needed: 8 p.m. description of evening, feel of weather, what can be seen on mtnsides
—what would have been in view from in front of theater: Fire Tower? Capitol Dome?
Sun goes down N of Mt. Helena, behind W corner of theater
Timber against skyline & clouds
Lilacs in bloom (but ending) that time of year
Sun wd have been going out of the Gulch, still on the fire tower
Winsome evening, touched w/ sense of lengthening time
Marlowe Theater pics on 1, #1 1st floor from theater side
#2 mp. gable
#3 corner on hill to SW

Park Ave to W: B'way dead-ends into it

Coy's Mansion: "Qm Anne style ... fanciful, irregular outlines pulled w/ gables, turreted chimneys, balconies & dormers."

"romantic, nostalgic mode"

came 6th 4 Evening
needed: pics

--location, relevant to Monty et al. coming into city and going to the Broadwater
(where else can it be seen from?)

-we have to be pointed out to them

--inscription A loving tribute to our Confederate soldiers

-opposite side: by Daughter 7, Confederate in MT AD 1916

description: in middle of Hill Park, water pours out of sports bowl-like
needed: perspective pics

--location, relevant to Wes's view from his mansion or walking to church

description:
Broadwater Hotel
Finished August 1889
Broadwater died 1892
Earthquake 1935
Gambling 1939
Closed 1941
Natatorium torn down 1946
MARY CLEARMAN • Bare Trees
(from a novel-in-progress)

WILLIAM LANG • Tempest on Clote Street (a historical look into Helena’s black community circa 1906)

JIM TODD • Reflections of a Montanan
(woodcuts)

TED KOOSER • To Feed the Birds
(a story)
TEMPEST ON CLORE STREET:
RACE AND POLITICS IN HELENA, MONTANA, 1906

The tempest on Clore Street is but a small piece of Helena’s history, and not a very pretty one, but it is a reminder that in the history of frontier towns becoming cities, temporary social problems often created great consternation. It is also a reminder that in community-wide disputes there are few, if any, disinterested participants — everyone has his own ax to grind.
A story involving a peculiar mix of sensational murders, political disputes, Republican party infighting, journalistic egos, and an undercurrent of racism, it is one of those small events that allows a quick but illuminating peek at a city’s inner history.

In the manner of so many other placer mining camps, Helena had grown up around its first industry — gold mining. In the early years along Last Chance Gulch, log cabins and hastily built clapboard structures housed miners and early businesses and formed the core of the new town. As the halcyon placer days waned and Helena’s business community diversified, substantial buildings began to appear down the gulch below Broadway to Sixth and beyond to Lawrence Street. By 1900, after fires had razed the town several times, the original log cabin settlement amidst mine tailings at the head of the gulch had given way to a hodge-podge of residences, Chinese vegetable gardens, stables, blacksmith shops, saloons and other businesses. On the edge of this area, only four blocks long and slammed up against a steep hillside where Park Street is today, ran Clore Street: “the viliest street in Montana.”

As early as 1881, the street had hosted “cribs,” the lodgings of prostitutes, and by the early 1890’s, the entire area was known as the place to frequent for wide-open gambling, opium purchases, illegal alcohol, and other contraband. Chinese gambling houses and opium dens, sporting houses advertising black and white women, and black saloons gave the street its reputation. It was one of the latter of these attractions, however, that created the tempest just after the turn of the century. Owned by two blacks, Lloyd V. Graye and David Gordon, the Zanzibar Club at 127 Clore Street was an entertainment center for many members of Helena’s black community. But for those Helena citizens who wanted the saloon closed, the Zanzibar was an “open social sore;” it was a symbol of a way of life that the “better classes” wanted eradicated from Helena.

The first recorded black settler in the Helena area was an unidentified prospector who was party to a gold discovery along Prickly Pear Creek in 1862, two years before the big strike on Last Chance Gulch. By 1870, there were seventy-one blacks in Helena, and in the first decade of this century, there were over four hundred members of Helena’s black community, constituting just over three per cent of the population. Black families lived in practically every neighborhood in the city. A variety of occupations were represented among them, although most were employed in service jobs of one kind or another.

Helena’s black community was vibrant. One

*Clore Street ran approximately where the old Eddy’s Bakery building now stands.

side could boast of business establishments, literary and debating societies, a baseball team, and even a progressive newspaper, begun in 1906. Its social center was the St. James Methodist Episcopal Church at Fifth and Hoback streets. The other side, however, was much like the raucous element in the white community that kept the saloons, prostitutes, and gamblers busy. It was toward this lower, rowdy class in the black community that Helena’s whites often specifically directed the animosities they may have felt towards the black community in general. But open racial conflict was rare in Helena. There were too few blacks to challenge white control of the city, and it was only when black entrepreneurs or politicians encroached upon white territory that conflicts developed. Nevertheless, the general attitude of whites in Helena had a racist underpinning. Whites expected blacks to accept a lower station in life and never to mix socially with whites.

Several years before the 1906 Zanzibar closing, questions had been raised about Clow Street dives, but city councilmen defended the district as the only place black soldiers from nearby Fort Harrison could go in Helena. The unexpressed reason, of course, was that white Helenans did not want black soldiers wandering into their saloons. By the time the Zanzibar opened in late 1903, however, the black community of Helena had nearly doubled from what it had been when black soldiers were first stationed at Fort Harrison in the mid-1880s. Clore Street had become much more than a servicemen’s haunt, and this became obvious when many of the black troops left the fort in 1905. In fact, the Zanzibar and other Clow Street saloons attracted a large white clientele and this development may have played a role in the anti-vice enthusiasm in 1906.

The beginnings of the Zanzibar’s problems came in the spring of 1906 when vice and gambling became a political issue: a sure way to lose perspective on a social problem. In March, the state’s attorney general had begun a statewide anti-gambling campaign. Helena had experienced a genuine resurgence of community spirit in the previous few years, and when the city elections approached in the spring, both parties put reform as the first plank of their platforms. Republican Frank S. P. Lindsay challenged incumbent Democratic mayor R. R. Purcell to explain why conditions had deteriorated in Helena. After a month of active campaigning, Lindsay captured an easy victory on April 2, 1906, and welcomed a new city council composed of nine Republicans and five Democrats.3

Pledged to “clean up Helena,” Mayor Lindsay entered office with a popular mandate. Both daily newspapers, the Republican Helena Daily Record and the Democratic Helena Daily Independent, pushed reform. And the new black weekly newspaper, The Montana Plaindealer, a Republican paper edited by Joseph B. Bass, also boosted for “a greater Helena and for a mutual progress of all the people of the community.” The editorial included a call for moral improvement.4

At the same time, the rowdy image of Clow Street was exacerbated by two sensational murder trials in late March and early April, 1906. The trials made the Zanzibar even more notorious in the public’s eye and also created racial friction.

On December 5, 1905, Nora Mentzel, a Clow Street prostitute who frequented the Zanzibar, reached for a revolver in a desperate moment and killed William F. Cyrus, a black soldier from Fort Harrison. Mentzel maintained that she was defending herself from the soldier’s violent attack, but County Attorney Leon Lacroix saw it as premeditated murder, charging that Mentzel had lured Cyrus into her Clow Street house after hustling him in the Zanzibar. On March 19, 1906, the case went to trial with Chad Spaulding defending...
Lacroix brought witnesses to the stand to testify that Mentzel was a low woman who killed Cyrus in a sudden rage of jealousy. He emphasized her profession and the immorality that seemed to breed on Clore Street. "It is time that the respectable white people of this community rise in their might and assert their rights," Lacroix told the jury. His message was a strident demand that Mentzel be found guilty and that Clore Street be shut down.\(^5\)

The defense put Nora on the stand to tell her own story. She told of the soldier’s anger and his threat to throw acid in her face. She had fired in self-defense; it was all she could do. And other witnesses characterized Cyrus as a drunken, immoral man and a woman beater. But, on the last day of the trial, Lacroix countered by charging that black barber L. L. Grisson had conspired to bribe witnesses and that Nora herself had committed perjury. He finished his closing remarks by telling of personal harassment he had received from Helena blacks. Several blacks had jeered him in public. Chad Spaulding, referring to Lacroix’s failure to prosecute lawbreakers in the white saloons on Main Street, responded to Lacroix: “People who live in glass houses should not throw stones.”\(^6\) After three days of testimony, much of it contradictory and off the question of Nora’s guilt or innocence, the jury retired.

It is difficult to tell what might have turned the jury’s mind. Perhaps it was the disclosure that Cyrus had purchased carbolic acid on the day of his death, or it may have been the general portrait painted of Cyrus as a low-life type who had no scruples. Whatever the reason, the jury acquitted Nora Mentzel.\(^7\)

The sensation of the Mentzel trial had barely abated when a second black woman was brought up for trial on murder charges for a crime that had also been committed the previous December. Julia King, the daughter of a respected Helena black family, had shot and killed her husband after an argument. It was the second marriage for Julia, then eighteen years old, and her husband, William King, was generally considered a “dandy,” a man who had many paramours including white women. As the trial opened on April 10, it was a near repeat of the previous month’s courtroom drama. Lacroix prosecuted and Spaulding defended.

The defense claimed that Mrs. King was prone to hysteria and that her husband had driven her nearly insane with his stories of amorous conquests. She had shot him in a fit, Spaulding claimed, after he told her he was leaving. Julia was popular, and to buttress his case, Spaulding gathered testimony on her character from many black men and women in Helena. He portrayed the dead husband as an immoral denizen of Clore Street, a man who almost deserved his fate.

Arguing that the defense was trying to trick the jury into believing that Julia King was defenseless, Lacroix recounted the crime in great detail, describing how Mrs. King had argued with her husband and then retired only to return suddenly and coldly shoot him down as he left the house. In the face of Lacroix’s relentless cross-examination, Mrs. King broke down and wept. Many of the jurors wept with her; it was an emotional scene. Yet, even as he challenged Julia’s story, the prosecutor continually emphasized how Clore Street’s degenerate influences spawned such crimes as her’s. Perhaps unwittingly, with his arguments, Lacroix helped support the defense’s contention that Julia was the victim of her husband’s immoral ways. Evidently the jury believed Julia’s story; she was found not guilty after a short deliberation.\(^8\)

The Mentzel and King trials brought Clore


\(^7\)Daily Record, March 24, 1906.

\(^8\)Daily Independent, April 10, 12, 13, 15, 17, 1906; Daily Record, April 12, 1906.
Street even more forcefully into public view. Everyone in Helena was ready for some reform action. On June 22, the new city council, believing it was following a public mandate, went after the worst of the Clore Street dives, Graye and Gordon’s Zanzibar Saloon.

Alderman Henry J. Longmaid successfully presented a resolution to revoke the Zanzibar’s liquor license; the vote was eleven to three. The Independent, long a critic of the Zanzibar, cheered the action. “The Zanzibar,” the editor wrote, “is an atrocious, anomalous, insolent, illegal, destructive and insulting thing. . . . It was the dirtiest and most repulsive scar on the body politic. The negroes who conducted it were hated for their management of a villainous dive. The white outcasts who patronized it were anathematized for their association with black and degenerate criminals. . . . It was an Ethiopian saturnalia devised for Caucasian libertines.”

The proposal to close the saloon, however, was not an open and shut matter. Several councilmen, all of them Republicans, objected to Longmaid’s resolution and the precipitate manner in which the council acted. Longmaid had made the outrageous claim that seventy per cent of Helena’s crime could be directly traced to the Zanzibar, a claim that the city’s police committee would not confirm. Alderman John Wendel, who thought the whole action against the saloon was illegal, asked why Longmaid and other councilmen wanted to scatter these “criminal elements” all over the city if they were so dangerous. Would it not be better to regulate the Zanzibar? Wendel asked. At that point, Alderman James Lissner expressed a sentiment held by many others; as much as anything, it was the behavior of one of the Zanzibar’s proprietors that angered them.

Lloyd V. Graye was an enterprising fellow. Shortly after arriving from Denver in 1903, he invested his money in two small businesses in the black community and then purchased the saloon on Clore Street in partnership with David Gordon, former co-owner of the Manhattan Club on Main Street. The Zanzibar flourished under Graye’s management. “This man. . . .” Lissner told the council, “disgusts everybody in the city with his pompous actions. He calls himself ‘King of the Blackbirds,’ and he struts about the city as though he owned every colored person in town.” Perhaps more than his manner, Graye’s success angered Lissner most. Not a disinterested councilman, Lissner owned a saloon a short distance from the Zanzibar on Main Street.

Apart from the accusations against Graye and also Longmaid’s fabrication of crime statistics, the council needed a legal rationale for the closing. The reason, however, did not come until after the fact on the following day. County Attorney

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*Daily Independent, June 22, 1906.

**Daily Record, June 22, 1906.
Lacroix announced that his records showed Graye to be guilty of having sold liquor to minors in October 1905, a direct violation of the state's liquor laws. This was the council's legal excuse.\textsuperscript{12}

Meanwhile, Graye and Gordon were busy circulating a petition demanding that the council reconsider its action. The conflict quickly escalated to involve the whole city, because Lloyd Graye and his supporters went to their political protectors, the Republican party, and asked for help. Blacks in Helena were Republicans in politics. Like other blacks throughout the nation after the Civil War, they consistently voted for the party of emancipation, Lincoln's party.\textsuperscript{13}

Graye's efforts were successful. Political pressure moved the council at its next meeting to reconsider the action against the Zanzibar. The editor of the \textit{Independent} was incredulous. He wondered aloud how the Republicans could cave in to Graye and ignore the wishes of Helena's citizenry: "The people of Helena have decided that the Zanzibar shall not survive. . . . The people of Helena have been insulted, menaced, discouraged and disgraced by the immoral effluvia and the indecent emanations of what is known to be the vilest, the most insolent, the most degenerate and the most amoral Warren of salacity and sin that Montana ever knew.\textsuperscript{14}"

Proponents of the Zanzibar closing relied on more than the \textit{Independent}'s bombast. Because the mayor had signed the original revocation, they argued, it was out of the council's hands. Furthermore, Lacroix had properly interpreted the state liquor law in the revocation of the license. Supporters of Graye and Gordon were also busy. They called Lacroix himself into question, noting that he unnecessarily harassed Claro Street prostitutes, in particular Mignon Belmont. They pointed to Judge J. M. Clement's opinion that Lacroix's numerous arrests of Mignon and her unusually high bail, set at fifty dollars, "looks very much like an official guilty of oppression which is a criminal offense."\textsuperscript{15} Both sides argued furiously in public in anticipation of the city council's next ruling. The Zanzibar issue had now developed into a full scale political row.

"After a star chamber proceeding by the police committee of the city council," J. B. Bass editorialized in the \textit{Plaindealer}, "they reported to the council . . . that for the good of the city, the license of the Zanzibar saloon be withheld . . . ." Now it was the \textit{Plaindealer}'s turn to be incredulous and outraged. Editor Bass charged that the issue boiled down to racism and greed. It was racist because the saloon owners were black, and it was avaricious because Alderman Lissner wanted to limit competition. For Bass it was just one more example of what happened when blacks competed successfully with whites.\textsuperscript{16}

The \textit{Independent}, of course, applauded the council's decision, expecting the Zanzibar issue finally to be laid to rest. But that was not to be. David Gordon, realizing that Lloyd V. Graye was a liability, decided to apply for a new liquor license at the same location in partnership with William C. Irvin, for many years the only black policeman in Helena. The petitioners used a familiar argument — blacks in Helena needed a "place to go," a club for entertainment. Not believing this turn of events, the \textit{Independent} asked: "If the negro wishes to have refreshments or make merry among his brethren, why should he hide his 'lawful and orderly' merrymaking in the most disreputable and feculent byway in Montana? If, as the petitioners urge, the place is to be conducted in a respectable manner, why not establish it in a respectable place? Why nest it in the city's moral sewer where a decent colored man must

\textsuperscript{12}Daily Record, June 23, 24, 1906.
\textsuperscript{13}Daily Independent, June 26, 1906.
\textsuperscript{14}Daily Independent, June 27, 28, 1906.
\textsuperscript{15}Helena Semi-Weekly Independent, July 3, 1906.
\textsuperscript{16}Montana Plaindealer, July 6, 1906.
hesitate to be seen?"17

Speaking for the black community, the Plain-
dealer went on record against all saloon licenses
in Helena, but implored the council to be fair.
"The Independent has certainly gone daffy on
Zanzibar," Bass wrote; "their objections are not
from a standpoint of public good, but from antip-
athy, personal feelings and caste."18 Bass had a
point, for in general Helenans respected ex-
policeman Irvin and they probably wished him no
harm. But the whole issue had grown too hot.
Temper flared, editorials had inflamed, and
political reputations had been compromised. The
opponents warned the aldermen sternly: "Every
voter, every taxpayer, every family man will look
eagerly to see what alderman voted for the most
atrocious insult that could be offered to the city at
this time."19

Recognizing that their petition was doomed, Ir-
vin and Gordon withdrew their license application
and replaced it with another one, this time apply-
ing for a location at 116 South Main Street, right
across from Lissner's saloon. The city council,
seeing an easy way out of the conflict, approved
the new request. Irvin and Gordon soon estab-
lished their groggery, the Luzon, and operated it
successfully for the next three years.20

The Zanzibar issue had been resolved, although
there was yet one more attempt to open a grog-
gery at the old saloon's location on Clore Street.
This time it was a white, William O'Brien, and the
council had little difficulty in unanimously reject-
ing the application — O'Brien could not bring the
political pressure to bear as had the blacks.21

Even though the Zanzibar issue was dead, the
basic racial-political conflict continued. Having
found new success in a shoeshine and tonsorial
parlor, Lloyd V. Graye continued to be active in the
Republican party, as did J. B. Bass and other
Helena blacks. The Zanzibar fight had split the
Republican party in Helena, and when ward elec-
tions came up in September, Graye won election
to leadership in the third ward and Bass acco-
lished the same in the first ward. The Democratic
Independent took great pleasure in reporting the
intercine battles between white Republicans,
noting that the whites had been outfoxed by the
black Republicans. If there was any winner in the
Zanzibar squabble, it may well have been the
Democratic party in Helena.22

There were other racial-political frictions in
Helena in subsequent years, but for most people
the memory of the Zanzibar faded quickly. The last
black troops left Fort Harrison in 1912, and with
them went many patrons of Helena's black busi-
nesses. By the late 1920s, Helena's black popula-
tion was on the decline, soon to be less than a
fourth of what it had been in 1900. And the par-
ticipants' situations changed: Nora Mentzel skip-
ped bail on her perjury charge in November 1906;
Julia King attempted suicide not long after her
trial; Joseph Bass had to give up the Plaindealer in
1911; and Lloyd Graye, the man who seemed
always to land on his feet, went on to better oppor-
tunities in Seattle in 1909.

17Daily Independent, July 18, 1906.
18Montana Plaindealer, July 20, 1906.
21Daily Independent, August 7, 12, 14, 1906.
22Daily Independent, September 12, 1906.
EXPERIENCES OF THE FRED BUCK FAMILY IN THE HELEN A EARTHQUAKES OF 1935

Since June, 1935, a period of ten years, Helena, Montana, had not experienced an earthquake of note, and those that had been felt were mere tremors compared with the major ones of 1935.

The first jolt came early in the evening of Thursday, October 3rd, 1935. We, the Fred Buck family, were sitting in the front room when it was noticed that pictures moved slightly and there was a gentle tingling of dishes and brick-a-brack. All was quiet again until about one o'clock the morning of Saturday, October 12th, at which time the first severe shock occurred. This lasted twelve seconds and shook the house until the walls seemed to be weaving in all directions. It's severity aroused us out of a sound sleep soon enough to witness the last half of the shake up. There was no doubt what had happened, nobody stopped to ask, "Was that an earthquake?" In a few minutes the populace of the whole town was in the streets. No one could sleep through it. Many people spent the rest of the night in their cars.

We hurried downstairs in night clothes, turned on the lights, and took positions on the deck of the front door. The front door was left ajar, too, in case a hurried exit was necessary. Every few minutes from then on for the next two hours there were lesser tremors. Finally the early morning chill drove us to venture back upstairs for some more clothes and a while later we retired to the bed rooms to lie down until daylight. We were nervous and excited. Every new tremor added new excitement, and the waiting for the next shock, which might be harder still, whetted our nerves to a keen edge. Juinicke was so sure that that was only the forerunner of what was to come that she could hardly force herself to stay in the house at all, and she was right, for had it not been for her uncanny premonition, some of the family might have been killed or seriously hurt in the terrific shock that wrecked our home on the night of Fri., October 18th.

The six days that intervened between the 12th and 18th were trying on the nerves to say the least. Shocks kept following shocks, some severe and others mild, but none of very long duration. It is the ones of long duration that do the damage to life and property. The City suffered some minor damage in the way of fallen chimneys, broken plaster, and cracked walls, but no one was hurt.

