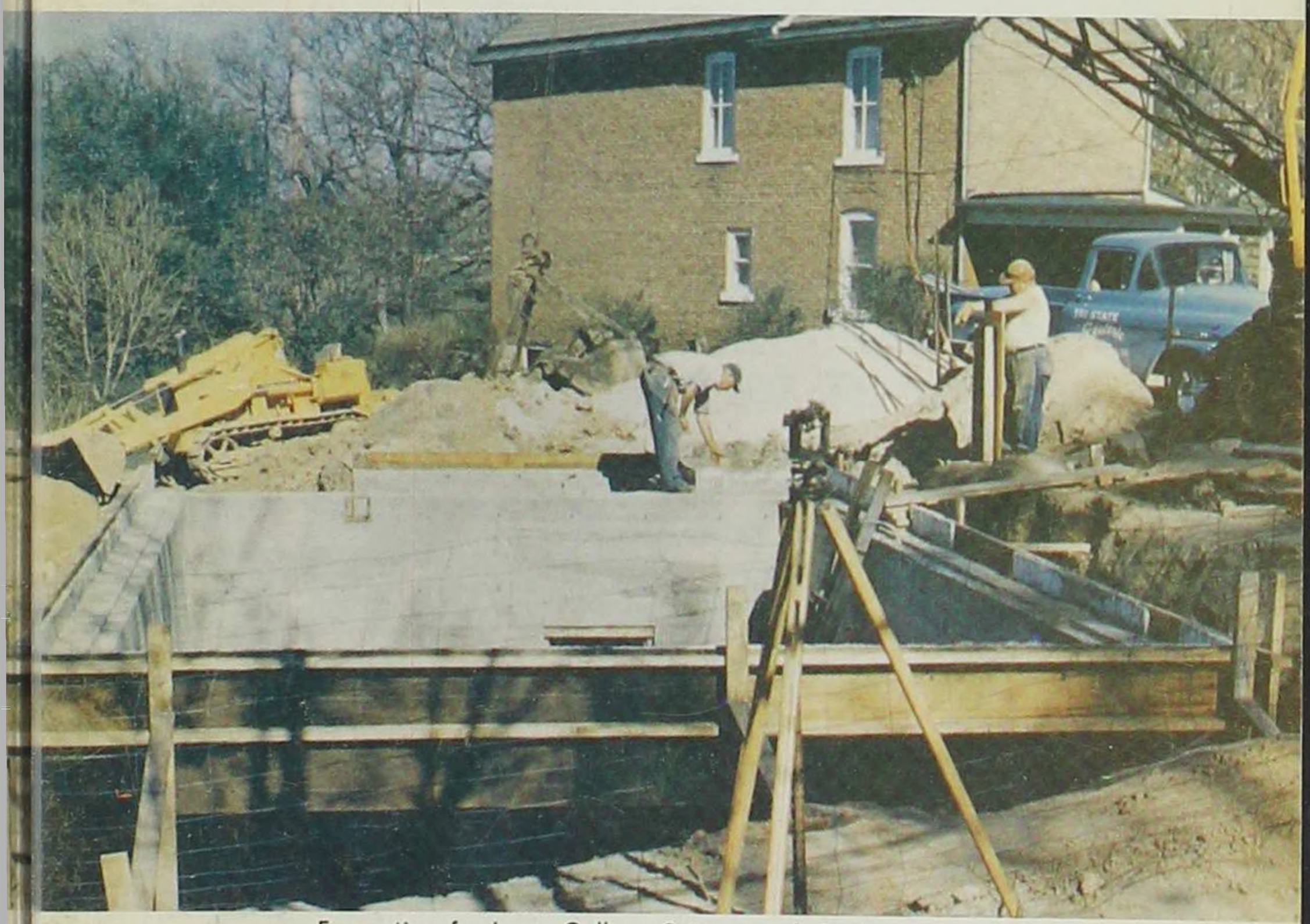
The PALIMPSEST



Excavating for Loras College Seismograph Station

Earthquakes in Iowa

Published Monthly by

The State Historical Society of Iowa

Iowa City, Iowa

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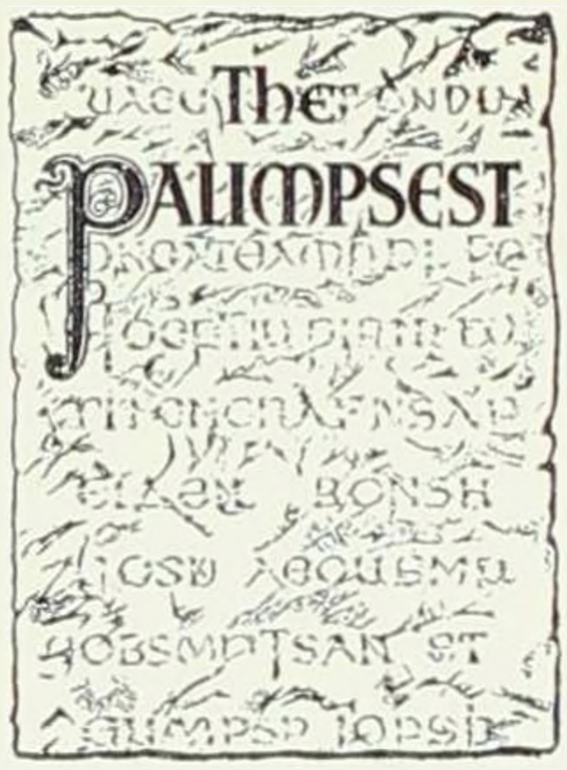

The Meaning of Palimpsest

In early times a palimpsest was a parchment or other material from which one or more writings had been erased to give room for later records. But the erasures were not always complete; and so it became the fascinating task of scholars not only to translate the later records but also to reconstruct the original writings by deciphering the dim fragments of letters partly erased and partly covered by subsequent texts.

The history of Iowa may be likened to a palimpsest which holds the record of successive generations. To decipher these records of the past, reconstruct them, and tell the stories which they contain is the task of those who write history.

Contents

Illustrations

All illustrations unless otherwise noted are courtesy Loras College.

Author

William J. Petersen is Superintendent of the State Historical Society of Iowa. The first article appeared in THE PALIMPSEST in April, 1933, and is retained with the addition of the 1925 earthquake. The center spread pictorial insert and the second article covering earthquakes from 1933 to 1965, is new material whose intensity is measured by the modified Mercalli intensity scale of 1931. A comparison of the Rossi-Forel scale used in the first article with the Mercalli scale used in the second article appears on the inside back cover.

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THE PALIMPSEST

EDITED BY WILLIAM J. PETERSEN

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New Madrid to Long Beach

The evening of December 15, 1811, was clear and quiet when the inhabitants retired in the little frontier community of New Madrid, Missouri. At two o'clock in the morning they were suddenly awakened by the "groaning, creaking, and cracking of timbers" and the "crash of falling chimneys." Trembling with fear, they groped their way frantically from their homes to escape the falling debris. They were forced to spend the night shivering in the cold as intermittent shocks continued to weaken their tottering dwellings.

