geologists estimated a 90 % chance of a magnitude 6 ? 7 tremor before 2055 , likely originating in the Wabash Valley seismic zone on the Illinois ? Indiana border or the New Madrid fault zone .

= = Background = =

The first recorded Illinois earthquake is from 1795 , when a small earthquake shook the frontier settlement of Kaskaskia . Data from large earthquakes ? in May and July 1909 , and November 1968 ? suggest that earthquakes in the area are of moderate magnitude but can be felt over a large geographical area , largely because of the lack of fault lines . The May 1909 Aurora earthquake affected people in an area of 500 @,@ 000 square miles (1 @,@ 300 @,@ 000 km2) ; the 1968 Illinois earthquake was felt by those living in an area of about 580 @,@ 000 square miles (1 @,@ 500 @,@ 000 km2) . Contradicting the idea that the region 's earthquakes are felt over a wide area , a 1965 shock was only noticed near Tamms , even though it had the same intensity level (VII) as those of 1909 and 1968 . Before 1968 , earthquakes had been recorded in 1838 , 1857 , 1876 , [a] 1881 , 1882 , 1883 , 1887 , 1891 , 1903 , 1905 , 1912 , 1917 , 1922 , [b] 1934 , 1939 , 1947 , 1953 , 1955 , and 1958 . Since 1968 , other earthquakes have occurred in the same region in 1972 , 1974 , 1984 , and 2008 .

= = Geology = =

The quake struck on Saturday , November 9 , 1968 at 11 : 02 a.m. The quake 's epicenter was slightly northwest of Broughton in Hamilton County , and close to the Illinois ? Indiana border , about 120 miles (190 km) east of St. Louis , Missouri . Surrounding the epicenter were several small towns built on flat glacial lake plains and low hills . Scientists described the rupture as " strong " . During the quake , surface wave and body wave magnitudes were measured at 5 @.@ 2 and 5 @.@ 54 respectively . The magnitude of the quake reached 5 @.@ 4 on the Richter scale . The earthquake occurred at a depth of 25 km (16 mi) . [c]

A fault plane solution for the earthquake confirmed two nodal planes (one is always a fault plane , the other an auxiliary plane) striking north ? south and dipping approximately 45 degrees to the east and to the west . This faulting suggests dip slip reverse motion and a horizontal east ? west axis of confining stress . At the time of the earthquake , no faults were known in the immediate epicentral region (see below) , but the motion corresponded to movement along the Wabash Valley Fault System roughly 10 miles (16 km) east of the region . The rupture also partly occurred on the New Madrid Fault , responsible for the great New Madrid earthquakes in 1812 . The New Madrid tremors were the most powerful earthquakes to hit the contiguous United States .

Various theories were put forward for the cause of the rupture . Donald Roll , director of seismology at Loyola University Chicago , proposed that the quake was caused by massive amounts of silt being deposited by rivers , generating a " seesaw " effect on the plates beneath . " The weight of the silt depressed one end of the block and tipped up the other , " he said . However , scientists eventually realized the cause was a then @-@ unknown fault , the Cottage Grove Fault , a small tear in the Earth 's rock in the Southern Illinois Basin near the city of Harrisburg , Illinois .

The fault , which is aligned east ? west , is connected to the north ? south trending Wabash Valley Fault System at its eastern end . Seismographic mapping completed by geologists revealed monoclines , anticlines , and synclines , all of which suggest deformation during the Paleozoic era , when strike @-@ slip faulting took place nearby . The fault runs along an ancient Precambrian terrane boundary . It was active mainly in the Late Pennsylvanian and Early Permian epochs around 300 million years ago .

= = Damage = =

The earthquake was felt in 23 states and affected a zone of 580 @,@ 000 square miles (1 @,@ 500 @,@ 000 km2) . The shaking extended east to Pennsylvania and West Virginia , south to Mississippi and Alabama , north to Toronto , Canada , and west to Oklahoma . Isolated reports were received from Boston , Mobile , Alabama , Pensacola , Florida , southern Ontario , Arkansas , Minnesota , Tennessee , Georgia , Kansas , Ohio , Mississippi , Kentucky , North Carolina , South Carolina , Missouri , West Virginia , Alabama , Nebraska , Iowa , Oklahoma , South Dakota , Pennsylvania , Michigan , and Wisconsin , presumably because of shaking . The worst affected areas were in the general area of Evansville , Indiana , St. Louis , and Chicago , but there was no major damage . There were no deaths ; the worst injury was a child knocked unconscious by falling debris outside his home .