I asked the State Engineer the next morning if he was scared, to which he answered, "No, I wasn't scared, I was terrified." This is the best description of one's feelings that I have heard and just fits the way every one felt. A veteran of the World War remarked, "I'll take my chances in a shell hole anytime in preference to this". If such remarks were initiated by this quake, which, by comparison with the violence of later ones, was hardly a cocktail to a dinner, we wonder what expressions, if any, could be expelled from the same lips later in the shakes that followed.

Junicke had become so nervous that when I returned home next evening she pointed to a bed roll, suitcases and clothes that she had collected and piled on the floor, and gave me orders that they were to be packed into the car that very night for emergency's sake. She was so sure that we would have to take refuge in the car before the thing was over. It struck me funny. I smiled and tried to kid her out of it, but no, she was in dead earnest, so in the car they went.
The next day Tip Npton, one of the boys working for me who had been thru
the major quake in Los Angeles in 1932, came into the office to ask how we
survived. He said that he had walked down town that evening and thought to him-
self that if it were California he would be sure that we were in for an earth-
quake as the temperature and feel of the air were just prime. He then said to
me confidentially, "You know what I would do if I were you? I would pack a bed
roll and some clothes in the car. I'm not kidding you a bit. I know from experi-
ence what happened in California, and you better take my tip and be prepared."
When I told Juanita this it bolstered up her convictions and I came in for a good
chiding to the tune of "I told you so." The luggage stayed in the car until noon
of the 18th, when I unpacked and piled it up in the dining room much against my
wife's wishes. (She claims it was not so much against her wishes as it was the
embarrassment of having the neighbors see what she had in the car.)

The fore part of the week preceeding the 18th, the shocks began to boom up
in frequency and intensity which terminated with three heavy ones on Tuesday,
then settled to a dead calm on Wednesday evening after a few scattering quivers.
All day Thursday and Friday scarcely a tremor of note was felt. It might seem
that people were beginning to like the rocking from the anxiety caused by this
stillness, but not so. Everyone interpreted it as a warning. The earth coming
to rest in such a sudden deathly calm after a series of crescendo shocks proved
to be a bad omen as people suspected.

When I came home for supper on Friday evening Juanita was very nervous over
the stillness and felt confident that something was in store. She spoke about
it several times before I returned to do some night work at the office. Shortly
after leaving home there was one very severe shock (or "jolt" describes it better)
with not a single after-tremor. This magnified the nervous anticipation of the
coming event, no one knew what, nor how severe, nor what the toll of life might
be, but, nevertheless the event seemed inevitable.

At the fatal moment, nine-fifty E. M., to be exact, six engineers were in
my office consulting over the design of a storage dam when the crash came. We
jumped out of our chairs but could not stand up only by holding onto something
solid. The noise alone of grinding brick and cracking timbers, the rattling win-
dows, and roar of the quake itself, were enough to terrify one to say nothing of
being jostled about like a lone marble in a tomato can. About that time the
plaster began showering from the walls and ceiling, and in the midst of it all
the lights went out. There we were trying to stay on our feet while being as-
swetted with falling plaster in the ghastly darkness. It was an experience I never
went to go through again. Every second I expected to be shot out of the window
to the pavement below, or have the walls crash around me. This terrible shaking
kept up severely and constantly for a period of 32 seconds - it seemed like 32
minutes. As soon as the worst was over, we struck matches to pick our way thru
the dark halls over the plaster and down the stairs to the street. The earth and
building were still trembling. The choking dust that filled the air was as thick
as a heavy fog. Old Mother Earth reminded me of a dog full of fleas barking him-
self to get rid of the dirt.

As I unlocked the car to hurry home, two women came running up so hysterical
they didn't know what they were doing. One threw her arms around me imploring,"For God's sake take me home quick. My child is in the house alone". Not until
we got out of the business district did I begin to realize the seriousness of it.
The pavements were strewn with brick and lumber; people were running as though
they were insane; women were screaming as though in death; the streets were alive
with ears; and the weird yellow cast of headlights piercing the thick blanket of
dust was uncanny.
When near the neighborhood where these two women lived, I asked them several times to tell me when to stop, but they were so excited they didn't pay any attention to me. Finally one of them threw her arms around my neck (they were both in the back seat of a two door sedan so it was necessary to fold back the front seat in order to get out) and said, "Stop, Stop, Stop!" Before I could stop, both of them were out of the car and across the street. I never will know how they got out of that car. The house was almost demolished; the front porch was crumpled in a heap and the brick wall had fallen out of the bedroom where the child lay sleeping. As I got there a man came out of the ruins carrying the baby in her night clothes. She was a six-year old girl so frightened that she couldn't cry. How she escaped death was a miracle.

I hurried on eight blocks more to my family and, upon arriving, found them seated on the bedding, suitcases, etc., in the parking space across the street from the house, where there were no buildings. I will never attempt to describe their fright, nervousness, fear, and anxiety for my safety. They knew I must have been killed or I would have been home before now. By this time there was not a soul in Helena; it is safe to say, that was inside of any building. They were out in the streets, in cars, and clustered in groups on vacant lots. Fortunately there was no snow and the night was not very cold.

To complete the story, I'll take up the movements of the family from dinner time until I met them again about ten-twenty. The baby had gone to sleep, and Juanita was so uneasy that instead of taking her upstairs to bed as usual, she had parked her on the davenport near the front door and had dragged out the bed roll, suitcases and clothes and piled them up at the front door. Juanita played the piano for a while and then went to the phone to call me to come home. The line was busy and just as she hung up, the pop came. She grabbed the baby, ran across the porch, down several steps to the sidewalk and was clear across the street before the lights went out. She said the porch pillars danced a shimmy and seemed to bounce up and down as if they were made of rubber. Several milk bottles came rolling off the porch after she had gotten across the street so we know she lost no time. It was her alertness and anxiety that saved herself and baby from what might have been a serious accident. Mother Evans was not far behind, and they both got out before wreckage began to show itself in the house.

The ground continued to shake and tremble all night almost constantly. The records show that there were 174 shocks during the night.

After pocking the car, we drove around to find some of our friends who did not have cars, but in all the confusion we could not find anyone we were looking for. About two o'clock in the morning we came back to the house to see what damage was done and turn off the gas. It was a spooky feeling to open the door and peek in, one that made cold shivers run down your back. About the time one would get up courage enough to venture in a few feet another pop would bring down more plaster and you would bolt for the door.

The house was a mess; a huge chunk of plaster buried the piano where Juanita was sitting only a few seconds before. The ceiling was unusually high and the plaster was the old thick type which had enough weight in falling so far that she would have been badly hurt if struck with it. The kitchen window was blown out completely and landed on the table right where the baby ate her lunch before going to sleep only a short while before. In the front room a big book case full of books was thrown down in the middle of the floor just after Juanita had crossed in its path to grab the baby, the radio was hurled clear across the room; stand lamps were upset and the floor was strewn with brick-a-brack, pictures, vases, etc. The
frigidare, which weighs five or six hundred pounds, was moved out about eighteen inches from the wall. In the hallway upstairs, a heavy bookcase full of books was jiggled out into the center of the hall until it met a trunk which had moved out from the opposite wall. In the kitchen broken dishes were piled up in a heap where they had slid out of the cupboard; bottles, fruit jars, syrup, beans, flour, etc., covered the floor; then over the top of this conglomeration the fallen chimney had spread a thick layer of black soot.

A peculiar thing about the wreckage in the house was, that everything was thrown from the East toward the West. Things hung on the West wall, or setting tight against it were not disturbed, but every thing against the East wall was dislodged. Against the West wall in the bathroom hung a frail medicine cabinet full of bottles, etc. Not a single article in it was upset, but on the opposite side, which would be the East wall of the kitchen, the dishes and groceries were thrown out of the cupboard onto the floor. The basement seemed to survive the best of all the house as the only thing disturbed there were two cans of fruit which had upset and rolled off the shelf. In a flimsy board shed in the back yard, I had piled up a lot of empty tin cans, that had been used for flower pots, and not a single one was moved. Such are the freaks of earthquakes.

The solid brick house in which we lived (531 Fifth Ave.) was split on all four sides and one wall bulged out of plumb about eight or ten inches and pulled loose from the inside partition. The bricks in the back of the house were almost all either shattered apart or split. Archways over all the doors and windows were broken until the entire loads of brick above were resting on the wooden casings. Although the building had been very substantially built, it suffered structural damage that did not show on the surface. We noticed this in particular when moving the furniture out which would make the floors and walls shake and creak. Two boards on the front room floor bulged up the full length of the room.

There was not a house in the block that was not either demolished entirely, or so badly wrecked that they were not liveable. A two-story brick adjoining ours on the West was shaken to the ground and there were scores of homes within a short radius of us that were demolished. The most severe damage was centralized in various localities and we seemed to be about in the center of one of these areas.

One of my engineers, Norman Benson, found us at the house about three in the morning after hunting for us all night. Nothing would do but to go over to his house until we could get located again. His home was a little four-room frame which was too small for his wife, three kiddies, my wife, Mary Clarabelle, Mother Evans, he and I, but his generosity was so thoroughly backed up with his insistence that we camped with them for the following two weeks, or until the next major quake came on the 31st.

During the interim I packed up the belongings at the house between quakes and hauled the small items such as pictures, clothes, dishes, groceries, etc., over to Benson's garage while the heavy furniture was put into storage at Curtins. It was a spooky job. The days were short so that the daylight hours were brief, the house was cold and most any second one could expect a good shake, I worked with the front and back doors wide open and the runways kept clear so that a hurried exit could be made in case the plaster got to flying too thickly. Several times I made a flying exit and often I got so weak, tired, and nervous I would have to go out in the car to rest awhile. The first three or four days I could not eat and subsisted almost entirely on black coffee.
You never saw such a pile of junk as there was in Benson's garage after it had been assembled on the cement floor. The weather turned cold during the next week while Juanita and I were trying to sort stuff out and arrange it in some kind of order to pack. Between this job, and trying to keep warm, and running out doors every little while to escape another quake, Juanita and I became much better acquainted with each others dispositions than ever before. Then, too, living in such small quarters with four small noisy children and not being able to sleep nights or eat right, just aggravated the situation.

People were living in tents pitched on vacant lots all over town. Many people slept in their cars from two to three weeks and many left Helena to take upabode in neighboring towns. Garages were made liveable while other people moved into homes with friends who were more fortunate. As an example of the congestion, I know of one place where 19 persons were sleeping in a one-car garage. Houses were scarce in Helena before the disaster and when some 460 homes were completely destroyed or badly damaged, as the census showed, you can imagine the congested conditions.

During all this time we were house-hunting every spare minute, but you couldn't find a vacant house, tourist camp, garage or chicken coop - one fellow did offer me a tent. At Fort Harrison some hundred or more town people were housed in army tents pitched hurriedly for the occasion; The Great Northern Railway Company brought in several Pullmans to accommodate the homeless. Had it not turned cold right afterwards with a light snow fall, conditions would not have been so tough, but, at that, nobody really suffered.

None of us could find a single thing we owned or wanted. I had a razor and tooth brush in my overcoat pocket and an extra pair of socks in the car, which were about the only personal belongings I could locate for the two months that we were homeless.

The thirteen days intervening between the 18th and the 31st were days filled with earthquakes: some 24-hour periods would record as many as 25, many of which were light jars, and again, many were good shake-ups. On the 30th things began to quiet down again and then people took on new alarm for peace and quiet were bad signs. At 11:30 the next morning the violent shock struck with all the force and duration of the major one of the 16th. It was not quite so terrifying though as it happened during daylight hours but the damage was perhaps more severe. It shook continuously for 27 seconds. As I glanced out of the window the west brick wall fell from St. Charles College building.

My office was a mad house if you ever saw one; more plaster fell; women and girls were hysterical; and nobody could get out of the building until it was over. As the walls vibrated in and out, I expected every second to land in the street amid a pile of brick and lumber. They bulged and cracked until you could look out upon the sky around the ceiling, but fortunately the walls did not fall or some of us might have been hurt. As it was, the building was wrecked to the danger point and every office and business in it ordered to vacate immediately. The building is being reconstructed and while repairing the upper story, it was discovered that the floor joists had pulled away from the walls until only 3/4 of an inch remained that was resting on the brick. Just a trifle more bulging of the walls and our floor would have crashed to the ground. In the meantime the office was moved to a roadhouse known as the Nite Owl, which is three miles outside of the City.
After the major part of the shock was over, the ground kept quivering almost constantly for about an hour. The records show that there were over 1000 shocks during the afternoon. By this time there were no human nerves left in the City. Streams of cars radiated out over the highways in all directions for the majority of those who had cars left town.

As the day was cold, I had parked the car in a public garage about half a block from the office. I ran to get it but the attendants were all out in the street, and it took a lot of persuasion to get one of them to go back with me long enough to get it out. My only escape was through the alley, which was built up solid on both sides with dangerous brick buildings, and adjoining was a tall stack that had cracked some ten feet below its top and was expected to fall any moment. I was desperate though to get home to the family as soon as possible, so took a chance and safely ran the gauntlet up the alley, past the chimney, and over fallen bricks from the wall of our office building.

The family was pretty excited, but no damage was done to the little frame house where they were. When I arrived, all of them were tramping in the snow out in the yard and wrapped in blankets to keep warm. As soon as we could get things together, we pulled out that afternoon for Great Falls and rented an apartment. I returned to salvage what was left of our wreck and later brought the family back to Helena to camp with the Tarrants, who were old friends of Mother Evans in the Black Hills many years ago. Not until the 6th day of December were we able to get a house in Helena and move into a new home after sixty days of homeless wondering.

The shock of the 31st just about finished the house where we were living the night of the 16th when it was cracked to pieces. The back door was torn off its hinges and slipped down on the floor; the big kitchen range was upset and the connections torn loose from the water tank. The water main was broken in the front yard. Had we been in the house at the time and could have dodged the remaining plaster that fell, there is no telling what the results might have been with a shock severe enough to play such havoc.

Even yet old Mother Earth keeps up her shimmies. On Thanksgiving morning there was another that lasted twelve seconds and shook things up good, bringing down more brick and plaster. Had the other catastrophes not been so fresh in mind, we would have been inclined to class this one as a major shock. Up to midnight, December 17th, the time this is being written, we have had a total of 1200 quakes since October 18th and are still having them. There have been eleven shocks within the last twenty-four hours, some of which are classed by the Weather Bureau as of “moderate intensity”.

It is almost safe to say that there is hardly a building in Helena that is not damaged to some extent. A recapitulation of the damage now being compiled by the City Engineer, shows that out of a total of 5500 buildings inspected in the City, 1769 were damaged from 1/2% to 100% and the survey is not yet completed. Besides the 460 homes ruined, some of the larger buildings condemned are: County Court House, St. Johns hospital, new half-million dollar High School, Bryant School, Cracker Factory, Montana Deaconess Home, St. Joseph Orphanage, County Poor Farm, City Hall, County Jail, Intermountain Union College, numerous stores and office buildings. Some of those badly damaged but which can be repaired, are: Montana Childrens Home, Florence Crittendon Home, Shrine Temple, Cathedral, Denver Block, Fort Harrison, Northern Pacific Depot, Great Northern Depot, Methodist Church, Hawthorn School, Central School, old High School, many stores, office buildings and apartments.
Intermountain Union College was moved by truck to Great Falls, and the Veterans Hospital, which was housed at Fort Harrison, was moved by special train to Walls Walls, Washington. Whether these institutions will eventually rebuild its buildings and return to Helena is still problematical. High School is being conducted in a train of railway cars and the Grade schools will not be reopened until the First of the Year. Temporary quarters will have to be provided until the school buildings can be repaired, and it is planned to send half of the children in the foremost and the other half in the afternoon in order to be able to accommodate them all.

During the first shock of the 18th two men were killed, and three more were taken on the 31st. Several have died since as a result of shocks. The hospitals were filled with injured and when St. John's Hospital went down on the 31st, its patients were hurried to Butte. When one drives around the City to observe the wreckage, they can't help but wonder why more people were not killed. The fact that people were so nervous, alert and held themselves ready to run is probably the reason.

In several places small cracks opened up in the earth after the severe shocks. In one locality down in the Valley, a large crevis belched up water which brought up volcanic ash sufficient to build up small cones six to twelve inches high. The ash was undoubtedly brought up from an artesian flow which was intercepted by the crack.

After the shocks of both the 18th and 31st, the main part of the business district was roped off to prevent auto travel. It was not necessary to prevent pedestrians from entering the restricted district for people were afraid to venture among the tall buildings, and even yet, a good many are reluctant about going down town to shop. Business houses were all closed for two or three days and the City was practically under Martial Law although such had not been officially declared. City Police, the County Sheriff's office, the State Highway Patrol, and the State Militia all joined hands to protect the populace and prevent looting.

We learned after experiencing a series of quakes, that if the earth kept quivering after a severe shock that there was not much danger of anything more serious happening, but if the earth settled down to composure, it was a warning to look out for something more. In other words, continual shakes quelled our minds, but silence generated uneasiness. With every quake there is a distinct rumbling which sounds like a heavy truck. During recent days, as the disturbance is subsiding, we can often hear the rumble very distinctly but do not feel the jar. It makes you wonder if old Mother Earth does not need a laxative.

The quakes, from their behavior, classify themselves into three distinct types; first, the severe ones which shook continuously for several seconds and did the damage, the ones that jostled you in all directions at the same time; second, the quivering kind, which were short in duration and from their behavior, were locally called, "The Stutters!"; and third, "The Jolts" that would hit one vicious crack like some heavy object striking the building with great force. Sometimes this latter kind would seem to be a side crack and again, they would strike vertically as though the force came from the basement. Some of them would fairly make your neck pop.

With every catastrophe there are always amusing sidelights. The evening of the 18th a salesman driving into the City, who had not felt the shock, couldn't imagine
why so many cars were on the highway leaving Helena. He saw a woman standing on
the walk and asked, "What on earth is the trouble, have all the people in Helena
gone crazy?", to which she indignantly replied, "What's the matter with you young
man, are you trying to be funny?" A fellow, who works for me, and his wife were
entertaining a neighboring lady when the pp came. In the darkness, he carried his
wife out of the house, but when he reached the street he found he had carried out
the wrong woman. Visitors from outside who flocked into the City to view the ruins
never had to stay over an hour or so to experience a good jolt. In their fright
they would get out of town as soon as possible. Two contractors, from out of the
State, who were in the office when a slight jar was felt, jumped to their feet in
excitement and would have run into the street if some of us quake veterans had not
 kidded them out of it. All the restaurants were emptied in a second and nobody
came back to finish their meals or pay for them.

After the earth had begun it's dancing, an interesting experience was told by a
rancher who lives in Helena valley within the vicinity where scientists eventually
located the epicenter of the quakes. He said that during haying time, early in the
summer, they had heard rumbling noises which were thought to be distant blastings.
These periodical rumblings finally aroused their curiosity enough to inquire where
the blasting was being done and, finding that there was none, eventually decided that
the noise was coming from the earth. He said that several times they had talked a-
bout it within the family circle, but never mistrusted its meaning until the surface
of the earth began its shaking spells and then they were convinced for the sake
rumbling sounds, only magnified in intensity, accompanied each quake.

During the thirteen days between the two major shocks, the first that shook the
office to pieces and the second that finished it, the employees were so nervous that
very little work was accomplished. Many times during this period quakes would send
them on a mad rush for the halls and stairways. The girls would get nauseated,
scream and faint. Many times I found myself reading through correspondence and after
completing a letter, couldn't remember a thing I had read: my mind, like every other,
functioned only in terms of earthquakes.

Even the animals were frightened. Many cases were reported where dogs set up
gastly spells of howling. Our eight-months old collie pup shook with fear, ran for
one of us, and crouched down whimpering every time a quake of major intensity occurred.

One who has never passed through an experience of this kind has no conception
of its meaning. The nervous shock far exceeds the physical shake and the anxious
waiting in anticipation of something more to come is indescribable. It brings one
to a sense of realization of how helpless and frail humanity is to battle with natural
forces. You experience a nervous sickness, a physical weakness, loss of appetite
and sleep, and move about on tiptoe ready to spring at a second warning.

THIS ENDS THE NARRATIVE OF HOW THE BUTTE BECAME QUAKERS

December 17, 1935
FOOTNOTES: How an Earthquake Feels

Smashers, Rumblers, Snakers

Sirs:

Bang! A steam locomotive struck the house and awakened me out of a sound sleep. Almost instantly the locomotive was replaced by a mighty sun-fisher broncho, Paul Bunyan size. I was riding it. It changed ends in mid-air, it veared savagely, and was a mighty mean "hiss." Three shelves of books hurtled over the bed and on the floor. The smash of crockery mingled with the clatter of falling canned goods, the grinding, creaking of the house joints, the thud of chimney bricks hitting the ground, and a staccato from the kitchen as (learning later) the heavy range danced eight inches off its base, the boiler stand broke, the stovepipe came down and things were a mess generally.

I heard my wife call and got up. She says she called loudly but that I was too scared to hear. . . . No use to clean up the mess until we felt it wouldn't be worse. So we piled into the car to survey Helena. Every main highway leading from the city was filled with fleeing cars. Passing the Shrine Temple I saw a car with passengers, parked directly beneath the tall tower (which still stands). Glad they felt safer there than at home.