The New Madrid disturbance was one of the three major earthquakes in the United States. The shock was felt from Canada to New Orleans and from the headwaters of the Missouri River to Boston. This is said to exceed the extent of any other known earthquake in this continent. If the earthquakes at Charleston in 1886 and at San Francisco in 1906 are better known, it is only because of the destruction of life and property in more densely populated regions.

Only roving bands of Indians inhabited Iowaland at the time of the New Madrid catastrophe, which explains the absence of any record of the shock in this section of the country. Since the intensity and scope of earthquakes may be measured by effects, the testimony of witnesses is particularly valuable in determining the character of the phenomenon. N. H. Heck in his *Earthquake History of the United States* has adopted the Rossi-Forel scale of classifying earthquakes in ten fairly distinct groups.

The weakest tremor in the Rossi-Forel scale is the *microseismic,* which is recorded by a single seismograph or by seismographs of the same model, but not by several seismographs of different kinds. Next comes the *extremely feeble shock* which is recorded by several seismographs of different kinds and may be felt by a small number of persons at rest. The third type, a *very feeble shock,* appreciable to people at rest, is strong enough to determine the direction or duration. A *feeble shock* of the "force of 4" may be felt by persons in motion and is capable of disturbing movable objects, rattling windows, and cracking ceilings. The fifth class is a *shock of moderate intensity* which is felt generally by everyone. It is marked by the ringing of bells and the disturbance of furniture and beds. Next came a *fairly strong shock* which awakens sleepers and is attended by the ringing of bells, the oscillation of chandeliers,

and the stopping of clocks. Some startled persons may even leave their dwellings. The seventh intensity is indicated by a *strong shock* capable of overthrowing movable objects and ringing bells, by falling plaster, and by general panic without seriously damaging buildings. Falling chimneys and cracked walls rank eighth in the Rossi-Forel scale with the rating of a *very strong shock*. The ninth, or *extremely strong shock,* involves the partial or total destruction of buildings; and a shock of *extreme intensity* with the "force of 10" results in great disaster, ruins, disturbance of the strata, fissures in the ground, and the fall of rocks from mountains.

