

The New Madrid Earthquakes of 1811 - 1812

or

"A Whole Lotta' Shakin' Goin' On"

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I was just wondering - How many of you in this room remember your first time? (I am, of course, assuming that you have all had a first time.) Do you remember feeling the earth move as you experienced it. The confusion. The exhilaration. Can you remember the awe you felt when you realized just how helpless you were during the whole thing? When it was all over, you tried to make sense of the whole turn of events and couldn't.

Do you remember thinking it was just a dream. Did it really happen? Then as quick as it started, it was over. You couldn't wait to talk to your friends about it. Was your experience like theirs? Then the bragging, the one up-man-ship in the stories you told. Telling how yours was better than theirs.

For me the first time came in 1968 and I was late in my teens. Oh I had thought about it often. I had read about it. My voyeurism had even allowed me to witness it through the eyes of others in pictures and on scratchy black and white films. But now it was my turn. It was a Saturday morning in autumn. My parents were gone for the day and I was just waking up and still lying there in my Fruit of the Looms. As I turned toward the bedroom door it happened. At first I was a bit confused by the turn of events. Why me? Why here? Why now? Was this really happening? No, it must be early blasting at Christian Quarries a scant quarter mile away. Then I realized that this was

really happening. The windows in the old house rattled, a picture fell from the shelf and I bolted for the stairs and the door. By the time I was standing in the side yard in my underwear it was all over. My first earthquake.

You see, I have always been fascinated by the power of nature. Tornadoes, hurricanes, thunderstorms, and floods have all captured my interest. But none of these can hold a candle to the raw energy which is released in an amazing short time by an earthquake.

An earthquake is the sudden and sometimes violent movement of the earth's surface caused by the release of energy in the earth's crust. As the plates of the earth slowly move, the crust of the earth is subjected to huge tectonic forces and bends slightly. But the crust is generally rigid and when the stress or pressure caused by the movement of the plates exceeds the strength of the rocks, the crust snaps to a new position. When this occurs seismic waves are generated and travel both through the earth and along its surface. These seismic waves cause the movement we call earthquakes.

Between the surface plates are fractures we call faults. It is along these faults that the plates of the earth slip and move against each other. One plate may move up while it's neighbor goes down. The two plates may move horizontally against each other in opposite directions. Geologists have found that earthquakes occur repeatedly along these faults. It is along these faults that about 95% of all earthquakes occur. California, Alaska, Japan, South

America and the Philippines are all on plate boundaries. Only 5% of earthquakes occur in areas of the plates far away from the fault lines. These are called mid-plate or intra-plate earthquakes and are poorly understood.

The strength of earthquakes is most often measured on the Richter Scale. This scale is a measure of amplitude of seismic waves and is related to the amount of energy released by an earthquake. This is estimated from the recordings of an earthquake on a seismograph. This scale is a logarithmic. This means that each whole number on the scale increases by 10 the force of the quake. An earthquake registering a 5.0 on the Richter Scale would be felt by everyone and would cause slight damage to some buildings. A magnitude 6.0 earthquake is 10 times greater than a 5.0 and a 7.0 is 100 times greater. An earthquake measuring an 8.0 would be 1,000 times greater than a 5.0 and is considered a "Great Earthquake." In this case virtually all structures fall flat, waves are seen on the ground as wide cracks are formed and people are tumbled and tossed.

Earthquakes occur at an amazingly high rate. It is estimated that a quake occurs somewhere in the world every 30 seconds or at a rate exceeding one million earthquakes per year. Relax, more than 2/3 of these go totally unnoticed except by seismologists and seismographs. Another 300,000 are generally felt only near the epicenter by the very observant and cause no damage. Another 55,000 quakes occur annually that are generally felt and

cause only slight or minor damage. Approximately 1,100 quakes occur each year that register between 5.0 and 5.9 on our scale and cause only moderate damage. Worldwide there are about 100 quakes a year that are considered destructive and register a 6.0 - 6.9. Eighteen is the average number of major quakes recording a 7.0-7.9 on the Richter Scale and are considered Major Earthquakes. An earthquake exceeding 8.0 usually occurs only once a year. An earthquake of this magnitude usually means total destruction in the area and is felt for many miles around.

The largest earthquake ever measured occurred in Chile in 1960. This quake measured 9.5 on the Richter Scale and resulted in more than 6,000 deaths. It triggered a tsunami or tidal wave that killed people as far away as Hawaii and Japan.