The tremors kept coming. We were parked on a rear street. . . . Following one shock, the door of a small brick house opened and out came a strapping young Negro, followed by an old mummy. "I'm goin' away from here, sudden," he told the woman. "Yo can't escape from the Lawd, sonny, you can't escape from Him. He's sho to follow you wherever you go." Across the street an irate husband and a frightened wife were in a violent argument. He was cleaning up the debris in the house but felt it was woman's work, but his wife wouldn't enter, and his efforts forcibly to make her do it failed.

The tumbling furniture became a blur as we carried on down the street carrying an alarm clock. In contrast, there was a miner who returned to his boarding house after the quake, not aware there had been one. The building was pretty badly wrecked and everyone else had fled. The miner, too tired to be observant, parked his car in front, went upstairs and climbed in bed. Two hours later his landlady, who had been riding the night out, passed by and saw his car. She and her friends decided to see if the miner was in the house. They found him in bed, a greyish pallor on his countenance. First he was thought dead, but he was breathing too hard for that, so they yelled and pulled at him until he opened his eyes. He couldn't understand his dream.

The earthquakes in Helena, Mont. last month were ably reported by the Press. But the Press was too busy, too fast-moving to record the intimate detail that shows, in effect, "what it's like to live through an earthquake." Lend me any of the illustrated papers in Helena to relate what they saw, heard, did during those eventful days. Nearly every reader invited wrote an eager, vivid account of his experiences. LETTERS herewith presents a medley of the responses, hereby thanks its reader-writers, regrets only that some excellent passages had to be eliminated for lack of space.—Ed.

Chas. D. Greenfield
Montana Life Insurance Co.
Helena, Mont.

Thrilling

Sirs:

. . . Helena is rapidly becoming earthquake unconscious. . . . On Oct. 18 the big 40-second shake came about 9:47 p.m. I was in the Rio Theatre. A low rumbling sound could be heard such as of an express train on a high trestle, which blended into a noise much stronger but of the same character as that of the noisemaker used by carnivals in the street tent. The floor vibrated as the stern of the Berengaria at full speed ahead. The lights went out. People arose but had difficulty in walking. It was over. No one screamed. People walked out quietly groping their way in the dark . . .

One slightly tipsy fellow in a "sober drink parlor" had just announced the quake could wipe out any man in the house. The shock came and everyone rushed to the street. Oblivious of the quake he turned to where the bartender had been standing and said: "See! They're all scared of me . . ."

Arthur P. Acher

A friend of mine immediately after the shock said to his wife that he could not breathe for fear, asked that she open a window. She entered the bathroom to open a window and found the rear wall of the house gone,
cautiously turning to the repair and rebuilding of its future being. But relatively large numbers of home and property owners in Helena are elderly retired agriculturists, cattle-men or their relics. Many of these, ordinarily comfortably situated financially, having suffered depression since 1928, after this catastrophe made decisions which would have far reaching effects upon the future rebuilding of Helena. Losing homes, apprehensive of further increased taxation in a town reputedly at the peak of allowable indebtedness, well along in years, they moved out of the city back to ranches and many out of the State to spend remaining years with more virile offspring. Since the last ounce of gold has been taken out of Last Chance Gulch (Main Street, Helena) many years ago, there remains nothing to attract the zealous active initiative of youth in rebuilding the town. Helena remains just and only the capital of Montana.

G. R. FITZGERALD
Airways Extension Supt.
Miles City, Mont.

Terror Rode

Sirs: For 30 centuries (seconds) the earth shivered in her seizure. Lampposts wobbled crazily and crashed. Level floors suddenly inclined at sharp angles. A panic-stricken patron of a beer parlor rushed for the middle of Main Street and imagined safety only to be engulfed by the front wall of a hotel. Last Chance Gulch roared with the whirling dust above the quaking earth. A wall crashed into the main primaries of the power system — and the lights went out.

A great pall of dust enshrouded the town’s splendid PWA-built high school, occupied for the first time this semester. It cowered, ashamed of the gross exposure of steel frames stripped of their covering of brick. On every vacant lot shivering, stoop-shouldered people huddled around wood fires... The streamlined ambulances swished through the street bringing to mind the ghostly forms of the apocalypse.

Dawn found a badly hurt and partially deserted town. The sun blended to see blanket-covered people sleeping on the Federal building lawn, others reading newspaper accounts of last night’s horror. After-shocks following the quake, continued through the day at near ten-minute intervals. Exiles in nearby cities wept for the fate of their homes as wild rumor reported fire, gas explosions, falling walls, and failure of the water supply... Quiet came again to the city. Heroic humor relaxed worry-drooped mouths but not for long. Stenographers, usually proficient, retyped most letters. Officials at the State House devised “quake drills,” and became expert at ducking under tables to dodge plaster... Nine federal prisoners not released from the county jail over the week-end were taken to Butte where they speedily pled guilty to all charges against them...

The succeeding week found Helena citizens sharply divided into two camps. An almanac predicted a third quake for the prediction, “would be most severe.” This soon became a betting proposition. A few hardy souls offered odds of 100-1 against the prediction. The day passed with only faint after-shocks recorded.

Halloween of 1935 in Helena put to shame the witches and goblins of olden times. A 9-seconds tremor shortly before noon killed two workmen employed only that morning to repair the stack of the local brewery; reduced the badly damaged high school to shambles, raising its damage to 75% of the total cost; sent scores of hospitals for shock treatment; necessitated the removal of patients from one hospital to private homes and nearby towns. Helena will recover... The spirit of the pioneers hovers over Helena tonight.

J. W. HUGHES
Works Progress Administration
Helena, Mont.

"That's That"

Sirs: We were sitting in the living room of our home listening to a radio program... when the entire house started to rock, shake and quiver as though it were being pulled in all directions at the same time. The large pictures on the walls seemed literally to fly out into the room and turn over... We started to run for the front door and just as we reached the porch all of the lights in town went out—nothing but darkness and the tense feeling of some terrible catastrophe. Then out of the dark came the shrill sounds of hundreds of cars hurrying, hurrying through the night.

The first thought that entered our minds was that the young son of the family was attending a movie some six blocks from home... Hurrying to the theatre through the dark streets we found men, women and children running out of all the entrances guided only by the lights of cars that had rushed to that point, every one frantic with fear, yet making no outcry. We learned afterward that the most nerve-racking part of the experience of those in the theatre was seeing the plaster from the ceiling falling in front of the screen.

where buildings were of brick veneer, the bricks shelled off like corn off the cob in the case of solid brick or stone build-ings, the sides or front or back would be entirely removed and the furniture in the rooms exposed to view. One strange thing was a car of liquor that had been spotted at a warehouse. The warehouse collapsed, the roof falling on the car and almost cutting it in two. Only six cases of whiskey were damaged.

... Some of the finest institutions in the community were badly wrecked, this being particularly true of the Catholic Orphanage on the edge of town, housing 125 little children, who with the nuns were compelled to seek shelter in the dairy barn until the railroad officials placed cars on the tracks at their disposal... While the children were in the cars one of the railroad officials said, "Well, where would you like to go—will it be New York or California?" A tiny girl replied, "I don't want to travel, I want to stay here and have earthquakes!"

... The residents of the town feel the same way... When a quake comes along, we just smile and say "Well, that's that."

EDITH G. BRISCOE
Acting Secretary Montana Liquor Control Board
Helena, Mont.

SEQUEL

Headless Helena

Sirs: Our excellent geology department was quick to point out the significance of the recent Helena earthquake (Times, Oct. 28). Another quake occurred in the same region in 1925. After it, a geologist predicted other severe shocks in the future and advised that the buildings in the region be given certain rather simple protections: veneer or face-brick should not be used without ties or bonding to fasten it to the back wall; poor or insufficient mortar should not be used, rich Portland cement being satisfactory; chimneys should have braces of iron; buildings not on hard rock should have deep and heavy foundations. Ten years later, Helena has suffered from its disregard of this warning...
her surprise the entire front wall had also disappeared. I asked one man if he heard the noise when the side of his two-story brick house fell. He said no—

that while the quake was on he rushed to the street, noticed the creaked wall of a nearby store building, casually looked around and to his consternation saw the side of his own house was gone. 

A Red Cross worker, visiting a lady in a house which had been seriously damaged, felt impelled to walk to the street, the lady following her. As they left the house the second jolt came and the building collapsed.

The County Court House being rendered unsafe by the continual tremors, the Clerk of Court now carries the Court seal in his pocket, does business where we find him.

While these earthquakes are a thrilling experience, news gatherers not satisfied to report real facts, delight in exaggerating reports. One newsroom photographer asked refugees in a relief camp to remove some of their clothing and shiver so that the suffering would be more realistic. They refused.

But a day or two after the second quake city firemen did rescue a lady from the second story window of an abandoned building, smashing in the glass, carrying her down the ladder, etc., for the Hearst-Metronome Newsroom cameraman. Photographers were seen snapping an abandoned school which has looked like the ruins of Kenilworth for at least five years that I know of.

Arthur P. Acher
Attorney at Law
Helena, Mont.

“Cutout! Gotohell!”

Sirs:

... Slight rumbles and moderate tremors continued daily setting more and more on the verge of exhaustion from fright and helplessness in the face of nature’s manifestation of power and might. Many Helenans retired at night partially clothed under their nightwear, with flashlights and car keys within easy reach, their coats and footwear across the foot of their beds. Subsequently many residents left town each and every night, repaired to nearby resorts which had not felt the temblers and returned to business in the morning. Others awakened by the minor shocks dressed, packed families in cars, drove to the airport seeking solace in the “All’s Well” flash of its green beacon every ten seconds plus the safety of wide open spaces.

On Oct. 31, the third violent shock of unusual duration was experienced in the face of a rapidly falling barometer and thermometer. Weakened buildings tumbled completely, others, having withstood previous quakes were cracked to the extent of making further occupancy extremely hazardous. Additional residents left town.

Nobby Photo Shop, from Reader Acher

Helena Residence
From 170 like it, 700 homeless Helenans.

U.S. Coast & Geodetic Survey
Accelerograph Record
Oct. 31, 1935 Earthquake
Helena, Montana

Oct. 31, 1935 will long be remembered by Helenans for the crushing shock that struck at 11:37 a.m. The seismogram above shows the earth movements in three directions: up-&-down, north-&-south, east-&-west.

A matronly bridge club of eight, reduced to a foursome by previous quakes, became no quorum at all after this shock.

Helena matrons soon became experienced seismologists, able to report the direction of movement of the latest earthquake by the number and direction of open drawers throughout their homes. A very talkative parrot became unusually quiet except at the start of a new tremor when a rapidly shrill “Cutout! Cutout!” continued for several seconds unless the quake ceased within that time, or tiring, he uttered a guttural “Gotohell!” as they failed to cease at his prior command. Our friendly little dog, loving and well loved by the children, would rise from her bed, make the rounds of each bed in the house, listen for signs of life and slowly return to her own troubled sleep only when assured of her masters and friends safety.

Hotels located in the business district became practically vacant. A report of the hasty exit of at least one guest after a slight shock may give an idea of the uppermost desire of everyone to get going.

This gentleman, without bag or baggage, clothed only in pajamas rushed from the lobby to a nearby bus, clambered aboard, with only a gasping entreaty to the driver, “I don’t know where you are going but let’s get there quick.”

Many people, after the reported experience of the sheriff who arrived home after the third severe quake to find his bathtub filled with brick and stone, were reluctant to even venture near a bathtub, much less draw a tub; their worry: the fitness of their garb should a quake occur while engaged in their ablutions.

Today, the city is hesitantly and
The Day That the Houses Shook Their Snow Off

By ROBERT E. MILLER

City Engineer Oscar Larson, in a quick survey, said the damage was $5,000 in the city.

Predicted Worse

On Oct. 13 The Independent reported on a certain radio announcer in the predicting that Helena would experience even more severe and disastrous effects. A copy on page one, asking people to fill in blanks with the identity of station and announcer who were "unnecessarily terrorizing" the city.

But by Oct. 19 the campaign was forgotten. By 9:32 p.m. a quake much more severe than that of Oct. 12 rocked the city.

In the same house on Hillside, where the children were upstairs in bed. Mother and father were reading in the parlor, suddenly the earth began to shudder. The plaster fell. The lights were out. Power was off. The house was in darkness.

The couple dashed for the stairs calling the names of first one child and then the other. No answer. The stairs seemed to rise to meet the feet. But the parents found the children safe in their beds with covers pulled over their heads.

"Why didn't you answer when we called?" Mother asked.
"We couldn't talk, we were too scared," one of them answered.

City Demoralized

This time the city was demoralized, the newspaper said the next day. People climbed into their cars and fled the town. They loaded up with blankets, food and whatever they could find, and many a family did not return until the quake had finished settling.

Again Helena was caught in a psychological as well as a physical disaster.

Some of the quakes were an old story and they became immune. They were the last straw, and they subsided. Gradually the community was restored, although in many cases it was never the same again.

Landmarks Gone

Gone were the landmarks as the clock tower on the courthouse and on the Great Northern depot. Gone was St. Paul's Methodist Church at Broadway and Ewing. Gone was Intermountain Union College east on Eleventh.

The city was the top story and the contrasting brick veneer of the Hawthorne School had become a beautiful new high school, but it later was rebuilt.

Gone was St. John's Hospital. Gone was the Armory. Gone was the fountain. It was half off the head of Main Street. Material was aiding Helena police. Buildings were closed. Firemen brought down the damaged chimney at St. John's Hospital.

Rehabilitation Started

And yet by Tuesday the city was started. By Wednesday the government was sending aid. Gov. Frank Combee called a meeting to plan aid for Helena.

Wednesday people were up and along the streets as the stores reopened. By Wednesday Helena was the mecca of thousands of sightseers from other parts of the state who came to see the damage.

By Bill A. Camp, the Independent editor and the Record-Herald were pouring quakes for their columns and new locations for businesses.

By Friday the banks and the Montana Reconstruction Corp. were announcing loans for those who need credits.

Saturday there was a camp meeting in the new homes for those who had lost residences.

Sunday another quake was felt, much more severe than the previous. Scientists said this proved that the worst was over.

By Thursday things were as near or as one could tell.

The sky at 11:37 came back, during which all the houses had their snow off.

At Newspaper Office

This time the young family was at his newspaper office on Broadway. The other day they were on morning paper time. This was just before noon, just as final decisions were made about the makeup of the Christmas papers. It was just the start to work under conditions never before experienced.

The highlight of the disaster were collected and organized as quickly as possible and the paper was out on time.

Two workmen, tearing down a sockerstuck damaged in the previous quake at the Kessler Brewery, were tossed from its top story when the rubber roof bricks rained down. They were the only fatalities.

Historians of Quakes

The historians of the quakes, C. R. Anderson and M.P. Martinson, whose book "Montana Earthquakes," published in 1938, gave credit to the newspapers for withstanding the rigors of the quakes. Here is what they said: "Much of the credit for maintaining the morals of the citizens during the long days of suspense and tremors can be given to the newspapers of the city. The editors and their loyal working forces kept right on, through it all, even at times they were caught in extremely dangerous situations. When things were at their darkest, the sight of a fresh newspaper gave the situation just a little extra and was, together with all the other items of interest, seemed to bring back a normal atmosphere.

The same book quoted an editorial in the Lewistown Democrat News which described the journalism during the quake: "Following the quake of Oct. 19, the Independent came out as usual, only a few minutes late. It also issued straight through, and following the big quake of Oct. 31, the Independent came out at 4 a.m. following the other. All papers were printed by George H. McLaughlin, George H. Bob Miller of the Record-Herald, and Bill A. Camp, the Independent editor. And editors had worked seven weeks a night and some of the best congratulated."
SEVERE DAMAGE IS REPORTED IN THIS CITY TODAY

Continued From Page One.

the stage, an entire section gave way and fell to the ground in the back.

New School.

Workmen were in all parts of the high school building but not one received a scratch, one of those inside when the crash came, said. He added, however, that all ran to safety and it was impossible to get back inside to turn off the gas.

Building in various parts of town and especially on the west side and in the depot section, which had been hurt when the Oct. 18 temblor struck, suffered additional damage today.

Several roofs of damaged brick buildings caved in on the floor below. Notable of these was the residence building in the 1100 block on Ninth avenue. The roof of this already weak structure settled down on the top of the lower floor.

The old Northern Pacific land office building opposite the station in the Sixth ward also acted in this manner and workmen who were tending the structure under the past week were greatly aided today. The building is now about half as high as it was before.

Sugar From Cold.

All over town people were standing in groups in front of houses, some damaged or just shaken. They conferred in low voices and many were afraid to remain. Despite the piercing cold.

Chimneys toppled all over the east side of the Sixth ward and many lamps, glass, dishes and other such equipment were dashed to faces and broken.

"The Northern Pacific roundhouse was at other damaged, sections of wall falling in some places and several wide cracks appearing in other parts of the building. Two men working on scaffolds repairing the building from the earlier damage were badly hurt and sent to the hospital.

St. Mary's school was further shorn of its outside brick walls, many bricks tumbling to the ground.

The roof of the National Hotel company warehouse settled further onto the building and much of that already badly damaged structure gave way. Piles of brick, several feet deep were noticeable on at least two sides. While the building already was a complete ruin, today's shake further completed the destruction.

A few injured came to St. John's hospital, where the building was again shingled after its previous shaking.

Two men, one named Crum, were reported as having been injured when they were shaken off scaffolding at St. Mary's school in the Sixth ward. They were brought to the hospital.

The steeple of St. Paul's church, reported dangerous after the last heavy quake, was still standing.

At Intermountain college more of the gymnasium wall, down from the previous quake, came out. Walls of Helena hall and Mills hall were further weakened and doors in Helena hall were torn from their hinges.

Some walls at the Mountain View apartments on the west side were out on the third story.

Top walls of the Maylor theatre were reported bulging out over the alley at Third. Workmen were not leaving the building, having completed repairs on previous damage, when the quake struck.

Girls at the Florence Crittenton home were reported as having been thrown to the ground and were moving out of the building, but what damage occurred to the home could not be learned.

wise was wrecked and all prisoners being held there were turned loose.

At Intermountain.

Mills hall on the Intermountain Union college campus was so severely struck that it evidently has shifted on its foundation and now presents a leaning appearance. The building has a decided list.

In East Helena the major damage was to the grade school building on Main street, which was entirely wrecked by the shock of the quake. The little city received a severe shaking up, however, and much plaster was cracked and fallen. Many chimneys toppled or cracked.

At the Capitol.

When the earthquake shock struck the state capitol building, the walls gave way from east to west as if the building was about to go over on its axis, and the roar that reverberated through the capitol was perhaps the most frightening feature of the event. As the big building shook and shivered officials and employees sprang from their seats in wild alarm. Blanched faces and trembling limbs were in sight everywhere. The extreme violence of the shock, seeming to exceed that of the destructive quake of Oct. 18, filled the building with more than 100 occupants of the building with alarm and there was an immediate and universal rush for halls and stairs and throngs were soon making for the exits.

Employees Ordered.

While there was no signs of panic and no marks of great excitement, and the droves of fleeing employees in the corridors were orderly, the grim silence of most of them indicated the depth of their feelings and the general apprehension that had permeated everybody.

One man yelled at another, "where are you going?"

The other replied, "out of here. I'm coming back," but not today.

Little Damage.

While no attempt to inspect the building for damage done by the temblor was made at the time, to the casual observation of people harrying from the structure there was no evidence on the basement or first floor of damage. Fallen plaster was not in sight in the main corridors, but the previous quake had cracked plaster in some of the offices, and now cracks were added by today's shock.

It did not take long to empty the building after the temblor took place, and since it was near noon, most of the employees went home at once. A box came to the back door at the time the crowd was escaping and it was crowed to the doors.

Nothing Serious.

Later, Walter Small, custodian of the building, made a detailed examination of the building on all its floors and in the offices, and stated afterward that he could find no serious or structural damage anywhere.

There was some slight falls of plaster in some of the offices, but nothing of a pronounced kind, and while the cracks made by the first heavy earthquake had been somewhat enlarged and had been supplemented by new cracks the damage did not seem important.

None of the steam or gas pipes in the building had been affected as far as could be observed by the building engineer on a first examination. There apparently were no discontinuities.

A look at the figure of justice on the dome of the building did not disclose any displacement, though ever since the first heavy earthquake struck, the statue figure and the probably was its trembling down the dome down into the rotunda have been the subjects of speculation and comment on the part of the building's tenants.

At Cathedral.

Little damage was done at the beautiful St. Helena cathedral, Father J. O. Tonga, pastor, said this afternoon.

However, foundations have been moved from compulsory attendance at mass. Masses are to be held in the lower auditorium of the church, he said.

Those students at St. Vincent academy who were attending school were released immediately after the shock struck.
This report would not be complete without a discussion of past earthquakes in Montana. They have been common in the geological past throughout the mountainous areas of the state. Their occurrence in pre-historic times is attested by the numerous offsets or displacements of rock formations; by the uplift of mountain blocks; by crushed or pulverized rock so commonly observed along fault zones in mines; by the abnormal development of streams, and by the peculiar shape of some topographic features. Note the fault map on plate 9.