Since the available evidence is adapted to this classification, the divisions of the Rossi-Forel scale will be used to indicate the nature of Iowa earthquakes. The first earthquake recorded by Heck in this region occurred ten years after permanent settlement began in eastern Iowa. On January 4, 1843, a severe shock at Memphis, Tennessee, caused walls to crack, chimneys to fall, and windows to break. No mention is made of the Territory of Iowa in the government report, but the *Fort Madison Democrat* contained the following item, recording the first known earthquake in Iowa: "The shock of an earthquake was sensibly felt" in Burlington on Wednesday evening "at about five minutes before nine o'clock. Several buildings were perceptibly affected by the

shock, and in some parts of the city loose articles were moved four inches from their place. Some . . . were considerably alarmed, but no injury done."

The next earthquake known to have visited Iowa was in 1858. The *Sioux City Eagle* recorded a shock "accompanied by heavy rumbling" on the third of July. The movement was from west to east, and the tremors were of sufficient force to shake "pictures and crockery" from their places, indicating approximately a fourth class shock.

The states of Kansas, Nebraska, Missouri, Illinois, Indiana, and possibly Ohio were visited by a quake on April 24, 1867. Although Iowa is not mentioned in Heck's report, it was probably the motion of this tremor which the editor of the *Wapello Republican* described as "not violent, but easy and swinging, giving one a sensation something like the first effects of a dram of whiskey." The *Dubuque Times* of April 25th declared that several shocks were "distinctly experienced." In the composing room of that paper the "cases shook agueishly and the gas burners vibrated like pendulums," while inmates of the *Herald* building "rushed out" into the street. People in Bishop's Block felt the "walls were sinking from a defective foundation" and fled outside in alarm. The shock was felt "very sensibly" on the outer levee and the occupants of the Pilots' Association rooms "rushed out in dread of their lives" when the plaster commenced to fall from the ceiling.

Three years later, on October 20, 1870, a strong earthquake rocked the St. Lawrence Valley between Montreal and Quebec and the New England coast from Portland to New York. It was widely felt, being reported at Richmond, Virginia, and Sault Ste Marie, Michigan. "A distinct shock of earthquake was felt" at Dubuque "about ten o'clock on Thursday morning by parties occupying the second and third stories of buildings and by not a few who were on terra firma. The motion continued several seconds and struck terror to nervous people occupying elevated positions but did no damage."

Western Iowa suffered a shock on October 9, 1872, when Sioux City and the adjoining territory in the Dakotas felt seismic tremors. Although the shock was not violent, the *Sioux City Journal* declared it to be of "sufficient force to set the ground a trembling and cause buildings to vibrate." The effect went unnoticed on the bluffs but was distinctly felt on low ground. Some attributed the "unusual thrill" to a "slight dizziness or nervous attack." Men, women, and children fled from the Hubbard House and teachers attending the institute at the high school "scattered in undignified haste, fearful that the structure was about to collapse." Several gentlemen in the third story of the First National Bank declared the building "swayed fully two feet" and the "pell-mell manner in which they came down the stairs indicated

that they felt the necessity for sudden exit very imperative." Since an earthquake was not "dreamed of," some thought it due to the strong gusts of wind, others believed the buildings were settling, while still others imagined the floors were giving way. The jokers declared it was merely "Greeley's tidal wave sweeping the country" while supporters of Grant assured their Liberal friends that it was nothing but "the Republican thunder" honoring Tuesday's election results.

Five years later, on November 15, 1877, another earthquake was felt throughout Iowa, eastern Nebraska, northwestern Missouri, Kansas, the Dakotas, Wisconsin, and Minnesota. The area was elliptical in form, 600 miles by 300 miles, though the vibration was strongest in the Missouri Valley. Numerous citizens in Council Bluffs "experienced a severe shock, sudden and terrible, as though the earth was being shaken to its center." High school teachers and students were "struck with terror" as desks "swayed to and fro for an instant and the entire building trembled." It was only by "coolness and presence of mind" that teachers were able to maintain an orderly exit so that no panic was created and no one injured. At one point west of Omaha the quake was said to have "caused a worse shock to citizens than could have been experienced by the combined cases of ague all over the United States had they centered in one man."