The largest quake in the U.S. was in Alaska in March, 1964. This Great Earthquake had a magnitude of 9.2. It lasted for seven minutes and killed 115 people. Most of the deaths were attributed to the resulting tsunami. The length of the ruptured fault in this quake was 625 miles and in some areas the ground surface was raised or lowered by more than 50 feet. The energy released in this seismic event was equal to 12,000 Hiroshima - type atomic bombs or 240 million tons of TNT.

It is just such an event, or rather a series of earthquakes, that I would like to focus my attention on tonight. The largest earthquake in the

continental United States happened right in our neighborhood. These events are usually referred to as the New Madrid Earthquakes, named after the small town in Missouri, and occurred from mid-December 1811 to early February 1812. During this time there was a series of three or four Great Earthquakes all of which registered 8.0 - 8.8 on the Richter Scale. The number of aftershocks and smaller quakes can only be guessed at but a resident of Louisville recorded 1,874 separate quakes from Mid- December to Mid-March of these years.

In the early morning of December 16 the Mississippi River Valley was rocked by an earthquake so severe that it awakened people in cities as distant as Pittsburgh, Pennsylvania and Norfolk, Virginia. This shock started what must have been the most frightening sequence of earthquakes ever to occur in the United States. Intermittent strong shaking continued through March 1812 and aftershocks strong enough to be felt occurred through 1817. The initial earthquake of December 16, 1811 was followed by three other principal shocks, one on January 23 and the other on February 7, 1812. Judging from newspaper accounts of damage to buildings, the February 7th earthquake was the biggest of the three. It reportedly caused church bells in Boston, Massachusetts to ring.

Eliz Bryan of New Madrid, Missouri described the first quake as follows:
"On the 16th of December, 1811, about 2 o'clock, A.M., we were visited by a violent shock of an earthquake, accompanied by a very awful noise resembling

loud but distant thunder, but more hoarse and vibrating, which was followed in a few minutes by the complete saturation of the atmosphere, with sulphurous vapor, causing total darkness. The screams of the affrighted inhabitants running to and fro, not knowing where to go or what to do - the cries of fowls and beast of every species - the crackling of trees falling, and the roaring of the Mississippi - the current of which was retrograde for a few minutes, owing as is supposed, to an irruption in its bed -- formed a scene truly horrible. "

From that time until about sunrise, a number of lighter shocks occurred; at which time one still more violent than the first took place, with the same accompaniments as the first, and the terror which had been excited in everyone, and indeed in all animal nature, was now if possible doubled. The inhabitants fled in every direction to the country, supposing (if it can be admitted that their minds can be exercised at all) that there was less danger at a distance from, than near the river. In one person, a female, the alarm was so great that she fainted, and could not be recovered."

Perhaps a more telling account of these events is offered by George Heinrich Crist of Nelson County, Kentucky near Louisville. "There was a great shaking of the earth this morning. Tables and chairs turned over and knocked around - all of us knocked out of bed. The roar I thought would leave us deaf if we lived. It was not a storm. When you could hear, all you could hear was

screams from people and animals. It was the worst thing that I have ever witnessed. It was still dark and you could not see nothing. I thought the shaking and loud roaring would never stop. You could not hold on to nothing, neither man nor woman was strong enough - the shaking would knock you lose like knocking hicror nuts out of a tree. I don't know how we lived through it. None of us was killed - we was all banged up and some of us knocked out for a while and blood was every where. When it got day break you could see the damage done all around. We still had our home it was some damage. Some people that the home was not built to strong did not. We will have to hunt our animals. Everybody is scared to death. We still do not know if anybody was killed. I made my mind to one thing. If this earth quake or what ever it was did not happen in the Territory of Indiana then me and my family is moving to Pigeon Roost as soon as I can get things together."

These earthquakes caused only slight damage to man-made structures and had a low death toll mainly because of the sparse population in the area of the epicenter in 1811. The extent of the area that experienced damaging earth motion was estimated to be 225,000 square miles. However, shaking strong enough to alarm the general population occurred in an area of about one million square miles. This area extended south to the gulf coast, southeast to the Atlantic coast, and northeast to Quebec, Canada. The western boundary could not be determined due to a lack of population in that region.

At the onset of the earthquakes the ground rose and fell, bending the trees until their branches intertwined and opening deep cracks in the ground. Landslides swept down the steeper bluffs and hillsides; large areas of land were uplifted; and still larger areas sank and were covered with water that emerged from the fissures or craterlets. Huge waves on the Mississippi River overwhelmed many boats and washed others high onto the shore. High banks caved in and collapsed into the river; sand bars and points of islands in the river gave way; whole islands disappeared. Surface rupturing did not occur, however. The region most seriously affected was characterized by raised or sunken lands, fissures, sinks, sand blows, and large landslides that covered an area of roughly 50,000 square miles. This area reached from Cairo, Illinois to Memphis, Tennessee.