An examination of the historical records of earthquakes in Montana brings to light some interesting, unsuspected, and important information. Table 1 shows that the first recorded earthquake in Montana occurred in Helena on the morning of May 22, 1869. Bishop Tuttle\(^1\) gives us an interesting account of this shock. He writes, "On the morning of May 22d, (1869) while we were at breakfast, there came a rumbling sound as of a heavy wagon dragged rapidly across a bridge. With it came a shaking of the house which threw down some pieces of furniture and some dishes in the pantry. The ladies said, 'Some great piece of furniture has fallen somewhere'. I thought one of the large freight wagons in the street which ran close by our front door had by the awkwardness of the driver collided with the corner of our house and shaken it, but going to the door I saw no wagon. Looking up-stairs and down I could find no large piece of furniture that had fallen anywhere. While finishing our breakfast we could only discuss the matter and wonder about it. Soon after, I went down Main Street and discovered that the same disturbance had been noted everywhere. We were then sure that the town had been visited by an earthquake. About midnight the same day, another shock came. A sudden violent rocking of the rooms and beds was felt by all who were awake. No damage, however, or only very trifling damage was caused, either at morning or at night."

Though the above quotation is the first known reference to an earthquake in Montana an earlier reference is made by Lewis and Clark\(^2\) which might have some connection with earthquakes. On July 4, 1805, they wrote, "Since our arrival at the falls, (Great Falls of the Missouri) we have repeatedly heard strange noises coming from the mountains in a direction a little to the north of west. It is heard at different periods of the day and night, sometimes when the air is perfectly still and without a cloud, and consists of one stroke only, or five or six discharges in quick succession. It is loud and resembles precisely the sound of a six-pounder piece of ordnance at the distance of three miles. The Minnetarees frequently mentioned this noise like thunder, which they said the mountains made, but we paid no attention to it, believing it to be some superstition or falsehood. The watermen also of the party say that the Pamees and Ricars give the same account of a noise heard in the Black Mountains to the westward of them. The solution of the mystery given by the philosophy of the watermen, is, that it is occasioned by the bursting of the rich mines of silver confined within the bosom of the mountain."

The second recorded earthquake in Montana occurred on December 10, 1872, the epicentre of which was placed near Emery, about eight miles east of Deer Lodge. The Deer Lodge Independent\(^3\) wrote, "...our valley was given a healthy earth shaking, which lasted about four seconds.... The first shock was followed

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1. Tuttle, D. S., Reminiscences of a Missionary Bishop, p. 220.
The shock on October 31 caused an additional $20,000 damage to buildings in East Helena. In Helena many structures which had been weakened by the previous shocks were further damaged. The exact amount of additional damage is difficult to estimate, but certainly would be measured by the tons of thousands of dollars. Taking into consideration destruction of every nature, the total amount of damage is estimated to be $4,000,000.

Other Damage

No damage to railroads or highways was reported. The few surface cracks in hard gravel roads in the vicinity of Stanchfield Lake were not large enough to necessitate repairs.

Fig. 2. — Diagram showing direction gravestones fell in Resurrection Cemetery, Oct. 31.

Fig. 3. — Diagram showing direction gravestones fell in cemetery, Oak and Livingston Streets, Oct. 31.

Fig. 4. — Diagram showing direction gravestones fell in Bryant Cemetery, Oct. 31.

All of the cemeteries were more or less damaged due to twisting and overthrown of gravestones. The Resurrection Cemetery, about three miles north of Helena presents an interesting case. The cemetery is laid out in a semi-circle with the greatest curvature to the south. On October 18 no gravestones were overthrown, however, many of them were twisted about one inch clockwise. (See plate 7, F and H). A few were twisted counter-clockwise. One stone composed of three sections showed differential twisting of the units. The middle unit was twisted clockwise one and one-half inch, and the upper section was twisted counter-clockwise about five-eighths of an inch. A second trip was made to this cemetery on October 31 for the purpose of measuring the additional slip on certain marked gravestones. However, to the observer’s surprise all of the marked stones had fallen over. Twenty-seven fell due south, two fell north, and one fell east. Furthermore, 25 of the fallen stones were at the south end of the curve where the face of the stone was directed south and could be thrown over with the least amount of effort.

An old cemetery near the Bryant School at the corner of Oak and Livingston Streets is in the district of maximum destruction in the city of Helena. Even though many of the stones in this old cemetery were not sitting perfectly upright no more fell over than did in the Resurrection Cemetery. Most of them were twisted clockwise.

Only a few of the stones in the Bryant Cemetery on the northwest side of town were overthrown.
Injury to Persons

The loss of life during the entire earthquake period was remarkably low. Only four people lost their lives, two on October 18 and two on October 31. Six additional deaths were attributed to nervous shock as a result of the earthquakes; however, from reliable sources it is learned that not more than two of the six can be attributed directly to the earthquakes. The deaths on October 18 were due to falling bricks and those on the 31st to the collapse of a large smoke stack at the Kessler Brewery. The lack of greater casualties is unquestionably due to the fact that the first severe shock occurred at night when schools were closed and few people were standing on the streets; and that at the time of the second severe quake the schools had been closed by far-sighted authorities and that Helena residents were more careful.

The exact number of injured cannot be definitely ascertained but it is estimated that not more than 50 persons were treated for major and minor cuts and bruises.

No injuries were reported as a result of cars being thrown from the road. Only one car was reported to have swerved from the road; no injuries to occupants resulted from the accident.

Of course, many inconveniences and much suffering was experienced by the homeless. The occupants of St. Joseph's Orphanage were moved to Boulder Hot Springs Hotel through the courtesy of Senator James E. Murray.

Sensations and Emotions

Although experiences of individuals are different depending upon their physical environment, the effects of an earthquake are in general the same. A hunter on Ten Mile Creek was thrown to his knees and probably would have fallen farther if he had not braced himself. A farmer near Lake Helena was standing in an open field on the morning of October 31 and heard a rumble coming from the southwest. He reports that he saw the ground moving in waves toward him, and was thrown to the ground when the wave passed under his feet. Many others lost their balance or were thrown down. Many persons in Helena probably owe their lives to the fact that they were unable to rise from their chairs and run outside where they would have been struck by falling bricks and stones. One man, who had been an officer in the world war and accustomed to danger, became exceedingly nervous and more or less dizzy. Many persons felt nauseated and extremely nervous. On the night of October 18 few people were able to sleep in their homes. Many persons slept in cars, others on mattresses in the open, some in improvised tents, but most found sleep difficult.

Animals were also greatly disturbed and showed signs of fright and terror. Many persons have reported that dogs became noticeably restless and uneasy just before shocks. Whether dogs were able to feel a slight preliminary shock or whether the observations were correctly made cannot be said. Fowl in Frickly Pear Valley were reported to flounder on the ground. A competent observer standing in a field near Logan in 1925 saw horses become startled and stumble as they ran. They were probably startled by the noise of large rock slides along the bluffs of Missouri River and Sixteen Mile Creek.

Sounds

Sounds accompanied all of the more important shocks. Mr. W. E Maughan, Meteorologist at Helena states: "Noise accompanied almost any shock of consequence. It was roaring with the three heavy shocks. On the 18th the sounds
seemed to come from deep down in the earth. On the 31st subterranean noises were less pronounced." About 50 percent of the people within a radius of 60 miles report sounds similar to those made by a passing train or heavy truck. The sounds in Butte on October 31 were comparable to the heavy, dull roar which precedes a spring rain storm. The rumble was so audible that the writer had time to stop in the midst of a lecture and call attention of a geology class to the approaching earthquake. The most distant points from Helena where sounds were reported are: Dillon, 102 miles south; Hamilton, 108 miles southwest; Havre, 174 miles northeast; Harlowtown, 110 miles east, and Livingston 102 miles southeast. Many persons report that earth sounds, without accompanying tremors, could be heard in Helena.

**Rock Slides**

No rock slides of any importance occurred as a result of the Helena earthquakes. On October 18, a small slide covered the highway near the Great Northern viaduct about seven miles south of Helena. It was not large enough to disrupt traffic. Loose rocks and boulders resting on steep slopes were generally shaken down. Ranchers in the Belt Mountains reported that rolling stones could be heard. One rock slide occurred south of Livingston, about 10 miles southeast of Helena, but its cause cannot be definitely charged to the earthquakes. It was probably caused by the normal agents of erosion.

**Effect on Mines**

As is to be expected no damage was reported from any of the mines in the state. In a few instances the earthquakes wore of actual benefit in that they caused an increased water supply. Many miners reported feeling the shocks, but the intensity seemed to decrease with depth in all cases.

The effects of earthquakes on mines is excellently shown from observations made in the Gould mine 28 miles northwest of Helena. Mr. Stanley R. Moore, Superintendent, made a special effort to interview the miners underground at the time of the earthquakes on October 18 and 31. As shown in table 3 the shocks were not positively felt below the 600 foot level.

**Table 3 Earthquake observations in mines**

<table>
<thead>
<tr>
<th>Mine</th>
<th>Men Interviewed</th>
<th>Level</th>
<th>Experiences (Men at Lunch)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Gould, Oct. 18, 28 miles NW of Helena.</td>
<td>2 5 2 3 2</td>
<td>200 350 500 800 1000</td>
<td>Felt quake severely - few small rocks fell. Felt quake strongly. Did not feel quake. Did not feel quake. Did not feel quake.</td>
</tr>
<tr>
<td>Gould, October 31.</td>
<td>2 5 3 4 2</td>
<td>200 350 500 600 1000</td>
<td>Felt quake plainly. Felt quake plainly. Felt quake plainly. Did not feel quake (one trammer felt quake). Did not feel quake. One man did not feel quake, other had a peculiar sensation but did not realize it was a quake.</td>
</tr>
</tbody>
</table>
This Month Is Anniversary of 1935

Editor's Note: "THE earth-quake?" that many residents recall having experienced or heard about happened 25 years ago this month.

The first quake, beginning Oct. 1, 1915, was minor compared to the major quakes of Oct. 18 and Oct. 21 when four men died.

Between Oct. 2, 1935, and Jan. 1, 1936, Helena experienced 2,418 quakes costing damage at an estimated $4,200,000.

The following article is a true account of the parent-teacher meeting at Kender School on Friday, Oct. 18, 1935. It was written by Dr. and Mrs. Jamison, who were living at Fort Harrison, where the doctor was a surgeon, with their daughter, Barbara Ann, who was a student at Kender School.

Someone struck a match. As it flickered in the dark, I heard my husband's voice shout, "For God's sake put it out." In short order I saw tears glaze in Miss Convair's eyes, as she said heavily, "she cries, everybody, be calm." Only a minute before about thirty young mothers and fathers had been covering numbers with corn as we played Bingo at Kenders School on Dad Night PTA. It was Friday, Oct. 18, 1935, Helena, Montana. Glass crushed, plaster spilled to the floor, the school building was trembling in the earthquake.

For two weeks we had experienced several shocks of quite heavy ones in the previous two weeks. On the previous Friday night a quake had been strong enough to shake the school. Since we all felt the children to school every day, we couldn't very well cancel the PTA meeting; Dad's Night was something special for the whole family attendance, I had been at school on Wednesday and Miss Convair, the first grade teacher, said "We had three heavy ones today. We played a game, I say, "down under the desk and count slowly to ten." Then she added thoughtfully, "I'm responsible for twenty little children and I'll admit that I'm disturbed but I can't let the children see it." My husband, Dr. G. V. Jamison, was on the Veteran Administration Hospital staff at Fort Harrison. The children from the post attended Kender School. It was a big gray stone building built on a hill. Our daughter Barbara thought it looked like a castle and was anxious to be six so she could go to school. Dawn was Dad's Night PTA and she was so excited that her father could go because they were going to sing.

Started in Normal Way

The evening started in a very normal way. We were gathered in the large Assembly room on the second floor. The children sang several songs, gave a skit, and then went to the basement play area for games. After an address by a school man, we gathered around a long Bingo table, others visited in the spacious hall while the committee prepared the refreshments in the basement. While I was chatting with Lilie Holmes, our daughters Dorothy and Barb were busy and said, "Lots of kids have bicycles, can't we have one." Lilie said, "They're

HELENA HIGH DESTROYED — This is the result of the Oct. 18 earthquake which caused the greatest amount of damage. The school did not only in use six weeks. Many left Helena, the night of the quake as soon as they found a few personal posses-

sions and obtained gasoline. One estimate was that 25 per cent of the population left the night of the quake and the follow-

ing day.

Well sit down and play," I noticed that Roger Smith, Helena's chief policeman, was counting the numbers at the table. I was singing, "away from my bed, because my door is like the door in the dark, you" I moved in the direction of rocks settling somewhere in the voice. People were milling around the voice. Earth, reaching inside a door. I called for help, I heard. My husband took my arm and moved slowly by voice, "Farther, where are you and moved slowly and cautiously toward the entrance. We saw cars from cars with flashlights and helped us down the cluttered, rock-strewn steps.
THE MONTANA EARTHQUAKE OF JUNE 27, 1925

By J. T. Pardee

SUMMARY

The earthquake of June 27, 1925, in Montana caused considerable damage within an area of 600 square miles or more, the center of which is in latitude 46° 5' N. and longitude 111° 20' W., a short distance southeast of Lombard. It was a seismic disturbance of the first order of magnitude, but, owing to the hour at which it occurred and to other fortunate circumstances, no lives were lost and no fires broke out. The shock was startling throughout an area extending 75 miles or more in all directions from the epicenter and was sensible to persons within an area of 310,000 square miles. Within the epicentral area brick buildings suffered severely, rocks fell from cliffs, cracks opened in the ground, and the inhabitants experienced the usual symptoms of illness and emotions of alarm. Isoseismals drawn according to the Rossi-Forel scale show a wide indentation at the south due to a rapid decline of intensity in the volcanic area of Snake River Plain and Yellowstone Park.

The main shock was preceded by two light foreshocks and followed by a great many aftershocks, one of which, occurring about three-quarters of an hour later, was almost as severe as the main shock.

The epicenter is in Clarkston Valley, a lowland surrounded by mountains of severely folded Mesozoic and older rocks and floored with Tertiary "lake beds" and Recent alluvium. Physiographic evidence indicates that Clarkston Valley is a structural depression bounded on the east by a fault of post-Miocene age. Presumably the origin of the earthquake was on this fault at a considerable depth below the surface. It is concluded that the region is in a state of moderate seismic activity and is likely in the future to be visited by an occasional severe shock.

INTRODUCTION

On June 27, 1925, practically all of Montana and parts of the neighboring States and Provinces were shaken by an earthquake of marked intensity. The shock, which was immediately preceded by a light foreshock, came at approximately 6.21 p. m., mountain time. Newspaper reports published the following days indicated that the greatest damage occurred in the villages of Three Forks, Logan, and Manhattan and at Deer Park, where a large rock slide blocked the Chicago, Milwaukee & St. Paul Railway. The area thus indicated lies from 20 to 40 miles northwest of Bozeman and about 55 miles east of Butte and an equal distance southeast of Helena. The epicenter as subsequently determined is a short distance southeast of Lombard, at approximately 46° 5' north latitude and 111° 20' west longitude. Three Forks contains about 1,200 inhabitants, Manhattan 600, and Logan 300. The remainder of the area of high intensity is very thinly inhabited.

The effects of the earthquake were investigated by the writer within the periods of July 10 to 31 and August 29 to September 5, 1925. Most of the settlements within a radius of 50 miles of the epicenter were visited, and trips were made to a few more distant points. The work consisted mainly in observing the remaining visible effects upon structures and natural objects and obtaining first-hand records from individual observers. In addition the geologic features of the epicentral area were briefly examined. (See pls. 3 and 4.)

For valuable information the writer is indebted to many persons interviewed, and in particular to W. T. Lathrop, of the United States Weather Bureau at Helena; J. P. Swarts, W. P. Laburg, and H. P. Allen, Northern Pacific Railway operators at Lombard; and A. D. Burkett, chemist of the Three Forks Portland Cement Co. at Trident.

EFFECTS OF THE EARTHQUAKE

DAMAGE TO BUILDINGS

The greatest damage caused by the earthquake was shown by the school buildings at Manhattan, Logan, and Three Forks and a church at Three Forks (pls. 5 and 6), all of which were built of brick. The church is almost a complete wreck. The schoolhouses, though very seriously damaged, were not beyond repair. In the business sections of Three Forks and Manhattan most brick, stone, and cement-block buildings were seriously damaged, but none were completely wrecked. Some brick and cement houses and virtually all frame buildings escaped serious injury. Rather serious damage was done to brick schoolhouses at Willow Creek, Bozeman, Radersburg, and White Sulphur Springs, to the courthouse and jail at White Sulphur Springs (pl. 6, B), and to cement walls and cement-block buildings at Trident. Damages to five schoolhouses in Gallatin County (two at Manhattan and one each at Three Forks, Logan, and Willow Creek) were estimated by the State architect at approximately $62,000. The additional property loss in the towns mentioned probably is not large. There was also damage at many other places within a radius of 75 miles of the epicenter. This damage consisted mostly of breaks in chimneys, plaster, and plate-glass windows.
In addition many persons suffered losses by reason of merchandise and household effects being thrown about and broken. No estimates of the amounts of these losses are available.

From even a casual inspection it is apparent that all well-constructed buildings of whatever type escaped with little damage. Buildings faced or veneered with brick laid up without being tied or bonded to the inner walls suffered the most. The schoolhouses (pls. 5 and 6) are conspicuous examples. In Three Forks several walls made of common brick tied in the usual way with a layer of "headers" every fifth or sixth row were observed to be practically undamaged, though they adjoined veneered or faced walls that had failed. Some walls tied as described were wrecked, but their failure was due to poor mortar, as shown by the fact that the fallen bricks were generally separated from one another. At White Sulphur Springs part of the cornice and veneer on the one-story brick jail was sheared from the inner wall, owing to the lack of ties or bonding (pl. 6, B). In the same town the peaks of the walls forming the gable ends of a two-story brick school and the two-story stone courthouse fell. The school had previously been condemned as unsafe, but the courthouse, though old, was apparently a substantial building. The gable peaks probably fell because they lacked the support of adjoining walls. At Radersburg the brick veneer on the one-story schoolhouse was partly sheared off.

DAMAGE TO RAILROADS

At the west portal of tunnel No. 8, near Deer Park, on the Chicago, Milwaukee & St. Paul Railway, the earthquake caused a rock slide, estimated at 40,000 cubic yards, that not only blocked the track but obstructed the canyon of Sixmille Creek, causing a lake to form (pl. 7, B). Two weeks was required to build a temporary track around the slide, so that the railroad could resume traffic over this part of its line. Clearing the permanent track would, it was estimated, take several months. A report, current in newspapers soon after the earthquake that the tunnel at Deer Park had been destroyed was erroneous. It had been clogged by débris at one portal but otherwise was undamaged. Between Deer Park and Lombard rocks fell on the track at several places, without, however, causing serious damage. At Cardinal a water tank of an older type, supported by timbers, was thrown down. At several places near Lombard the Northern Pacific Railway track was broken or obstructed by masses of fallen rock (pl. 8).

DAMAGE BY FIRE

Fortunately, no fires were caused by the earthquake, but an indirect result of it was a fire the night of July 20 which destroyed the main business block in Toston. This fire caught from a chimney that had been cracked by the earthquake and was not repaired. Efforts to put out the fire were hindered by a lack of water, due also to the earthquake, which had cut off the public supply formerly derived from gravel beneath the dry channel of Sixmille Creek.

INJURY TO PERSONS

Though many persons experienced narrow escape in the Montana earthquake, none lost their lives, only two were reported to have been injured. The fortunate lack of casualties is no doubt due to the fact that the shock came at a time when schools, churches, and other places of public assembly were vacant. The people were mostly on the streets or in homes and away from the large buildings that lapsed. At Three Forks a woman had a leg broken as a result of falling or being thrown down by shock, and near Ennis a man received slight injury when the vibrations sheared the automobile in which he was riding off of the road. A west-bound Chicago, Milwaukee & St. Paul Railway passenger train, two sections and a Northern Pacific Railway passenger train were in the epicentral area of Lombard when the shock came. The Chicago, Milwaukee & St. Paul train sections had only a few minutes before passed the place where the Deer Park slide buried the track. They came to a stop where the tracks were falling on the tracks in front of them and behind them, and their escape without a scratch seems little short of miraculous.

EMOTIONS, SENSATIONS, ETC.