Accompanied by a "peculiar rumble like that of a railroad train," the same quake, of the "force of 7," caused Sioux Citians to suffer three-quarters of a minute of horror. As the *Sioux City Journal* records: "Buildings rocked, articles were displaced in homes and buildings, clocks stopped, doors opened as if by unseen hands, windows rattled, dishes and tinware tumbled from their accustomed places. The manifestation consisted of a shock and a recoil, both of which were the most vigorous ever felt in these parts. The streets filled very suddenly, district court was in session and a stampede took place from the Court House. Panic was averted at the Catholic Church, where confirmation services were taking place, by the presence of mind displayed by cool-headed men. Schools were emptied quickly and accident averted by prompt action of the teachers. There were no fatalities but damage to several buildings in the way of large cracks in their walls was the result of the shake-up."

It was about ten o'clock on the evening of August 31, 1886, when a low rumbling sound was heard by residents of Charleston, South Carolina. The rumble rapidly deepened into a mighty roar, and the mild trembling of the earth soon became violently destructive. More than a score of lives were lost as buildings fell, railroad tracks twisted, fissures and craters formed, and water, mud, and sand spouted from the earth. The earthquake at

Charleston was felt over an area with a diameter of a thousand miles, from Boston to Cuba and from Bermuda to Iowa.

Several towns in eastern Iowa "distinctly felt" the tremors but no damage was done. A number of people in Keokuk noticed the ground tremble and occupants of high buildings in Burlington "beat a hasty retreat" to the streets when they became suddenly aware of the effects of the first shock. At Dubuque the printers in the fourth story of the *Herald* building "ran for their lives down the stairway" and the audience in the opera house was "very much frightened." Iowa was one of the farthest points affected by the Charleston earthquake.

An earthquake of varying degrees of intensity was reported throughout Iowa shortly before eleven o'clock on Saturday night, September 26, 1891. At Amana a number of persons distinctly felt a "shaking," at Tipton a "rumbling" was heard which sounded like the passing of a train, while at Cedar Rapids the shock was of "considerable violence," the vibrations being strong enough to cause windows and doors to rattle and to awaken people from a sound sleep. Dr. J. M. Shaffer felt a "distinct shock" at Keokuk and recorded it in his journal: "I was wide awake, and the house seemed to vibrate or move back and forth; sensation was very singular; listened for some movable trifle to fall, but heard none and

observed none. Motion lasted perhaps half a minute." Mild as it was, the editor of the *Keokuk Gate City* deemed it "considerable of a luxury" and believed many residents would "deplore the fact that they were not awake to enjoy it."

Lest the good citizens of Keokuk should feel slighted, apparently, mother earth had a "Fit of Ague" at about 5:30 on the morning of October 31, 1895. It was declared to be the most pronounced quake experienced there in the history of Iowa. This is not altogether surprising, for Heck describes it as "the hardest shock in the entire region since the New Madrid earthquake." Twenty-three states reported the shock.

The *Keokuk Gate City* was quite voluble over the advent of such a "luxury." "Many of the less soundly sleeping citizens," it declared, "were aroused" by the "unusual trembling of their houses or the elbows of their better halves. The early awakening was heralded by the glimmering of lights in bed chambers and the hasty exit from their homes of women and children. There were two distinct shocks (some say three) lasting about twenty-five seconds each with a short intermission. The rattling of windows, shaking of beds and in one or two instances the falling of brick from toppling chimneys" were all experienced at Keokuk. Apparently the vibrations were of the eighth intensity. E. T. Bartruff, in his excitement, declared that "several gallons of cream

were churned into fine butter" on his farm near Moar. Walter Brinkman was delighted to note that the "ashes were shaken out of the furnace," but B. F. Hagerman was somewhat chagrined to find the "buttons were missing from his trousers" and, not to be excelled in imagination, insisted that "the shock shook them off."

The earthquake of 1895 was probably felt throughout Iowa, particularly in the southeastern half of the State. It was reported by many towns from Lansing to Sidney and southward. The houses at Keosauqua were shaken so violently that dishes rattled on the shelves and people sleeping in the upper stories were "considerably alarmed." Two shocks were felt in Dubuque. Buildings trembled, dishes rattled, and people were awakened from their sleep, but no serious damage was done.