The most notable subsidence is evident in the creation of Reelfoot Lake in Tennessee. This lake is 19 miles long and 4 miles wide and was formed during the quakes. The subsidence or lake depth ranges from 5 -22 feet.

Large waves were generated on the Mississippi River by fissures opening and closing below the surface. Local uplifts of the ground and water waves moving upstream gave the illusion that the river was flowing north. The crew of the *New Orleans*, (the first steamboat on the Mississippi, which was on her maiden voyage) reported mooring to an island only to awaken in the morning and find that the island had disappeared below the waters of the river.

But alas, the great quakes were not over. In mid-January of 1812 the third of the four major earthquakes hit. Again the words of George Crist; *"What are we gonna do? You cannot fight it cause you don't know how. It is not something that you can see. In a storm you can see it in the sky and it shows dark clouds and you know that you might get strong winds, but this you can not see anything but a house that just lays in a pile on the ground - not scattered around and trees that just falls over with the roots still on it. The earth quake or what ever it is came again today. It was as bad or worse than the one in December. We lost our Amandy Jane in this one - a log fell on her. We will bury her upon the hill under a clump on trees where Besys Ma and Pa is buried. A lot of people think that the devil has come here. Some thinks that this is the beginning of the world coming to a end."*

And yet two weeks later on February 7 the last in this series of Great earthquakes again rocked Mr. Crist. *"If we do not get away from here the ground is going to eat us alive. We had another one of them earth quakes yesterdy and today the ground still shakes at times. We are all about to go crazy - from pain and fright. We can not do anything until we find our animals or get some more. We have not found enough to pull the wagons."*

Indeed, the Eastern part of our country has not experienced anything to rival the power contained in this series of earthquakes since 1812. And fortunately as they say: "That's history, Right?" Wrong!

Invariably three questions are asked when one discusses the 1811 - 12 earthquakes.

- (1) Could such an earthquake happen again?
- (2) If so, when will it happen, and
- (3) What would be the affect of such an earthquake if it were to occur now?

The answer to the first question is a resounding yes! Field studies by the U.S. Geoolgical Survey provide topographic and geological evidence of large magnitude earthquakes in this area dating back to the sixteenth century. Indeed there were two instances of 6.0 or stronger earthquakes along the New Madrid fault during the nineteenth century. In fact, in the first 66 days of this year there were 7 quakes in the area that registered 2.0 or higher. The New Madrid fault averages more that 200 quakes each year. So maybe a more apt question would be when?

No one can accurately predict earthquakes. This would involve picking dates and magnitudes. But that doesn't mean that they can't try. The best example of this was Iben Browning's prediction for December 3, 1990. City and state governments made plans, school classes were canceled and emergency plans were put into place from St. Louis to Memphis. Nothing happened. However, this non- event did raise the public's awareness concerning the possibility of earthquakes in our area and it was a boom to insurance agencies

across a four state area.

Earthquake forecasting involves assigning probabilities for earthquakes of varying magnitudes. We have less than a 1% chance for an event of the magnitude of the 1811-12 quakes within the next 15 years. This probability stays at less than 4% when looking at a 50 year time span. If we consider a quake of 6.3 magnitude, which would cause much damage to buildings, our likelihood jumps to 40-63% within the next 15 years and a 86-97% probability in the next 50 years.

The affects of a major earthquake today would be much greater than in 1812. Obviously, the area is much more developed and more heavily populated. A 6.0 earthquake would heavily damage most older structures especially those of masonry construction. It would result in hundreds of deaths, thousands of injuries, and the cost would easily run into the tens of billions of dollars. So, what should we do?

Education, preparedness, planning, and proper building construction are proven means to minimize the deaths, injuries, and economic losses due to earthquakes. In 1989, Northern California and Armenia experienced 7.1 and 6.9 earthquakes respectively. Northern California was prepared, Armenia was not. In Northern California 62 people died and there was more than \$6 billion in losses. In Armenia over 25,000 people died and the losses were greater than \$20 billion. The central United States is more prepared than Armenia, but not

nearly prepared as Northern California.

We can get ready and reduce our losses, or we can suffer the full consequences of a damaging earthquake. We need to plan, to build better buildings, and make sure that earthquake preparedness becomes a part of our lives. We cannot prevent the coming earthquake, but we can reduce the effects.