The earthquake was violent enough to alarm inhabitants generally throughout an area having a radius of as much as 75 miles from the epicenter. In Three Forks and other places near the epicenter many persons became wildly excited or hysterical and the alarm caused by the main shock was renewed and increased by several of the closely following aftershocks. Because of earth motion during the heavy parts of the main shock and of the first aftershocks many persons were unable to walk or go toward door or in any other certain direction. Near Three Forks a man who had raised his foot to step over a ditch was unable to change this pose for a few seconds, then fell into the ditch. Persons sitting unable to rise out of their chairs. A man who in one of the damaged schoolhouses at Manhattan probably owes his life to the fact that he was unable to get to the door for a few seconds, during which time several heavy masses of brick fell just outside. Miraculously persons were partly or completely thrown down, in falling caught at the nearest object for support. A lady thus thrown in the street at Three Forks for herself clasping the knees of a strange man.

As soon as persons were able to regain their feet make progress despite the earth movements they
no time in getting out of doors. In their excitement some persons picked up articles of no value. At Butte a woman is said to have laid down her baby and picked up the cat. Within a large area nearly everyone experienced more or less dizziness or nausea, and many felt a nervousness difficult to overcome for days or weeks afterward.

Most persons who had not already eaten failed to get their suppers that night. Near the epicenter many tables with suppers already served were thrown to the floor in a general mixup with other household articles. At Three Forks and places similarly situated dishes were commonly upset, and in general the people became too excited or ill to think of eating. Many of the inhabitants of Three Forks, Manhattan, and other places and even a few as far away as Butte and Anaconda remained out of doors part or all of the night after the earthquake. At Three Forks and other places that suffered conspicuous damage to buildings the people wisely did their cooking out of doors for several days or until their chimneys could be repaired. Fortunately, because it was summer, this caused the least amount of inconvenience, and for the same reason the houses did not need to be warmed. There is record of only one fire resulting from the use of a damaged chimney (p. 8).

Fright or terror was exhibited also by domestic animals within the area of startling shock, but few details were obtained on this phase of the subject.

**EFFECT UPON MINES**

Contrary to a rather widespread apprehension, the workings of mines were not damaged by the earthquake, and in fact the shock was not generally noticed by the miners who were underground at the time. At Barker a group of miners who were at work in a stope at a depth of 250 feet did not feel the shock, though it was generally noticed in that neighborhood by persons at the surface. So far as learned the thousands of miners at Butte who were underground at the time were generally unaware that an earthquake had occurred. In view of the fact that mine workings are generally constructed so as to withstand the jars from blasting, it is not surprising that they would resist damage by the less violent vibrations of this earthquake. Owing to the common occurrence of the jars caused by blasting, miners at work would not be likely to notice especially the somewhat similar vibrations of seismic origin. Furthermore, as these vibrations are less destructive in areas of solid rock than in loose materials, they would be less noticeable underground than at the surface.

**ROCK SLIDES**

Rocks and rock masses were shaken down rather generally from the steep slopes and cliffs existing within a radius of 12 or 15 miles of the epicenter, and a few rock falls occurred as far away as 40 miles.

*Deer Park slide.*—The largest mass dislodged by the earthquake was that which blocked the valley of Sixteenmile Creek at the west portal of tunnel No. 8, near Deer Park (pl. 7, A). The size of this slide does not mean, however, that the shaking was more severe in that locality than elsewhere, but that at that point an unusually large mass was already sufficiently loosened by erosion to be easily shaken down. Tunnel No. 8 goes through a narrow limestone spur that projects a short distance from the south wall of the canyon and causes Sixteenmile Creek to make a north bend (pl. 4). At the point of the spur the canyon is narrow, and its floor is practically occupied by the stream, which is 10 to 12 yards wide. Above and below the spur the canyon widens a few hundred feet. The east side of the spur, which faces upstream, is a sheer wall of limestone (pl. 7, B), which before the slide was 100 to 300 feet high. The north side of the canyon opposite the spur is a similar wall, and the west or downstream side of the spur is only a little less precipitous. Surmounting the walls on both sides of the canyon are steep slopes that rise 1,000 feet higher. The gorgelike constriction of the valley at this place is due to a belt of resistant Paleozoic limestone that trends northward across the course of the stream. The bend in the gorge is probably an incised meander. The limestone dips about 30° W. and therefore inclines downstream and at right angles to the axis of the spur. A fault or slip plane that coincides nearly with the bedding (pl. 9) touches the top of tunnel No. 8 at or near its west portal. Its trace appears about 60 feet above the tunnel at the east portal, in the vertical east wall of the spur (pl. 7, B). This trace is visible farther south and also across the stream on the north side of the canyon (pl. 10, A), where it shows the maximum dip. Above and below this fracture are other similar slip planes. All of them probably were caused by the readjustments between the beds necessitated by the folding, and none are to be regarded as major structural features.

The mass of the spur above the fault plane described fell during the earthquake. Prior to that event its supports had been cut away on all sides except the south. The shaking, therefore, easily broke it loose along joints and minor fractures and started it sliding down the inclined floor on which it lay. Scratches made on this plane by the sliding mass go across small grooves and ridges made during previous fault movements.

*Slides near Lombard.*—For a mile or more north and south of Lombard, Missouri River is bordered on the east side by limestone cliffs and talus slopes several hundred feet high (pl. 10, B), at the foot of which the Northern Pacific Railway is built. On the west side of the river are lower cliffs beneath which the Chicago, Milwaukee & St. Paul Railway passes for a short distance. Fortunately, the bedding planes in
the cliffs east of the river are nearly horizontal. If their dip was toward the river slides probably exceeding that near Deer Park would have occurred. Joint planes were opened in these rocks, however (pl. 11, A), and considerable material was shaken down (pl. 8, B). Solid masses weighing as much as 100 tons were detached from the cliffs and rolling down smashed the track (pl. 8, A). One of these masses estimated to weigh 30 tons is illustrated on Plate 11, B. Along Sixteenmile Creek below the Deer Park slide and along Missouri River west of Lombard the Chicago, Milwaukee & St. Paul track was similarly obstructed in many places. In all tributary canyons or other places near by where steep or cliff-like slopes occur much material was dislodged and added to the talus accumulations already existing. Observers along Sixteenmile Creek reported that for some time after the rocks began to fall the air was filled with a dense and choking dust. At Lombard the cliffs were hidden for several minutes by a cloud of dust, below which the rock debris could be seen rolling and sliding down to the river.

**Rock falls in outlying areas.**—Beyond the epicentral area rock falls of comparatively small extent occurred along the bluffs adjacent to Madison River south of Three Forks, along Jefferson River above Willow Creek, near Accola, and near Canyon Ferry. Most of these were masses that were well on the way to being let down by the ordinary processes of erosion. Dust arising from some rock falls near Willow Creek appeared from a distance like smoke and led to the report that the town was on fire.

**GROUND CRACKS**

Newly formed ground cracks were observed in many places within a radius of 15 or 20 miles of the epicenter and also at one place, Canyon Ferry, about 40 miles distant. Apparently all were due to the shaking, and none represented a surface slip along the line of a deep-seated fault. Those described in the following paragraphs were observed in or near the epicentral area.

**Garden Gulch.**—In the bottom of Garden Gulch about 3 miles south of Cardinal, several cracks were observed in alluvium, causing certain areas to settle and thus obstruct the flow of water through ditches. At another place three cracks having a direction little west of south cut across a ridge of Tertiary “lake beds.” These cracks are each 100 yards or more long and from 1 to 3 or 4 inches wide. The ground on the west side of each had settled slightly.

**North of Cardinal.**—Near the ranches of Jonas Stockburger and Dave Johnson, respectively about 2 miles northeast and 3 miles north of Cardinal, many ground cracks were observed that range from 50 to 200 or 300 feet in length and from 1 to 3 inches in width. These occur in a hilly region composed chiefly of Paleozoic limestones bearing a rather thin soil or surface mantle. The cracks appear in the soil and generally follow along the foot of a hill just below the outcrops of bare rock. Whether or not they penetrate the rock beneath the soil is not shown. As a rule the area on the lower side of each cracks has settled a little.

**Near Three Forks.**—On the highway northeast of Three Forks a crack several rods long and several inches wide opened in the embankment forming the approach to the bridge over Jefferson River. The crack had been filled up and was not visible when the writer visited the scene, but evidence of it is given by a photograph (pl. 12, B). A report published in the papers soon after the earthquake stating that a fissure had opened extending continuously from Three Forks to Manhattan was apparently without foundation.

**Greyson Creek.**—At John Denzer’s place, about 15 miles north of Cardinal, on alluvial land bordering Greyson Creek, a crack opened more than 100 yards long and 6 inches in maximum width. It is parallel to the creek, and the bank on that side has settled a little.

**Canyon Ferry.**—In the field of William Ames, near Canyon Ferry, cracks 2 or 3 inches in maximum width (pl. 13, A) partly surround an area of an acre or less that has settled slightly. This block lies in an area of alluvium in the valley near the edge of the bench lands. It includes a shallow swale that is not crossed by a stream, the swale apparently being the result of settling at some former time.

**CHANGES IN SPRINGS AND WELLS**

Many springs within a radius of 50 miles from the epicenter were increased or diminished by the earthquake. Some were made turbid for a short time. Several wells went dry, and others became muddy. The ground-water flow beneath the dry bed of Sixmile Creek, upon which the town of Toston depended mainly for its public water supply, 1 failed shortly after

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the earthquake. Presumably the water was diverted to some other underground channel. Big Spring, above Toston, was said to have been muddy for two days, and the flow of Mockel Spring, south of Radersburg, was considerably increased. Increased flows of hot water are reported by the proprietors of White Sulphur Springs and Alhambra Springs, at Clancy. In the valley of Jefferson River, near Willow Creek, several new springs are said to have broken out, though existing springs went dry. According to press reports, a spring having a flow estimated on July 20 at 100 gallons a minute broke out in a field near Lewistown shortly after the earthquake.

RENEWED FLOW OF OIL AND GAS

An oil well near Cody, Wyo., that had been unproductive for several years "blew" considerable gas and oil for a few days after the earthquake. This well, which probably is the one described in published reports as Shoshone Oil Co.'s well No. 1, is situated north of Shoshone River, 3 miles east of Cody. It was bored in 1909-1912 to a depth of 1,720 feet and found gas and small amounts of oil in several different layers. Its total production, however, probably did not exceed 200 barrels. The well is about 300 feet north of the Cody branch of the Chicago, Burlington & Quincy Railroad and 300 feet east of Cottonwood Creek.

W. O. Taylor, of Cody, who witnessed the recurrence of activity, reports that the well started flowing about noon of the day after the earthquake. By the middle of the afternoon the flow had reached such proportions that the fire hazard appeared too great for trains to pass. Throughout the afternoon the well threw a column of mixed oil and water accompanied by gas from 30 to 40 feet in the air. The flow of gas was estimated at about 5,000,000 cubic feet a day, and the oil and water together at 1,500 barrels a day, the proportion of oil ranging from 5 to nearly 100 per cent. At 7 o'clock the next morning (June 29) the well was still spouting 10 or 15 feet in the air and making considerable oil. At 9 o'clock the flow had ceased. As a result of the well's activity the ground had become oil soaked for 100 feet around it.

Since the spurt described the well has remained quiet, and at the time of Mr. Taylor's report (Dec. 19, 1925) oil stood in the casing about 60 feet below the top.

Edwin Binney, jr., of New Haven, Conn., who visited the scene about three weeks after the earthquake, observed evidences of the recent activity of the well as described. Mr. Binney saw the same well in 1924. At that time it was discharging a small amount of gas, and oil was standing in it to the depth of at least 100 feet. The writer is indebted to Mr. Binney for calling his attention to the behavior of this well and suggesting its possible relation to the earthquake.

The well is within the zone in which the earthquake intensity ranged from 4 to 5 on the Rossi-Forel scale. The Byron, Garland, and Elk Basin oil fields in Wyoming, and the Cat Creek and Kevin-Sunburst oil fields, in Montana are also in the same zone; the Salt Creek and other fields in Wyoming are in zones of less intensity. It is not known whether any wells in these fields were affected by the earthquake.

SAND SPOUTS

At Clarkston, in the alluvial bottom lands along Missouri River, a crack opened and sand and water spouted up for several hours. Afterward the crack closed, and at the time of the writer's visit, two months later, nothing could be seen but the deposit of sand spread over a square rod or two. Similar occurrences were reported near Townsend and in the horseshoe basin west of Menard, where water and mud are said to have spouted up like a geyser.

INTENSITY OF THE EARTHQUAKE

The intensities of the earthquake at different places, as shown by the following table, were estimated by the writer from the visible effects upon buildings and natural objects; reports obtained by letter or interview from persons who experienced the shocks, reports made by observers of the United States Weather Bureau, and reports published in the newspapers. Altogether 110 reports were obtained by interviews with persons who were within a radius of 40 or 50 miles of the epicenter. Sixty-five replies were received to letters addressed to postmasters or others in the outlying parts of the disturbed area, and a score or more of reports from scattered points were obtained from Weather Bureau observers and selected from the newspapers.

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1 Idem, p. 46.
2 Idem, p. 47.
<table>
<thead>
<tr>
<th>Place</th>
<th>Latitude N</th>
<th>Longitude W</th>
<th>Intensity</th>
<th>Effects, etc.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Cardinal</td>
<td>46 8</td>
<td>111 20</td>
<td>9+</td>
<td>Extensive rock falls from cliffs. Heavy stove moved east.</td>
</tr>
<tr>
<td>Stockburger’s, 2 1/2 miles north of Cardinal.</td>
<td>46 8</td>
<td>111 20</td>
<td>9+</td>
<td>Furniture in small house thrown violently about. Cracks in ground.</td>
</tr>
<tr>
<td>Deer Park</td>
<td>46 8</td>
<td>111 19</td>
<td>9+</td>
<td>Log buildings distorted and made to lean eastward.</td>
</tr>
<tr>
<td>Garden Gulch, 4 miles southeast of Lombard.</td>
<td>46 6</td>
<td>111 20</td>
<td>9+</td>
<td>Extensive rock falls and slides. Heavy stove moved northwest.</td>
</tr>
<tr>
<td>Dave Johnson’s, 3 miles north of Cardinal.</td>
<td>46 9</td>
<td>111 21</td>
<td>9+</td>
<td>Other furniture in small house thrown about.</td>
</tr>
<tr>
<td>Lombard</td>
<td>46 8</td>
<td>111 24</td>
<td>9+</td>
<td>Loose cloths in plowed field “danced and shuffled about.” Stove in cabin thrown over eastward. Log cabin sprung out of shape. Ground cracks. All loose objects in small house thrown about violently. Extensive rock falls. Telephone poles leaned strongly to the northwest, then righted. Heavy steel safe in Northern Pacific Railway depot moved to the southeast. Strong surge on Missouri River. Swells formed on railway track. 9 Doors of stove jerked off. 9 Ground cracks. 8 Chimneys overturned. 8 Rock falls. Chimneys overturned. Cracks opened in cliffs. Water thrown out of troughs. 8 Chimneys overturned. 8 Some chimneys overturned. Loose articles fell from shelves. 8 Rock falls. 8 Chimneys overturned. 8 Chimneys overturned. Some brick and stone buildings seriously damaged. 8+ Visible ground waves. Water thrown out of trough. 8 Heavy tractor thrown south of the timbers on which it had been blocked up. Chimneys overturned. 8 Doors on one-story frame house swung violently. Loose articles fell. 8 Loose articles thrown from shelves. Doors and lights swung violently. Some chimneys overturned. 8 Brick schoolhouse seriously damaged. Some chimneys overturned. Plate-glass windows broken. Visible earth waves. Goods spilled from shelves on north and south sides of rooms. Few articles on west side down. 8 Loose articles thrown about. Rock falls. 8 Cornice on brick schoolhouse fell. Some chimneys overturned. Brick and stone walls cracked. 8 Loose articles thrown from shelves. Chimneys broken. 7 Slight damage to some buildings and a few chimneys wrecked. Loose articles fell from shelves in several stores. 7 Top of a two-story brick wall fell off on west side. Chimneys damaged. Some loose articles fell from shelves. Automobiles facing east and west in a garage rolled forward and back in unison. 7 Buildings and other objects swayed alarmingly.</td>
</tr>
<tr>
<td>Place</td>
<td>Latitude</td>
<td>Longitude</td>
<td>Intensity</td>
<td>Effects, etc.</td>
</tr>
<tr>
<td>----------------------------</td>
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<td>-----------------------------------------------------------------------------</td>
</tr>
<tr>
<td>Boseman</td>
<td>45 41</td>
<td>111 3</td>
<td>7</td>
<td>A few chimneys overthrown. A few brick buildings seriously damaged.</td>
</tr>
<tr>
<td>White Sulphur Springs</td>
<td>46 33</td>
<td>110 54</td>
<td>7</td>
<td>Chandeliers swung violently. Heavy steel safe moved a few inches south.</td>
</tr>
<tr>
<td>Doggett's, 18 miles northwest of White Sulphur Springs</td>
<td>46 43</td>
<td>111 12</td>
<td>7</td>
<td>A few brick or stone buildings seriously damaged. Several chimneys overthrown. Water in a trough splashed out on north and south sides.</td>
</tr>
<tr>
<td>Fort Logan</td>
<td>46 42</td>
<td>111 11</td>
<td>6+</td>
<td>Chandlers swung violently.</td>
</tr>
<tr>
<td>House's, 10 miles northeast of Bozeman</td>
<td>45 50</td>
<td>110 53</td>
<td>6+</td>
<td>Buildings swayed alarmingly.</td>
</tr>
<tr>
<td>Clyde Park</td>
<td>45 58</td>
<td>110 37</td>
<td>7</td>
<td>Building swayed. Some chimneys cracked; one fell.</td>
</tr>
<tr>
<td>Wilsall</td>
<td>46 0</td>
<td>110 39</td>
<td>6+</td>
<td>Plastic cracked. Some chimneys overthrown.</td>
</tr>
<tr>
<td>Ringling</td>
<td>46 16</td>
<td>110 40</td>
<td>7</td>
<td>Some loose objects thrown from shelves.</td>
</tr>
<tr>
<td>Canyon Ferry</td>
<td>46 39</td>
<td>111 42</td>
<td>7+</td>
<td>Cracks in plaster and chimneys.</td>
</tr>
<tr>
<td>Norris</td>
<td>45 34</td>
<td>111 42</td>
<td>7</td>
<td>Earth banks fell.</td>
</tr>
<tr>
<td>Harrison</td>
<td>45 42</td>
<td>111 48</td>
<td>7+</td>
<td>Several chimneys thrown down. Flow of hot springs increased.</td>
</tr>
<tr>
<td>Livingston</td>
<td>45 40</td>
<td>110 34</td>
<td>7+</td>
<td>Chimneys damaged; some overthrown.</td>
</tr>
<tr>
<td>Eldridge</td>
<td>45 12</td>
<td>111 14</td>
<td>7+</td>
<td>Cement walls cracked. Chimneys damaged and plaster cracked.</td>
</tr>
<tr>
<td>Ennis</td>
<td>45 21</td>
<td>111 44</td>
<td>7+</td>
<td>Visible earth waves.</td>
</tr>
<tr>
<td>Virginia City</td>
<td>45 18</td>
<td>111 56</td>
<td>7+</td>
<td>Some chimneys cracked. Loos object fell.</td>
</tr>
<tr>
<td>Twin Bridges</td>
<td>45 33</td>
<td>112 20</td>
<td>6+</td>
<td>Log house shaken strongly. Loose objects moved or rattled.</td>
</tr>
<tr>
<td>Butte</td>
<td>48 0</td>
<td>112 33</td>
<td>6+</td>
<td>Hanging lamps swung. A few loose bricks fell from top of wall.</td>
</tr>
<tr>
<td>Sieben</td>
<td>47 54</td>
<td>112 8</td>
<td>6+</td>
<td>Old stone walls and chimneys cracked. A few chimneys down.</td>
</tr>
<tr>
<td>Wolf Creek</td>
<td>47 1</td>
<td>112 4</td>
<td>6+</td>
<td>Plastic cracked. A few bricks shored from the cornices of some buildings.</td>
</tr>
<tr>
<td>Drummond</td>
<td>46 40</td>
<td>116 8</td>
<td>6+</td>
<td>Several chimneys damaged and a few overthrown.</td>
</tr>
<tr>
<td>Great Falls</td>
<td>47 50</td>
<td>111 17</td>
<td>6+</td>
<td>Some old brick walls and chimneys cracked or fallen. Chandeliers swung.</td>
</tr>
<tr>
<td>Nehart</td>
<td>46 15</td>
<td>110 43</td>
<td>6+</td>
<td>Vases and similar objects toppled over. Small house strongly shaken.</td>
</tr>
<tr>
<td>Belt</td>
<td>47 22</td>
<td>110 56</td>
<td>6+</td>
<td>Chandeliers swung.</td>
</tr>
<tr>
<td>Barker</td>
<td>47 4</td>
<td>110 37</td>
<td>5</td>
<td>Hanging lamps swung.</td>
</tr>
<tr>
<td>Monarch</td>
<td>47 6</td>
<td>110 50</td>
<td>5</td>
<td>House shook. Hanging lamps swung.</td>
</tr>
<tr>
<td>Cascade</td>
<td>47 15</td>
<td>110 42</td>
<td>5</td>
<td>Chandeliers swung.</td>
</tr>
<tr>
<td>Anacoda</td>
<td>46 7</td>
<td>112 57</td>
<td>5</td>
<td>Small house strongly shaken.</td>
</tr>
<tr>
<td>Phillipsburg</td>
<td>46 20</td>
<td>113 18</td>
<td>5</td>
<td>Hanging lamps swung.             Posts, etc., swayed. An old cracked chimney thrown down.</td>
</tr>
<tr>
<td>Columbus</td>
<td>45 38</td>
<td>109 15</td>
<td>5</td>
<td>Buildings swayed. Posts swayed. Loose articles moved.</td>
</tr>
<tr>
<td>Butte</td>
<td>48 0</td>
<td>112 33</td>
<td>5</td>
<td>Loose objects moved. A few articles fell from shelves.</td>
</tr>
<tr>
<td>Butte</td>
<td>47 4</td>
<td>110 37</td>
<td>5</td>
<td>Buildings swayed; some loose bricks fell. Some dishes and vases overturned.</td>
</tr>
<tr>
<td>Monarch</td>
<td>47 6</td>
<td>110 50</td>
<td>5</td>
<td>Automobiles in garage moved back and forth. Water splashed out of pail.</td>
</tr>
<tr>
<td>Cascade</td>
<td>47 15</td>
<td>110 42</td>
<td>6</td>
<td>Building swayed alarmingly. Some plaster cracked and loose bricks shaken from tops of some walls. Courthouse clocks stopped at 6:22 p.m.</td>
</tr>
<tr>
<td>Superior</td>
<td>37 12</td>
<td>114 59</td>
<td>6</td>
<td>Felt by nearly everyone. Some foundations settled and some chimneys toppled.</td>
</tr>
<tr>
<td>Roundup</td>
<td>46 27</td>
<td>108 34</td>
<td>5</td>
<td>Hanging lamps swung.             Posts, etc., swayed. An old cracked chimney thrown down.</td>
</tr>
<tr>
<td>Fort Benton</td>
<td>47 50</td>
<td>110 41</td>
<td>5</td>
<td>Felt generally. Hanging lamps swung moderately. A few cracks in plaster.</td>
</tr>
<tr>
<td>Grangeville, Idaho</td>
<td>45 50</td>
<td>116 8</td>
<td>4</td>
<td>Chandeliers swung. Walls creaked. Felt distinctly for several seconds.</td>
</tr>
<tr>
<td>Moscow, Idaho</td>
<td>46 42</td>
<td>117 0</td>
<td>4</td>
<td>Felt by everyone indoors and out. Lamps swung. Loose objects moved.</td>
</tr>
<tr>
<td>Shelby</td>
<td>48 30</td>
<td>111 52</td>
<td>4</td>
<td>Felt by several persons outdoors. Loose objects moved. Frame building creaked. Shocks came at 6:30 and 7:30 p.m.</td>
</tr>
<tr>
<td>Havre</td>
<td>48 33</td>
<td>110 40</td>
<td>4</td>
<td>Felt by many persons. Houses creaked and bed &quot;wiggled.&quot;</td>
</tr>
<tr>
<td>Cody, Wyo</td>
<td>44 33</td>
<td>109 3</td>
<td>4</td>
<td>Felt generally by persons indoors. Hanging lamps, etc., swung.</td>
</tr>
<tr>
<td>Salmon, Idaho</td>
<td>45 10</td>
<td>113 58</td>
<td>3+</td>
<td>Felt by everyone. Loose objects moved or rattled. Lamps swung.</td>
</tr>
<tr>
<td>Mackay, Idaho</td>
<td>43 56</td>
<td>113 37</td>
<td>3+</td>
<td>Noticed by several persons indoors. Chandeliers swung and windows rattled.</td>
</tr>
<tr>
<td>Nezperce, Idaho</td>
<td>46 12</td>
<td>116 15</td>
<td>3</td>
<td>Noticed by several persons indoors. Windows, etc., rattled slightly.</td>
</tr>
<tr>
<td>Pullman, Wash</td>
<td>46 44</td>
<td>117 11</td>
<td>3</td>
<td>Noticed by several persons indoors. Windows rattled.</td>
</tr>
<tr>
<td>Malta</td>
<td>48 22</td>
<td>107 52</td>
<td>4</td>
<td>Noticed by nearly everyone indoors. Hanging lamps swung and windows rattled.</td>
</tr>
<tr>
<td>Challis, Idaho</td>
<td>44 30</td>
<td>114 14</td>
<td>3</td>
<td>Felt by several persons indoors.</td>
</tr>
<tr>
<td>Dubois, Idaho</td>
<td>44 10</td>
<td>112 15</td>
<td>3</td>
<td>Felt by nearly everyone. Pendulous objects swung. Doors and windows rattled.</td>
</tr>
</tbody>
</table>
### Intensity and effects of Montana earthquake of June 27, 1925—Continued