Damage was confined to Illinois , Indiana , Kentucky , Tennessee , and south @-@ central Iowa , and largely consisted of fallen chimneys , foundation cracks , collapsed parapets , and overturned tombstones . In one home in Dale , Illinois , near Tuckers Corners and southwest of McLeansboro , the quake cracked interior walls , plaster , and chimneys . Using a type of victim study , the local post office surveyed residents and implemented a field inspection which indicated the strongest shaking (MM VII) took place in the Wabash Valley , Ohio Valley , and other nearby south @-@ central Illinois lowlands . Outside this four @-@ state zone , oscillating objects including cars , chimneys , and the Gateway Arch were reported to authorities .

McLeansboro in particular experienced minor damage over an extensive area . Its local high school reported 19 broken windows in the girls ' gymnasium , along with cracked plaster walls . Most of the high school 's classrooms sustained fractured walls . The facade of the town 's First United Methodist Church was damaged , and a brick and concrete block fell off the top . Hamilton County Courthouse withstood several structural cracks , including one on the ceiling above the judge 's seat . The town 's residents also reported collapsing chimneys ; three chimneys toppled at one home , leading to further damage .

Most of the buildings that experienced chimney damage were 30 to 50 years old . The City Building in Henderson , Kentucky , 50 miles (80 km) east @-@ southeast of the epicenter , sustained considerable structural damage . Moderate damage ? including broken chimneys and fractured walls ? occurred in towns in south @-@ central Illinois , southwest Indiana , and northwest Kentucky . For instance , a concrete @-@ brick cistern caved in 6 @.@ 2 miles (10 @.@ 0 km) west of Dale .

In Lineville , Iowa , about 80 miles (130 km) south of Des Moines on the Missouri border , the quake was felt as a long shaking . The quake damaged the town 's water tower which began to leak 300 US gallons (1 @,@ 100 L) of water an hour .

Donald Roll correctly predicted the earthquake would have no aftershocks . He later said , " That was kind of a safety valve . The pressure which has been built up has been released . " He also described the earthquake as " a very rare occurrence " .

= = Response = =

Millions in the area experienced the earthquake , the first major seismic event in decades . Following the tremor , businesses in the area emptied . Many residents did not believe that the earthquake was over magnitude 5 . Others did not realize an earthquake was taking place , for example , some residents thought their furnaces had exploded , and one man thought that the

shaking was caused by his son " jumping up and down " . At the Suntone Factory in McLeansboro , 30 miles (48 km) from the epicenter , workers rushed out of the building , thinking a 1 @,@ 100 @-@ US @-@ gallon (4 @,@ 200 l) water tank inside had fallen .

People 's reactions varied : some described themselves as " shocked " ; others admitted to being " shaky " or nervous for the rest of the day . Harold Kittinger , a worker at the Suntone Factory , said , " I do not care to tell anyone I was frightened . But I was not shaking in my shoes . My shoes were moving . " One woman hypothesized that the shaking was a " bomb " . Grace Standerfer suggested the earthquake was sudden , saying , " I was just scared to death . My husband and I were in the house . The Venetian shades began to shake one way , then another . When that awful blast came , he grabbed me and we ran outside . Things were falling and breaking in the house . I said to him , ' This is it . ' I thought the world had come to an end . Outside , wires were moving . There was no wind . The ground was quivering under our feet . I was so scared . I did not know I was scared . " People in the community of Mount Vernon , Illinois were frightened by the shaking . However , some did not notice the earthquake ; Jane Bessen said her party was " in a car ... to Evansville and didn 't know about it until we got there " .

= = Future threats = =

In 2005 , scientists determined there was a 90 % probability of a magnitude 6 ? 7 earthquake in the New Madrid area during the next 50 years . This could cause potentially high damage in the Chicago metropolitan area which has a population near ten million people . Pressure on the fault where the 1811 ? 1812 Madrid earthquakes occurred was believed to be increasing , but a later study by Eric Calais of Purdue University and other experts concluded the land adjacent to the New Madrid fault was moving less than 0 @.@ 2 millimetres (0 @.@ 0079 in) a year , increasing the span between expected earthquakes on the fault to 500 ? 1 @,@ 000 years . Scientists anticipating a future earthquake suggest the Wabash Valley Fault as a possible source , calling it " dangerous " .

Douglas Wiens , a professor of earth and planetary sciences , reported : " The strongest earthquakes in the last few years have come from the Wabash Valley Fault " , and said the fault needs more scientific observation . Steven Obermeir of the United States Geological Survey is one of several scientists who have found sediments suggesting Wabash Valley Fault earthquakes around magnitude 7 on the Richter scale . Michael Wyssession , an associate professor of earth and planetary sciences , denigrated the Madrid fault zone and said , " in 20 years there have been three magnitude 5 or better earthquakes on the Wabash Valley Fault . There is evidence that sometime in the past the Wabash Valley Fault has produced as strong as magnitude 7 earthquakes . On the other hand , the New Madrid Fault has been very quiet for a long time now . Clearly , the Wabash Valley Fault has gotten our deserved attention . "