**[Principal shock at 6:21 p.m.]**

<table>
<thead>
<tr>
<th>Place</th>
<th>Latitude N</th>
<th>Longitude W</th>
<th>Intensity</th>
<th>Effects, etc.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Lethbridge, Alberta</td>
<td>49 43</td>
<td>112 52</td>
<td>3+</td>
<td>Felt by persons indoors only. Clock in Canadian Pacific Ry. station stopped at 6:23 p.m. Shock lasted 30 seconds. Lights and hanging objects in hardware store swayed. Flower pots fell from a window ledge. A piano moved perceptibly. Clocks stopped. A second shock about 6:45 p.m.</td>
</tr>
<tr>
<td>Macleod, Alberta</td>
<td>49 44</td>
<td>113 23</td>
<td>3+</td>
<td>Felt by many persons, some of whom were outdoors. Hanging objects swayed and windows rattled. Shocks came about 6 and 7 p.m.</td>
</tr>
<tr>
<td>Forsyth</td>
<td>46 16</td>
<td>106 38</td>
<td>4</td>
<td>Felt on ground floor. Caused dizziness. Loose objects moved or rattled.</td>
</tr>
<tr>
<td>Baker, Oreg</td>
<td>44 47</td>
<td>117 52</td>
<td>3</td>
<td>About 6:25 p.m. (=6:25, mountain time). Felt by several persons indoors only. Chains and saws in hardware store rattled. Time of &quot;regulator&quot; clock in jewelry store was slowed down 2 minutes.</td>
</tr>
<tr>
<td>Colfax, Wash.</td>
<td>46 54</td>
<td>117 24</td>
<td>3</td>
<td>Felt by several persons indoors only. Windows rattled. A bench and a bed moved perceptibly.</td>
</tr>
<tr>
<td>Medicine Hat, Alberta</td>
<td>50 00</td>
<td>110 40</td>
<td>2+</td>
<td>Felt by several persons indoors only. Hanging lamps swayed slightly. Persons sitting in chairs felt a swinging motion. Clock in Canadian Pacific Ry. station stopped at 6:23 p.m.</td>
</tr>
<tr>
<td>Cardston, Alberta</td>
<td>49 11</td>
<td>113 20</td>
<td>3</td>
<td>Felt by several persons, some of whom were outdoors. Shock composed of two tremors. Furniture moved &quot;nervously.&quot; Some persons became ill.</td>
</tr>
<tr>
<td>Maple Creek, Saskatchewan</td>
<td>49 55</td>
<td>109 27</td>
<td>2</td>
<td>Felt by several persons indoors only. Slight on ground floor. Fairly distinct on upper floors. Dishes rattled in an apartment on the fourth floor.</td>
</tr>
<tr>
<td>Swift Current, Saskatchewan</td>
<td>50 17</td>
<td>107 49</td>
<td>3</td>
<td>Felt by most persons indoors. Hanging lamps swung slightly.</td>
</tr>
<tr>
<td>Glacier Park</td>
<td>45 26</td>
<td>113 12</td>
<td>3+</td>
<td>Felt by a few persons indoors and on upper floors. A rocking sensation like that caused by ocean waves. Windows rattled.</td>
</tr>
<tr>
<td>Wibaux</td>
<td>46 59</td>
<td>114 11</td>
<td>2</td>
<td>Felt on fifth floor. Loose objects rattled.</td>
</tr>
<tr>
<td>Casper, Wyo</td>
<td>42 52</td>
<td>106 17</td>
<td>2+</td>
<td>Felt by a few persons indoors only. Loose objects rattled slightly.</td>
</tr>
<tr>
<td>Lewiston, Idaho</td>
<td>46 23</td>
<td>117 11</td>
<td>2</td>
<td>Felt by several persons indoors only.</td>
</tr>
<tr>
<td>St. Anthony, Idaho</td>
<td>42 58</td>
<td>111 43</td>
<td>3</td>
<td>Felt by a few persons indoors. Lamps swung and loose objects rattled.</td>
</tr>
<tr>
<td>Weiser, Idaho</td>
<td>45 11</td>
<td>116 58</td>
<td>3</td>
<td>Some brick veneering fell and some walls cracked.</td>
</tr>
<tr>
<td>Warm Springs</td>
<td>46 11</td>
<td>112 47</td>
<td>5+</td>
<td>Some merchandise shaken from store shelves. Some plaster cracked.</td>
</tr>
<tr>
<td>Hamilton</td>
<td>46 15</td>
<td>114 10</td>
<td>3+</td>
<td>People rushed out.</td>
</tr>
<tr>
<td>Kalsipell</td>
<td>48 12</td>
<td>114 17</td>
<td>5</td>
<td>Felt by several persons indoors. Shock lasted 10 seconds at 6:30 and 7:10 p.m.</td>
</tr>
<tr>
<td>Dillon</td>
<td>45 14</td>
<td>112 38</td>
<td>6+</td>
<td>Some plaster fell and some dishes broken. People alarmed and ran out.</td>
</tr>
<tr>
<td>Lima</td>
<td>44 38</td>
<td>112 36</td>
<td>5+</td>
<td>At 6:23 p.m. People ran out of doors.</td>
</tr>
<tr>
<td>Miles City</td>
<td>46 24</td>
<td>110 51</td>
<td>3+</td>
<td>At 6:26 p.m. Pictures and chandeliers swung. Some persons ran out of doors. A second shock at 7:07 p.m.</td>
</tr>
<tr>
<td>Boise, Idaho</td>
<td>43 37</td>
<td>116 12</td>
<td>2+</td>
<td>At 6:23 p.m. Slight alarm on upper floors of hotels.</td>
</tr>
<tr>
<td>Sheridan, Wyo</td>
<td>44 48</td>
<td>106 54</td>
<td>3+</td>
<td>Small shock. Felt in several widely scattered localities. Time, 6:23 p.m.</td>
</tr>
<tr>
<td>Thermopolis, Wyo</td>
<td>43 38</td>
<td>108 12</td>
<td>3</td>
<td>Light shock at 6:35 (6:25) p.m.</td>
</tr>
<tr>
<td>Southern Cross</td>
<td>46 12</td>
<td>113 15</td>
<td>5+</td>
<td>Water in a pool splashed up in the face of a man drinking. A large rock loosened and rolled down hill. Trees waved from side to side.</td>
</tr>
<tr>
<td>Sand Point, Idaho</td>
<td>48 17</td>
<td>116 32</td>
<td>3</td>
<td>Tremors felt lasting 2 or 3 minutes.</td>
</tr>
<tr>
<td>Bonners Ferry, Idaho</td>
<td>48 42</td>
<td>116 20</td>
<td>3</td>
<td>Do.</td>
</tr>
<tr>
<td>St. Maries, Idaho</td>
<td>47 19</td>
<td>116 33</td>
<td>3</td>
<td>Do.</td>
</tr>
<tr>
<td>Carmangay, Alberta</td>
<td>50 5</td>
<td>113 6</td>
<td>3</td>
<td>Do.</td>
</tr>
<tr>
<td>Taber, Alberta</td>
<td>49 39</td>
<td>112 8</td>
<td>3</td>
<td>Shock lasted 15 to 30 seconds. Rocking motion felt upstairs in a 1½-story house.</td>
</tr>
<tr>
<td>Calgary, Alberta</td>
<td>51 4</td>
<td>114 5</td>
<td>3</td>
<td>Shock lasted 3 or 4 seconds. Lights suddenly swayed. A counter in a store swayed forward and back. A house swayed gently.</td>
</tr>
<tr>
<td>Moose Jaw, Saskatchewan</td>
<td>50 24</td>
<td>105 32</td>
<td>2</td>
<td>Felt by persons in high buildings only. Clocks stopped at 6:28 p.m.</td>
</tr>
<tr>
<td>East End, Saskatchewan</td>
<td>49 35</td>
<td>108 50</td>
<td>2+</td>
<td>Felt by several persons. Dishes danced on a table on the fourth floor. Elevator, which had stopped at the same floor, was made by the shock to move up 2 feet. Four distinct shocks reported.</td>
</tr>
<tr>
<td>Assinibola, Saskatchewan</td>
<td>49 41</td>
<td>106 0</td>
<td>3</td>
<td>Distinct. Shock lasted 8 seconds.</td>
</tr>
</tbody>
</table>
THE MONTANA EARTHQUAKE OF JUNE 27, 1925

NEGATIVE REPORTS RECEIVED FROM THE FOLLOWING PLACES:

<table>
<thead>
<tr>
<th>Place</th>
<th>Latitude</th>
<th>Longitude</th>
</tr>
</thead>
<tbody>
<tr>
<td>Regina, Saskatchewan</td>
<td>50 27</td>
<td>104 35</td>
</tr>
<tr>
<td>High River, Alberta</td>
<td>50 35</td>
<td>113 52</td>
</tr>
<tr>
<td>Rosslund, B. C.</td>
<td>49 4</td>
<td>117 37</td>
</tr>
<tr>
<td>Cranbrook, B. C.</td>
<td>49 30</td>
<td>115 46</td>
</tr>
<tr>
<td>Culbertson, Mont.</td>
<td>48 9</td>
<td>104 31</td>
</tr>
<tr>
<td>Plentywood, Mont.</td>
<td>48 46</td>
<td>104 35</td>
</tr>
<tr>
<td>Baker, Mont.</td>
<td>46 26</td>
<td>104 15</td>
</tr>
<tr>
<td>Elkala, Mont.</td>
<td>45 53</td>
<td>104 39</td>
</tr>
<tr>
<td>Sundance, Wyo.</td>
<td>44 24</td>
<td>104 20</td>
</tr>
<tr>
<td>Newcastle, Wyo.</td>
<td>43 52</td>
<td>104 10</td>
</tr>
<tr>
<td>Lander, Wyo.</td>
<td>42 50</td>
<td>108 43</td>
</tr>
<tr>
<td>Evanston, Wyo.</td>
<td>41 15</td>
<td>110 57</td>
</tr>
<tr>
<td>Kemmerer, Wyo.</td>
<td>41 48</td>
<td>110 32</td>
</tr>
<tr>
<td>Green River, Wyo.</td>
<td>41 32</td>
<td>100 28</td>
</tr>
<tr>
<td>Paris, Idaho</td>
<td>42 15</td>
<td>111 24</td>
</tr>
<tr>
<td>Montpelier, Idaho</td>
<td>42 18</td>
<td>111 18</td>
</tr>
<tr>
<td>Preston, Idaho</td>
<td>42 6</td>
<td>111 39</td>
</tr>
<tr>
<td>Twin Falls, Idaho</td>
<td>42 34</td>
<td>114 49</td>
</tr>
<tr>
<td>Gooding, Idaho</td>
<td>42 56</td>
<td>114 43</td>
</tr>
<tr>
<td>Rupert, Idaho</td>
<td>42 37</td>
<td>113 41</td>
</tr>
<tr>
<td>Idaho Falls, Idaho</td>
<td>42 29</td>
<td>112 14</td>
</tr>
<tr>
<td>American Falls, Idaho</td>
<td>42 47</td>
<td>112 53</td>
</tr>
<tr>
<td>Shoshone, Idaho</td>
<td>42 56</td>
<td>114 24</td>
</tr>
<tr>
<td>Blackfoot, Idaho</td>
<td>43 11</td>
<td>112 21</td>
</tr>
<tr>
<td>Postelto, Idaho</td>
<td>42 55</td>
<td>114 30</td>
</tr>
<tr>
<td>Hailey, Idaho</td>
<td>43 30</td>
<td>114 18</td>
</tr>
<tr>
<td>Silver City, Idaho</td>
<td>43 0</td>
<td>110 42</td>
</tr>
<tr>
<td>Council, Idaho</td>
<td>44 44</td>
<td>119 25</td>
</tr>
<tr>
<td>Logan, Utah</td>
<td>41 45</td>
<td>111 50</td>
</tr>
<tr>
<td>Brigham, Utah</td>
<td>41 30</td>
<td>112 1</td>
</tr>
<tr>
<td>La Grande, Ore.</td>
<td>45 20</td>
<td>118 5</td>
</tr>
<tr>
<td>Enterprise City, Ore.</td>
<td>45 25</td>
<td>117 18</td>
</tr>
<tr>
<td>Pomeroy, Wash</td>
<td>46 28</td>
<td>117 42</td>
</tr>
<tr>
<td>Walla Walla, Wash</td>
<td>46 4</td>
<td>113 22</td>
</tr>
<tr>
<td>Dayton, Wash</td>
<td>46 17</td>
<td>112 53</td>
</tr>
<tr>
<td>Rawlins, Wyo.</td>
<td>41 47</td>
<td>107 14</td>
</tr>
</tbody>
</table>

DIRECTION OF THE MOTION

Positive evidence as to the direction in which the vibrations traveled is given by the operator of the Chicago, Milwaukee & St. Paul Railway at Jefferson Island. He was working on the train dispatcher’s telephone at the time and heard the operator at Three Forks say they were having an earthquake. In a few seconds he felt it himself, and still later he heard it reported by the operator at Butte. In a straight line Three Forks is 20 miles east of Jefferson Island and Butte 30 miles to the west. Near Toston during the earthquake an observer in an automobile traveling on a road leading southeastward, or toward the epicenter, noticed nothing unusual in the behavior of his car. Another traveling in a northeasterly direction had difficulty in keeping his car on the road, presumably because he was traveling crosswise to the direction of motion. Many of the observers reported the direction that the earthquake waves seemed to travel, and most of these directions, whether leading toward or away from the epicenter, when plotted on the map, coincide nearly with radii.

NATURE OF THE MOTION

Observers near the epicenter describe the earthquake motion as a violent bumping and rocking. Elsewhere practically all describe it as a rocking motion, which a few qualify with the terms bumping, jerking, or twisting. Visible ground waves, much like the swell in the wake of a steamboat, were reported by many persons. Similar waves were indicated by the behavior of buildings, fences, telegraph poles, etc., which were observed to lean to one side and then to the other, describing arcs of as much as 30°. Standing automobiles, including a heavy tractor, were seen to dance a comical sort of jig, rising first on one side then on the other. At Three Forks a frame house appeared to buckle up along the comb of the roof, like a cat humping its back at sight of a dog, and then straighten out again without being seriously damaged. At Willow Creek an observer was able to see clear under a house momentarily as one end lifted clear of the foundation and settled back to place.

At Radersburg, Logan, and other places some chimneys were broken at the roof line and twisted clockwise one-eighth to one-quarter of a revolution (pl. 13, B).

SOUNDS

Sounds of low pitch were heard by 80 per cent of the observers who were within 25 miles of the epicenter, and by 65 per cent of those within 80 miles. Beyond that distance only 30 per cent of the observers report sounds, but information from this outlying belt is too scanty to fix the limit of the sound area. The great majority of the observers describe the sounds as a low rumbling, and several add that it was like a train or a heavy truck passing by or crossing a bridge, or like thunder. A few describe the sound as a roaring, a rushing or swirling like the wind, or like a storm or a low growl.

AREA

The area throughout which the shock was sensible to persons, which is the area bounded by isoseismal 2 (see pl. 3) is about 310,000 square miles. The disturbed area is therefore of about the same order of magnitude as that of tectonic earthquakes of the first rank. The intensity of the Montana disturbance was apparently somewhat less than that of the California earthquake of 1906, and the damage, owing, as already explained, to the lack of populous cities near the epicenter, was comparatively insignificant.

TIME AND DURATION

The time at which the main shock occurred is reported variously from 6.15 to 6.35 p. m., but 70 per cent of the observers set the time between 6.20 and
6.25 p. m. Of those who were within a radius of 50 or 60 miles from the epicenter 60 per cent reported the time as either 6.20 or 6.21 p. m., the weight of evidence, all things considered, being much in favor of 6.21. Clocks stopped at that time in a drug store at Three Forks and in the office of the United States Weather Bureau at Helena. Outside the area described, 12 observers out of a total of 24 place the time at 6.23 and 4 at 6.25; the remainder are scattering.

Estimates of duration reported by 66 persons range from 5 seconds to 3 minutes, but about three-fourths of the estimates lie between 15 seconds and 1 minute, and their average is about 30 seconds. No one reported having timed the shock with a watch or other instrument, but within the area of startling shock the duration was at least 15 or 20 seconds, for in less time the observers could hardly have traversed the distances or performed the tasks that they claimed to have done while the shaking was in progress. Apparently in outlying areas where the intensity was moderate or feeble the sensible vibrations continued for 30 seconds or more.

**SPEED OF TRANSLATION**

Clocks in Canadian Pacific Railway stations at Lethbridge and Medicine Hat, Alberta, and East End, Saskatchewan, stopped at 6.23 p. m. A Western Union clock at Glasgow, Mont., was reported stopped also at that time. The distance of these places from the epicenter ranges from 264 miles for Lethbridge to 276 miles for Medicine Hat. If the times as given for these places and for the epicenter are accepted as correct, then the vibrations were propagated outward an average distance of 270 miles in two minutes, or at the rate of 2½ miles a second. Owing to the fact, however, that the time observations were made to the nearest minute only, there remains the possibility of an error as great as one minute, plus or minus. Therefore, the total time of translation for the distance mentioned may be as short as one minute or as long as three minutes, and the speed at which the vibrations traveled lies between 4½ and 1½ miles a second.

**ISOSEISMALS**

**DATA AVAILABLE**

Compared to the size of the disturbed area, the number of observations available is rather small, and therefore the isoseismal lines as drawn (pl. 3) doubtless appear more precise and definite than they should. Where their position is believed to be determined within rather narrow limits they have been drawn as full lines; where the evidence for placing them is less definite, they are represented by dashes.

Isoseismal 9 is perhaps determined with more certainty than any of the others. It incloses Three Forks, Manhattan, Logan, Toston, and other places where the earthquake effects were most conspicuous and abundant. The central part of this area is thinly inhabited and almost devoid of structures that would be easily damaged by earthquake shocks. If the effects on similar things are compared, however, the intensity seems to have been considerably higher in this central area than at Three Forks and the other places mentioned. Accordingly, an isoseismal provisionally labeled 10 has been drawn inclosing an area of about 80 square miles in Clarkston Valley and the adjoining hills on the east and north. Lombard, the largest settlement within this isoseismal, contains two railroad stations of one-story frame construction with brick chimneys and eight or ten small frame houses, some of which are merely converted box cars. Clarkston consists of a station, a grain elevator, and two or three small houses. Cardinal and Deer Park each have two or three small buildings. The remainder of the area contains only a few small houses of frame or log construction. None of these buildings was very seriously damaged, though they plainly show the effects of severe shaking. All chimneys were overthrown and plaster was broken in the few houses that possessed such features. Commonly door, window, or house frames were sprung or distorted. Some log cabins and barns were noticeably sprung out of shape or made to lean to one side. Some doors were jerked off their hinges. Furniture, including stoves and ranges, and other loose articles were overturned or thrown about, and in most houses practically every dish or other breakable article was demolished. The racking a small but substantial unplastered frame house at Cardinal suffered is shown by torn wall paper and lining. The intensity of the shock at Roy Gulch is indicated by the cracking and shattering of moderately firm ground and the overturning of clogs (pl. 12, B). At Garden Gulch an observer saw the clogs in a plowed field shuffled about like checkers being shaken on a board. Rock falls in this area have been described (pp. 9–10).

At Three Forks and other places outside the area being considered the overthrowing of furniture and the breaking of dishes were less general or complete and the springing or racking of door and house frames was rather exceptional. The crack that appeared in the road north of Three Forks opened in an artificial embankment not to be compared in resistance to the firm ground which was shattered at Roy Gulch. At Trident there are cliffs essentially similar to those at Lombard, but much less material was shaken down from them.

So far as the evidence goes, therefore, the shock appears to have been much stronger in this central
area than elsewhere. After comparing effects in the field it is difficult to escape the conclusion that had a town such as Three Forks, for example, been situated here every brick building in it would have leveled.

**POSITION OF THE EPICENTER**

The longer axis of the innermost isoseismal trends about N. 10° E. and lies a little east of Cardinal, crossing the lower parts of Roy and Garden Gulches. Its position is not far from a line dividing T. 4 N., R. 3 E., into east and west halves. The longer axis of the next isoseismal (No. 9) is parallel to that of the smaller curve, but it lies about a mile farther west. As nearly as can be determined, therefore, the epicenter lies either on one of these axes or between them and within a belt extending south 3 or 4 miles from Cardinal.

**FORM OF THE ISOSEISMS**

As drawn isoseismal curves 7, 8, and 9 show a tendency to expand toward the west; possibly this is an erroneous interpretation, due to the lack of sufficient data or to undue weight having been given to the evidence from the more populous areas. Such a result has been guarded against as far as possible, however, and the expansion is believed to be real. It may possibly be due to the westward hase of the fault on which the earthquake is supposed to have originated, (see p. 22).

The three outer isoseismals show a striking irregularity at the south, where they are crowded inward so as to exclude a wide reentrant from the area of sensible shock. St. Anthony, Idaho, near the peak of this reentrant, is only 150 miles south of the epicenter, whereas in other directions the shock persisted for distances of 300 to 400 miles. This abrupt and abnormal decline of intensity begins at the edge of the Snake River Plain, a great valley floored with lava. Presumably the lava overlies a considerable thickness of unconsolidated sediments, and these in turn rest upon the upturned and eroded edges of older and harder rocks like those of the surrounding mountains. At the northeast the lava of the Snake River Plain merges with the lavas of Yellowstone Park, which consist of a great thickness of flows, tuffs, and breccias. The whole forms a heterogeneous mass that coincides suggestively with the zone in which the southward progress of the vibrations was arrested. At the west a similar indentation is indicated where the disturbed area touches the Columbia Plateau, but only isoseismals 2 and 3 are affected. Here the vibrations persisted somewhat beyond the edge of the lava, but there was a sudden and marked decline of intensity as soon as the main lava area was reached.

Columbia Plateau is made up of many lava flows, between some of which are beds of gravel or silt, the whole forming a mass of similar physical character to the rocks of the Snake River Plain and Yellowstone Park. It would seem, therefore, that these rather loosely aggregated masses were able to break up and check the rather feeble vibrations that reached them. This explanation, however, becomes less certain when the fact is considered that toward the northeast the vibrations extended farther than anywhere else, though the region they traversed is underlain by rocks (Cretaceous sediments) that are not especially dense or homogeneous.

Both the Snake River Plain and the Columbia Plateau may be regarded as great structural depressions, and it is possible, therefore, that the vibrations were cut off or deflected by bordering fault zones, but there are many similar though smaller structural features within the disturbed area that do not seem to have hindered the tremors at all.

**FORESHOCKS**

Although 80 per cent of the observers report the onset of the main shock as rapid or abrupt, without any warning, the remainder felt a preliminary quiver which, according to several persons, was separated from the main shock by a brief pause. Reports of this preliminary tremor which may possibly be classed as a foreshock, were obtained at places well distributed through an area measured by a radius of 125 miles from the epicenter. Doubtless the failure of most observers to notice it was due to lack of experience. Many of the shocks that were rather generally observed after June 27 were probably of no greater intensity.

An interesting foreshock occurred May 31, reports of which were obtained from five observers. At Lombard this shock, as timed by J. P. Swarts and W. P. Luburg, Northern Pacific Railway operators, occurred at 7.55 a. m. Loose articles in a small frame house (a converted box car) moved or rattled, and a doorframe was sprung slightly. At the same time another observer, Arthur Jersey, who was walking in the hills 3 miles northwest of Sixteen, felt a shock in which the ground seemed to rise suddenly and then settle back and quiver a little. At Menard the same shock, as reported by Mrs. A. R. Hill, made things rattle, and according to W. T. Lathrop, two light shocks were felt in the office of the United States Weather Bureau (sixth floor) at Helena, and in a residence at Kenmore. Lombard is a short distance northwest, Menard 12 miles southeast, Sixteen 20 miles northeast, and Helena about 50 miles northwest of the epicenter of the earthquake of June 27. Apparently the shock of May 31 emanated from the same center.

**AFTERSHOCKS**

A great many aftershocks were felt at Three Forks, Manhattan, and other places near the epicenter, and several of them were perceptible also at more distant
points. The ground is said to have been in an almost continuous tremble during the night of June 27 at Lombard, Deer Park, and similarly situated places. At Trident sensible shocks are estimated to have averaged four a day for the first month and two a day for the second month after the earthquake. Between June 27 and July 6 a record was kept by A. D. Burkett of 52 shocks that were strong enough to be felt by nearly everyone. The total number of aftershocks recorded prior to August 14 is about 75.

The strongest aftershock and the first one to be generally observed occurred at 7.10 p.m., or about three-quarters of an hour after the main shock. It was more or less distinct over a large area, most of the observers in which describe it as being nearly, if not quite, as strong as the main shock but of somewhat shorter duration. It caused additional rock falls, threw down some more chimneys, and caused many brick walls that had been loosened by the first shock to topple over. It came on very abruptly, accompanied by a deep rumble or roar, and caused renewed and increased alarm among the inhabitants.

This shock was felt at Miles City, 270 miles east, at Macleod, Alberta, 270 miles north, and at Kalispell, 200 miles northwest of the epicenter. On the south the most distant point reporting it is Hutchens, on Madison River, 75 miles from the epicenter. There the intensity was between 3 and 4. The shock is thus indicated to have been sensible throughout an area of nearly 200,000 square miles. The available records are tabulated below:

**Summary of reports of aftershock of the Montana earthquake of June 27, 1905, occurring at 7.10 p.m. mountain time**

<table>
<thead>
<tr>
<th>Place *</th>
<th>Latitude N.</th>
<th>Longitude W.</th>
<th>Intensity</th>
</tr>
</thead>
<tbody>
<tr>
<td>Townsend</td>
<td>46° 20'</td>
<td>111° 32'</td>
<td>8</td>
</tr>
<tr>
<td>Deer Park</td>
<td>46° 8'</td>
<td>111° 9'</td>
<td>9+</td>
</tr>
<tr>
<td>Dave Johnson’s, 3 miles north of Cardinal</td>
<td>46° 9'</td>
<td>111° 21'</td>
<td>9</td>
</tr>
<tr>
<td>Stockburger’s, 234 miles northeast of Cardinal</td>
<td>46° 8'</td>
<td>111° 20'</td>
<td>9+</td>
</tr>
<tr>
<td>Butte</td>
<td>46° 0'</td>
<td>112° 33'</td>
<td>9+</td>
</tr>
<tr>
<td>Logan</td>
<td>45° 53'</td>
<td>111° 26'</td>
<td>9+</td>
</tr>
<tr>
<td>Manhattan</td>
<td>45° 52'</td>
<td>111° 20'</td>
<td>9+</td>
</tr>
<tr>
<td>Three Forks</td>
<td>45° 53'</td>
<td>111° 53'</td>
<td>9+</td>
</tr>
<tr>
<td>Trident</td>
<td>45° 57'</td>
<td>111° 29'</td>
<td>9+</td>
</tr>
<tr>
<td>Roy Stillman’s, 7 miles southeast of Townsend</td>
<td>46° 4'</td>
<td>111° 17'</td>
<td>8+</td>
</tr>
<tr>
<td>Jacob’s, 7 miles southeast of Townsend</td>
<td>46° 15'</td>
<td>111° 22'</td>
<td>8+</td>
</tr>
<tr>
<td>Clarkston</td>
<td>46° 2'</td>
<td>111° 24'</td>
<td>8+</td>
</tr>
<tr>
<td>Perugin’s, 9 miles southeast of Townsend</td>
<td>46° 15'</td>
<td>111° 22'</td>
<td>8+</td>
</tr>
<tr>
<td>Belgrade</td>
<td>45° 2'</td>
<td>111° 11'</td>
<td>8+</td>
</tr>
<tr>
<td>Willow Creek</td>
<td>45° 50'</td>
<td>111° 39'</td>
<td>8+</td>
</tr>
<tr>
<td>Walsburg’s, 9 miles north-northwest of Three Forks</td>
<td>46° 2'</td>
<td>111° 38'</td>
<td>7+</td>
</tr>
<tr>
<td>Radersburg</td>
<td>46° 13'</td>
<td>111° 39'</td>
<td>7+</td>
</tr>
<tr>
<td>Menard</td>
<td>45° 48'</td>
<td>111° 12'</td>
<td>7+</td>
</tr>
<tr>
<td>Maudlow</td>
<td>46° 8'</td>
<td>111° 10'</td>
<td>7+</td>
</tr>
<tr>
<td>3 miles south of Manhattan</td>
<td>45° 50'</td>
<td>111° 20'</td>
<td>7+</td>
</tr>
<tr>
<td>Mockel’s, 7 miles south-southwest of Radersburg</td>
<td>46° 8'</td>
<td>111° 36'</td>
<td>7+</td>
</tr>
<tr>
<td>Helena</td>
<td>46° 36'</td>
<td>112° 0'</td>
<td>7</td>
</tr>
<tr>
<td>Whitehall</td>
<td>45° 48'</td>
<td>111° 6'</td>
<td>5+</td>
</tr>
<tr>
<td>Jefferson Island</td>
<td>45° 47'</td>
<td>111° 57'</td>
<td>6+</td>
</tr>
<tr>
<td>Bozeman</td>
<td>45° 41'</td>
<td>111° 3'</td>
<td>6+</td>
</tr>
<tr>
<td>White Sulphur Springs</td>
<td>46° 33'</td>
<td>110° 54'</td>
<td>6+</td>
</tr>
<tr>
<td>Fort Logan</td>
<td>46° 42'</td>
<td>111° 11'</td>
<td>6+</td>
</tr>
<tr>
<td>House’s, 10 miles northeast of Bozeman</td>
<td>45° 50'</td>
<td>110° 53'</td>
<td>6+</td>
</tr>
<tr>
<td>Clyde Park</td>
<td>45° 53'</td>
<td>110° 37'</td>
<td>7+</td>
</tr>
<tr>
<td>Norris</td>
<td>45° 34'</td>
<td>111° 42'</td>
<td>7+</td>
</tr>
<tr>
<td>Harrison</td>
<td>45° 42'</td>
<td>111° 48'</td>
<td>7+</td>
</tr>
</tbody>
</table>

* In Montana except as otherwise indicated.

Remarks:
- Clock stopped 7.10 p.m. Duration 30 seconds. Almost as strong as first shock.
- Short but so violent persons could not stand alone.
- Shorter than first shock.
- Seemed longer than first shock.
- Duration 40 seconds.
- Seemed harder than first shock. Bricks fell at schoolhouse.
- Abrupt and harder than first shock but shorter. Some persons standing were thrown down. Most of the brick fell from church at this time.
- Seemed stronger than first shock.
- Abrupt but shorter than first shock.
- Seemed stronger than first shock.
- Do.
- Seemed longer than first shock. In two phases.
- At 7.15 p.m. Many bricks came down. One observer says it was more violent than first shock; another observer who was in a moving automobile on a slippery road did not feel the shock.
- Shorter than first shock, but trees swayed as if they would snap off. House raised clear off foundation on one side and came back to place.
- Do.
- Shorter than first shock. Did not shake as many goods from shelves as first shock, but more bricks came down.
- This shock turned upper part of brick chimney one-eighth revolution clockwise and threw dishes from shelves.
- Strong vibration of several seconds at 7.07 p.m., but shorter and weaker than first shock.
- Do.
- Automobile moved forward and back. Flagpole swayed east and west.
- Weaker than first shock.
- Buildings swayed.
- Seemed harder than first shock.
- Seemed harder than first shock but shorter. Kitchen cabinet flew open and dishes spilled. Seemed harder than first shock to one observer.
### Summary of aftershocks of the Montana earthquake of June 27, 1925, occurring at 7:10 p. m. mountain time—Continued

<table>
<thead>
<tr>
<th>Place</th>
<th>Latitude N.</th>
<th>Longitude W.</th>
<th>Intensity</th>
<th>Remarks</th>
</tr>
</thead>
<tbody>
<tr>
<td>Twin Bridges</td>
<td>45 33</td>
<td>112 20</td>
<td>5±</td>
<td>Seemed lighter than first shock. Fence swayed strongly. 40 seconds.</td>
</tr>
<tr>
<td>Butte</td>
<td>46 0</td>
<td>112 33</td>
<td>5±</td>
<td>Some movement of dishes, but none fell.</td>
</tr>
<tr>
<td>Drummond</td>
<td>46 40</td>
<td>113 8</td>
<td>4±</td>
<td>Scarcely felt by persons out of doors.</td>
</tr>
<tr>
<td>Great Falls</td>
<td>47 30</td>
<td>111 17</td>
<td>4±</td>
<td>Part of a dry stone wall fell.</td>
</tr>
<tr>
<td>Netburt</td>
<td>46 56</td>
<td>110 13</td>
<td>3±</td>
<td>About like first shock.</td>
</tr>
<tr>
<td>Belt</td>
<td>47 22</td>
<td>111 56</td>
<td>4±</td>
<td>Fence swayed back and forth. Seemed harder than first shock to one observer. 3-4</td>
</tr>
<tr>
<td>Anaconda</td>
<td>46 7</td>
<td>112 51</td>
<td>5±</td>
<td>Felt distinctly.</td>
</tr>
<tr>
<td>Philipsburg</td>
<td>46 20</td>
<td>114 18</td>
<td>5±</td>
<td>Weaker and shorter than first shock.</td>
</tr>
<tr>
<td>Hutchens's, on Madison River</td>
<td>44 51</td>
<td>111 37</td>
<td>3±</td>
<td>At 7:07 p. m. Lamps swung.</td>
</tr>
<tr>
<td>Superior</td>
<td>47 12</td>
<td>114 39</td>
<td>2±</td>
<td>About 7 p. m.</td>
</tr>
<tr>
<td>Macleod, Alberta</td>
<td>49 44</td>
<td>113 23</td>
<td>2±</td>
<td>At 7:06 p. m.</td>
</tr>
<tr>
<td>Miles City</td>
<td>46 24</td>
<td>105 51</td>
<td>2±</td>
<td>At 7:06 p. m.; 20 seconds.</td>
</tr>
<tr>
<td>Kalispell</td>
<td>48 12</td>
<td>114 17</td>
<td>2±</td>
<td>At 7:07 p. m.; 20 seconds.</td>
</tr>
<tr>
<td>Missoula</td>
<td>46 53</td>
<td>114 0</td>
<td>2±</td>
<td>At 7:05 p. m.</td>
</tr>
<tr>
<td>Hardin</td>
<td>45 49</td>
<td>107 37</td>
<td>2±</td>
<td>At 7:00 p. m.</td>
</tr>
<tr>
<td>Billings</td>
<td>45 47</td>
<td>108 30</td>
<td>3±</td>
<td>At 7:10 p. m.</td>
</tr>
<tr>
<td>Lethbridge, Alberta</td>
<td>49 43</td>
<td>112 52</td>
<td>3±</td>
<td>Stronger than first shock.</td>
</tr>
<tr>
<td>Pine Grove</td>
<td>46 49</td>
<td>109 4</td>
<td>3±</td>
<td>At 7:10 p. m.</td>
</tr>
<tr>
<td>Big Timber</td>
<td>45 50</td>
<td>109 53</td>
<td>3±</td>
<td>Duration, 10 seconds.</td>
</tr>
<tr>
<td>Butte d.</td>
<td>48 53</td>
<td>109 22</td>
<td>3±</td>
<td>At 7:13 p. m.</td>
</tr>
<tr>
<td>Flood</td>
<td>46 37</td>
<td>110 22</td>
<td>3±</td>
<td>At 7:05 p. m.</td>
</tr>
<tr>
<td>Hebgen Dam</td>
<td>44 51</td>
<td>111 20</td>
<td>3±</td>
<td>At 7:10 p. m.</td>
</tr>
<tr>
<td>Hobson</td>
<td>47 0</td>
<td>109 50</td>
<td>3±</td>
<td>At 7:10 p. m.</td>
</tr>
<tr>
<td>Flatwillow</td>
<td>48 50</td>
<td>108 24</td>
<td>3±</td>
<td>At 7:00 p. m.</td>
</tr>
<tr>
<td>Ovando</td>
<td>47 2</td>
<td>113 7</td>
<td>3±</td>
<td>At 7:05 p. m.</td>
</tr>
<tr>
<td>Stevensville</td>
<td>46 31</td>
<td>114 7</td>
<td>3±</td>
<td>At 7:05 p. m.</td>
</tr>
</tbody>
</table>

As nearly as can be determined the epicenter of the shock at 7:10 p. m. is a short distance south of the epicenter of the main shock.

### Additional aftershocks up to August 13 recorded as follows, including the 52 shocks reported by A. D. Burkett at Trident:

#### Aftershocks from June 27 to August 13

<table>
<thead>
<tr>
<th>Time</th>
<th>Places reporting</th>
<th>Indicated size of area disturbed (square miles)</th>
</tr>
</thead>
<tbody>
<tr>
<td>June 27, 8.35 p. m</td>
<td>Stevensville, Helena, Anaconda, Billings (8.37), Big Timber (8.40)</td>
<td>50,000</td>
</tr>
<tr>
<td>June 27, between 9.20 and 9.41 p. m.</td>
<td>Conway, Philipsburg, Helena, Anaconda (violent)</td>
<td>17,000</td>
</tr>
<tr>
<td>June 27, between 10.25 and 10.30 p. m.</td>
<td>Anaconda, Helena, Philipsburg, Trident (heavy)</td>
<td>17,000</td>
</tr>
<tr>
<td>June 27, between 10.30 and 10.40 p. m.</td>
<td>Livingston (set light bulbs swaying), Trident (heavy), Helena</td>
<td>7,500</td>
</tr>
<tr>
<td>June 28, between 1.55 and 2.00 a. m.</td>
<td>Trident (heavy), Philipsburg</td>
<td></td>
</tr>
<tr>
<td>June 28, 2.20 a. m.</td>
<td>Trident (heavy)</td>
<td></td>
</tr>
<tr>
<td>June 28, 3.09 a. m.</td>
<td>Phillipsburg</td>
<td></td>
</tr>
<tr>
<td>June 28, between 3.30 and 3.35 a. m.</td>
<td>Conway, Hebgen dam</td>
<td></td>
</tr>
<tr>
<td>June 28, 5.14 a. m.</td>
<td>Trident (heavy)</td>
<td></td>
</tr>
<tr>
<td>June 28, 6.05 a. m.</td>
<td>Helena (distinct, 2 or 3 seconds)</td>
<td></td>
</tr>
<tr>
<td>June 28, 8.39 a. m.</td>
<td>Trident (moderate)</td>
<td></td>
</tr>
<tr>
<td>June 28, 11.00 a. m.</td>
<td>Trident</td>
<td></td>
</tr>
<tr>
<td>June 28, between 3.30 and 3.35 p. m.</td>
<td>Helena (light), Manhattan (heavy), Trident, Bozeman, Livingston</td>
<td>7,500</td>
</tr>
<tr>
<td>June 28, 10.30 p. m.</td>
<td>Helena</td>
<td></td>
</tr>
<tr>
<td>June 28, 10.53 p. m.</td>
<td>Trident</td>
<td></td>
</tr>
<tr>
<td>June 28, 12.30 a. m.</td>
<td>Trident (very noticeable in quarry; rock falls)</td>
<td></td>
</tr>
<tr>
<td>June 29, 2.02 a. m.</td>
<td>Trident (shock town from one end to the other), Helena (sharp; 7 seconds),</td>
<td></td>
</tr>
<tr>
<td>June 29, between 2.25 and 2.30 a. m.</td>
<td>Great Falls (several seconds; dishes and pictures moved), Billings, Philipsburg</td>
<td></td>
</tr>
<tr>
<td>June 29, 4.10 a. m.</td>
<td>Trident (small)</td>
<td></td>
</tr>
<tr>
<td>June 29, 4.30 a. m.</td>
<td>Helena</td>
<td></td>
</tr>
<tr>
<td>June 29, 8.00 a. m.</td>
<td>Lombard</td>
<td></td>
</tr>
<tr>
<td>June 29, 10.00 a. m.</td>
<td>Lombard</td>
<td></td>
</tr>
<tr>
<td>June 29, 10.49 a. m.</td>
<td>Trident (moderate)</td>
<td></td>
</tr>
<tr>
<td>June 29, 5.39 p. m.</td>
<td>Trident (heavy)</td>
<td></td>
</tr>
<tr>
<td>June 29, 10.16 p. m.</td>
<td>Trident</td>
<td></td>
</tr>
<tr>
<td>June 29, 10.30 p. m.</td>
<td>Bozeman</td>
<td></td>
</tr>
<tr>
<td>June 29, between 11.30 and 11.35 p. m.</td>
<td>Helena, Livingston, Philipsburg, Trident (very noticeable in kiln room), Bozeman</td>
<td>30,000</td>
</tr>
<tr>
<td>Time</td>
<td>Places reporting</td>
<td>Indicated size of area disturbed (square miles)</td>
</tr>
<tr>
<td>--------------</td>
<td>------------------------------------------------------</td>
<td>-----------------------------------------------</td>
</tr>
<tr>
<td>June 30, 2.44 a. m.</td>
<td>Trident (one shock)</td>
<td></td>
</tr>
<tr>
<td>June 30, 2.48 a. m.</td>
<td>Trident (light)</td>
<td></td>
</tr>
<tr>
<td>June 30, 3.45 p. m.</td>
<td>Trident (light, but nearly steady for 15 minutes)</td>
<td></td>
</tr>
<tr>
<td>July 1, 7.26 a. m.</td>
<td>Trident (light, but nearly steady for 15 minutes)</td>
<td></td>
</tr>
<tr>
<td>July 1, 7.45 a. m.</td>
<td>Trident (long and steady, but not very severe)</td>
<td></td>
</tr>
<tr>
<td>July 2, 2.50 a. m.</td>
<td>Trident (long and steady, but not very severe)</td>
<td></td>
</tr>
<tr>
<td>July 2, 3.15 a. m.</td>
<td>Trident (long and steady, but not very severe)</td>
<td></td>
</tr>
<tr>
<td>July 2, 3.35 a. m.</td>
<td>Trident (long and steady, but not very severe)</td>
<td></td>
</tr>
<tr>
<td>July 2, 8.15 a. m.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>July 2, 8.24 p. m.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>July 3, 1.25 a. m.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>July 3, 2.30 a. m.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>July 3, 8.27 a. m.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>July 3, 10.00 p. m.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>July 3, 10.15 a. m.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>July 4, 2.25 a. m.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>July 4, 4.00 a. m.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>July 4, 9.04 p. m.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>July 4, 10.20 p. m.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>July 4, 10.30 p. m.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>July 5, 2.10 a. m.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>July 5, 2.17 a. m.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>July 6, 2.21 a. m.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>July 6, 2.40 a. m.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>July 8, 4.47 a. m.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>July 6, 6.10 a. m.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>July 9, 7.26 p. m.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>July 7, 1.55 a. m.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>July 6, 8.10 a. m.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>July 6, 9.10 a. m.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>July 9, 11.40 a. m.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>July 9, 12.00 a. m.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>July 9, 6.00 a. m.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>July 10, between 7.42 and 7.48 a. m.</td>
<td>Anaconda (30 seconds; in two parts with a pause between), Deer Lodge, Bozeman, Missoula (intensity 2–3), Great Falls (3 seconds; intensity 3–4), Billings (intensity 2), Three Forks (loose bricks fell; intensity 6), Manhattan (intensity 6), Trident (stiff shock; 30 seconds), Helena (10 seconds), Cardinal (intensity 6–7), Logan, Livingston, Willow Creek, Butte. Helena (very noticeable in transformer building). Missoula, Great Falls (slight).</td>
<td>50,000</td>
</tr>
<tr>
<td>July 10, 2.00 p. m.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>July 10, between 10.05 and 10.07 a. m.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>July 22, 4.53 p. m.</td>
<td>Lombard (light)</td>
<td></td>
</tr>
<tr>
<td>July 24, 2.55 p. m.</td>
<td>Lombard (light)</td>
<td></td>
</tr>
<tr>
<td>Aug. 12, 8.10 p. m.</td>
<td>Lombard (strong; 5 seconds; ground waves)</td>
<td></td>
</tr>
<tr>
<td>Aug. 13, 1.30 a. m.</td>
<td>Lombard (strong)</td>
<td></td>
</tr>
<tr>
<td>Aug. 13, 3.30 a. m.</td>
<td>Lombard (strong)</td>
<td></td>
</tr>
<tr>
<td>Aug. 29, 8.00 a. m.</td>
<td>Lombard (upset bottles, etc.; rocks fell; three light shocks the following night)</td>
<td>1,000</td>
</tr>
<tr>
<td>Aug. 29, 10.00 a. m.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Sept. 3, 2.00 a. m.</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Shocks reported from Helena by the Associated Press occurred September 19 at 3.45 a.m. (sharp, short), September 30 at 2.30 a.m. (caused snow slides from roofs), and early in the day of October 6 (short, sharp). These also are doubtless to be classified as aftershocks of the earthquake of June 27, but reports of them from places nearer the epicenter are lacking.

**PHYSIOGRAPHY AND GEOLOGY OF EPICENTRAL AREA**

**SURFACE FEATURES**

The area within isoseismal 10 includes a lowland along Missouri River at Clarkston and parts of the hills that adjoin it on the east and north (pl. 4). The lowland, which will be referred to herein as Clarkston Valley, is a depression about 10 miles long and 5 or 6 miles across at the middle and widest part. It is bordered on the east by the moderately steep Horseshoe Hills, 1,000 to 3,000 feet high, which are in fact the extreme northern part of the Belt Mountains. At the north and south are broad spurs extending west from the Horseshoe Hills, and at the west is an unnamed range of hills of somewhat less elevation. Together the hills and ridges described form a surrounding wall that is broken at three places only, each opening being a narrow stream-cut valley or gorge. At the northeast is the gorge of Sixteenmile Creek, in which the Deer Park slide occurred. At
the south, at Trident, is a narrow, steep-sided valley that admits Missouri River, and at the north, beginning at Lombard, is a deep, narrow, and crooked gorge, known as Horseshoe Bend, through which the river escapes.

Clarkston Valley consists of a strip of level bottom land along the river and a larger area of rather low terraces or bench lands. The terraces, which are generally known throughout this region as "benches," are remnants of stream-cut plains that were developed at higher levels and at an earlier period than the plain that now forms the valley bottom. They are due to the downcutting of streams, and it follows that most of them surmount the divides between stream courses that lead from the mountains to the river. Their fronts or edges are steep descending slopes or scarps, and their tops are smooth plains that rise gradually toward the mountains. In the gorges at Trident and Lombard and here and there along the west side of Clarkston Valley are small benches 40 or 50 feet higher than the bottom lands.

On the east side of the valley the benches occupy the greater part of an area about 3 miles wide that adjoins the mountains and extends the full length of the valley. Here the fronts or scarps of the benches are mostly 100 to 150 feet high, and their tops slope upward toward the mountain with a gradient of about 300 feet to a mile. Near the mountains this slope is increased slightly, but not enough to mask the point at which a definite and rather abrupt change to the steeper slope of the mountain takes place (pl. 4).

**STRATIGRAPHY**

Rocks ranging in age from pre-Cambrian to late Mesozoic (Cretaceous) form the surrounding mountains and hills and, within Clarkston Valley, probably constitute a bedrock floor beneath the Tertiary and later deposits. As shown by Peale, the spur that incloses the valley at the south is composed chiefly of Paleozoic limestones with some sandstone and other beds of Paleozoic and Algonkian age. The same rocks continue northward, forming the hills east and west of the valley and the spur that bounds it on the north. North of Clarkston, near the middle of the valley, a hill of the Paleozoic limestones projects through the Tertiary beds like an island in a lake, and there is a similar occurrence farther northeast on the north side of Garden Gulch. North of Lombard sandstone, shale, and limestone of Cretaceous age are folded in with the Paleozoic rocks. Excellent sections of the rocks mentioned are exposed in the gorges of Missouri River and Sixteenmile Creek, and stratigraphic details of them are given by Campbell and Haynes.

Beds of moderately hardened clay and weakly cemented sand and gravel, commonly known as Tertiary "lake beds," compose the "benches" and probably occur also beneath the alluvium of the valley bottom. They lie upon the upturned and eroded edges of the older rocks described and are in turn partly covered and concealed from view by gravel of Pleistocene and Recent age. They are correlated with the Oligocene and Miocene beds occurring a short distance to the north in Townsend Valley and in the valleys of southwestern Montana generally.

**STRUCTURE**

The older rocks mentioned are involved in rather close folds that vary in trend from north to northeast and cause the beds in most places to be steeply inclined. The section at Trident shows an anticline that is overturned eastward and faulted. In the neighborhood of Deer Park several faults of apparently small extent that trend northwestward are mapped by the geologists of the Anaconda Copper Mining Co. Their age and displacement are not known. In the hills west of Missouri River is an overthrust fault, called the Lombard overthrust, that extends from a point north of Three Forks northward to 13 miles or more. Its trace crosses Horseshoe Bend about a mile west of Lombard. There the fault dips about 40° W. and has brought Belt (Algonkian) rocks eastward over rocks of Cretaceous age. Beds that are stratigraphically 6,800 feet apart are in contact, and the maximum displacement is estimated at about 2 miles. The fault is younger than Lower Cretaceous (Kootenai) strata exposed near Lombard and probably older than the lower Oligocene beds described by Douglass.

The only visible structural feature of the Tertiary beds is a persistent eastward dip of 10° to 20°. Owing to the fact that these beds break down rather easily under weathering, good exposures are few and are generally confined to very steep slopes or newly cut ravines. Hence it is possible that some minor folds or faults were overlooked, but there seems no doubt as to the prevailing eastward dip. At only one place north of Garden Gulch and within 100 feet of the area of older rocks were the Tertiary beds observed as

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3 Campbell, M. E., op. cit., p. 117, fig. 26.

4 Unpublished map.

5 Haynes, W. P., op. cit.

dipping westward. The boundary between the Tertiary and older rocks at the east edge of the valley is rather generally concealed by alluvium and deep surface mantle, but it holds a rather straight course and is not extensively deflected where it crosses gulches or ridges. Apparently, therefore, this boundary is the trace of a steeply pitching surface toward which the Tertiary beds are inclined. Such a relation is difficult to explain except as a result of faulting by which the Tertiary beds were relatively downthrown. This idea is supported by certain features of the valley itself. Clarkston Valley is a wide depression in deformed and eroded pre-Tertiary rocks. Its rim or surrounding wall is broken only by three narrow stream gorges. Such a basin could be formed in only two ways—by erosion or by structural movements. If due to erosion, it must have been an area of rocks that were softer and more easily eroded than the rocks in which the gorges were cut, which is evidently not true. Therefore there seems no alternative but to regard the valley as a relatively depressed or down-faulted area. The features of the Tertiary beds indicate that down faulting occurred along the east side of the valley during Miocene or later time, the pitch of the fault being toward the west.

Similar features are shown in Townsend Valley, a short distance to the north. There also the Tertiary beds rest in a basin depressed in the older rocks and show a persistent dip toward the east side of the valley. At the point where Sixmile Creek (which is about 4 miles north of Sixteenmile Creek) leaves the mountains the eastward-dipping Tertiary beds about against the older rocks,14 the relation being interpreted as due to a fault with the downthrow on the side next to the valley.

CAUSES OF THE EARTHQUAKE AND LOCATION OF THE FOCUS

The size of the disturbed area, the gradual decline of intensity away from the epicenter, and other features of the Montana earthquake indicate that it was the result of fault movements rather than of volcanic action. So far as observed in the neighborhood of the epicenter no new fault displacement is manifest at the surface. This may be explained by the fact that there is a thick superficial cover of rather soft sediments (Tertiary "lake beds"), in which a slip originating in the rocks below might be distributed and lost.

Of the faults previously mapped in this region the Lombard overthrust (p. 21) is too far from the epicenter to be considered. The faults mapped by geologists of the Anaconda Co. as crossing Sixteenmile Creek near Deer Park are not far from the epicenter, but their strike differs considerably from the course of the longer axis of the isoseismic curves. They cut Paleozoic rocks, and whether they are older or newer than the Tertiary beds is not known. The writer did not identify them, but owing to their location and trend he is inclined to believe that they do not contain the focus of the earthquake.

In the absence of positive evidence to the contrary it must be admitted that the earthquake may have originated along some fracture that has not yet been discovered or even suspected. All necessary conditions, however, are met by the assumption that the slip occurred in depth on the fault postulated as extending along the east side of Clarkston Valley. This fault is Miocene or younger and is probably still active.

The difference between the longer and shorter diameters of the inner isoseismal curves is from 6 to 10 miles, which presumably is of the same order of magnitude as the length of the focus or the distance along which slipping occurred. The extent of the area in which the shock was strong or destructive presumably indicates that the focus was moderately deep, perhaps several miles.

PROBABILITY OF FUTURE EARTHQUAKES

On the theory that the earthquake of June 27 with its succeeding aftershocks accomplished the relief of stresses that for some time had been accumulating a period of quiet may be expected so far as movement on the particular fault that caused the disturbance is concerned. The neighboring region, however, probably contains many other faults that are carrying unreleased strains and may therefore become active at any time. Several of the mountain ranges of this region—Madison Range, for example—present high, steep fronts which suggest that they have been newly elevated and perhaps are still growing and therefore to be regarded as accumulating strains that will eventually result in earthquakes. Southwestern Montana is part of the Cordilleran region, which as a whole is a region in which rather severe earthquakes have occurred now and then in the past and are reasonably to be expected in the future.

In Montana prior to 1925 no destructive earthquakes have been recorded, but earlier than 50 or 60 years ago settlements here were so few and far between that strong shocks might have passed unnoticed. According to some of the pioneer residents a moderate earthquake was experienced in the Gallatin Valley in 1883 that threw dishes off shelves and awakened sleepers. In 1805 sounds that were probably of earthquake origin were noticed near the present site of Great Falls by members of the Lewis and Clark expedition. In his journal of June 18–20, 1805, Captain Clark15 records that the men of the expedition first told him of hearing the sound for which he supposed they had mistaken distant thunder. On June 19, however, while walking on the plain above the falls he himself

heard the noise distinctly and paused, listening for two hours, during which time it was twice repeated. He describes it as an "unaccountable rumbling" and also as resembling distant artillery fire. It seemed to come from the west, was heard at irregular intervals, and consisted of a single discharge or of several discharges in quick succession. This description tallies closely with that of sounds called brontides,16 which are regarded by authorities as partly at least of seismic origin—possibly the final representatives of a series of aftershocks.

It is probable, from the facts above set forth, together with the evidence of the recent earthquake, that the general region here considered is in a condition of moderate seismic activity and is likely to be visited by an occasional severe shock. It behooves the inhabitants, therefore, to take at least a few simple precautions toward the prevention of future damage.


For example, the prevailing custom of laying up veneer or face brick without ties or bonding to fasten it to the back wall should be outlawed. The use of poor or insufficient mortar is of course to be condemned under any condition. Apparently a rich Portland cement mortar will make brick walls proof against shocks as severe as the recent one, and chimneys may be prevented from falling by a few braces of strap iron. Many of the towns are built on deposits of unconsolidated stream gravel, on which a shock is likely to be more destructive than on solid rock. This condition can be overcome, however, by making the foundations deeper and heavier than ordinarily is needed. It is evident that the wrecked schools at Three Forks and elsewhere could have been made earthquake proof when they were built, at a fraction of the cost it has taken to repair them. Apart from this there appears a more weighty consideration. When will the next earthquake come? When schools are in session or congregations assembled?
Lang

feeling of Helena?

famous
colored person stay @ Broadway in 1925?
- pushin' it! He did - embrace Klan, but
Ambrose & Goodwin? Can't even put up
- only Under 7 Mason

Dixie

Dad's wife - cancer / Th Xmas -
- radiation - chemo - 50% chance
- 20 yrs younger (63 dad)

across from old Shrinel
Hosp. - park / obelisk -
Helena Ave

hospitality from black county - edge of exodus
3 churches & no employment - close St / military
day from

social structure
Ford family (Ky) had black servants
Mont Club - black bartenders / help
intersection pts by wri underworld, or
with li rollers are red by blacks

Holes: energy funnel into. Gulch
- cut in flat valley, rains pull you into
station; even Prospect road from W
jacks you into center T city
- 6-7-6 story blocks stacked into, canyon
show-off

Billing, 30 story piny, on plains
- analog, reach back, thin & long to

"hence, it operated from Park hotly
to dry areas with hydraulic mining
hydrated sense or it - outwash, L Ch,

hill stream, deposits its self into, flats
mother loads up into crevices - Huan
want to, plates, hill = gulch climax

- cramp (viv)
Lang: H & C - You into him Am for something
- win in Am republic - put back reason for
- genius
- repress that pop his, you still have to
do. (Edmund Morris does)
- Taylor Branch
- Am still Randa either, cut 'em up &

Shrewd 'em thru

dave's mountebank/
Schorringer's worst!

- Archivis of went dem source, not
contents

Manannán: why too hard
- weren't remodeled / fan diabetes

rain down / called B/
- get him to drink
anything / What's
going on?

Murray Morgan
Rosa / Romania / Mexico
- dance hall
- Bar Bums / $ on the sunset

Lana lives in CALA.
"Broadwater Hotel 3 miles from Helena, Mont. - 1889-90"

A. J. Lawson
photographer
"Broadwater Hotel, no date"

[Note shrubs and trees much larger perhaps 1900]
"Broadwater Hotel, no date"

Note size of shrubs and trees - much larger than 1890 views.
Broadwater Hotel & Natatorium [1890]
F. Jay Haynes photographer
The Office, The Broadwater
Helena MT 1890
SEPARATION NOTICE

The following items have been removed from Box 175, Folder 1, Collection 2002, for oversize storage elsewhere.

Items Removed:

35 mm slides, #516-521 were removed from Series 10: Research, Subseries 2: Research topics. Transparencies were relocated to Series 8: Photographs, Subseries 1: 35 mm slides.

X Material has been placed in Box 155, Folder NA, Collection 2002

___ Location information is available from the Special Collections Staff.