An earthquake occurred in Nebraska, South Dakota, and western Iowa on July 28, 1902. A dispatch from Omaha stated that the "seismic disturbances were felt at a large number of towns in the three states and lasted ten to fifteen seconds." No damage was reported, although the shock was "sufficient to rattle dishes and shake bell towers" at various points. On the same date heavy shocks were registered in California.

Three years later, on April 13, 1905, Heck records several shocks of the "force of 5" at Keokuk. Buildings were shaken but no serious damage was

done. Burlington was inclined to believe it "inopportune" to report an earthquake at that time. "A seismic disturbance," declared the *Burlington Hawk-Eye,* "would shatter the best dam that could be constructed. If enterprising correspondents in the Gate City must have or see things, they ought to describe the symptoms in a different manner." The shock was apparently local in character but important enough to be located on a government map showing the historic earthquakes of the United States.

Three earthquakes were recorded in Iowa in 1909. An intensity of 8 in the first of these was noted in portions of northern Illinois and southern Wisconsin, and the shock was felt over an area eight hundred miles in diameter from Missouri to Michigan and from Minnesota to Indiana. The disturbance caused widespread alarm throughout eastern Iowa — several towns reporting tremors of varying intensities.

In Dubuque the effect was particularly noticeable in the higher buildings. The overall factories were "jarred" so sharply that the girls fled from their machines to the street in terror. Occupants of the Bank and Insurance Building thought a heavy body had fallen down the elevator shaft, and hurried from their offices apprehensively. A workman on a forty-foot scaffolding at the Presentation Convent became terrified and jumped, alighting fortunately on a pile of sand. "Pictures

were left topsy turvy on walls," observed the *Telegraph-Herald* of May 26, 1909, "vases were overturned, crockery 'sang' out when it came in contact with other crockery, glasses on sideboards and on bars tinkled." The dishes at Althauser's and Becker-Hazelton's "danced blithely about, developing a code of their own. The festivities were brief but furious and in the excitement several platters jumped to the floor."

On July 18, 1909, another earthquake with the epicenter a little north of Springfield, Illinois, rocked eastern Iowa. Beds and tables were shaken and dishes rattled at Iowa City. Chimneys were reported down at Davenport. A number of people telephoned the *Davenport Times* that they had been awakened from their sleep by the shock. Others said that pictures on the walls moved and dishes in the pantry rattled perceptibly. Some described it as a hard shock followed by two lesser tremors. Many people rushed out of their homes and congregated with neighbors in the street to await another shock which failed to come.

The third 1909 earthquake in Iowa occurred on September 27th. It was strongest in Indiana, though recorded in Kentucky, Illinois, Missouri, Arkansas, Kansas, and southwestern Iowa.

Western Iowa experienced a mild quake on June 2, 1911. The shock, which was felt over an area estimated at 40,000 square miles, affected chiefly South Dakota and Nebraska. Two slight

tremors were noted but no damage was done. The first report in Sioux City came from the Farmers Loan & Trust Building and similar accounts were quickly received from other buildings. A little later, descriptions of the phenomenon came from the residence district where dishes in the china closet and pictures on the wall quivered. Persons seated in office buildings were given the sensation of dizziness.

On January 2, 1912, an earthquake of the force of 5 and 6 was felt in northern Illinois and southern Wisconsin. Three distinct tremors were observed in Dubuque at 10:22 a.m., the most perceptible being in the residence districts. Everything was "nice and quiet," according to the *Telegraph-Herald,* when "suddenly 'Crash!' down comes all your nice China and musses up the dining room floor you have just swept. Immediately a thousand housekeepers all over the city ran to the telephone and called up the weather man just as if he was to blame."

One of the last quakes known to have visited Iowa before 1933 was felt throughout the southeastern section on the afternoon of April 9, 1917. The direction of the shock was northwest by southeast, covering an area of 200,000 square miles from Kansas to Ohio and from Wisconsin to Mississippi. The maximum force was 6 and the epicenter was in the New Madrid region, according to the seismograph at Saint Louis University.

At Iowa City the offices in the Johnson County Bank Building were jarred, tables and desks moved, and books were shaken out of place. Considerable vibration was felt in private residences throughout the city. Residents on the third floor of the Y. W. C. A. at Burlington found the sensation "decidedly unpleasant." Similar effects were reported at Bellevue, Cedar Rapids, Clinton, Davenport, Keokuk, Lineville, Mount Vernon, Muscatine, and Ottumwa.

Eight years later, in 1925, an earthquake whose exact epicenter was widely disputed at the time, was felt throughout Iowa. Known today as the Quebec earthquake, March 1, 1925, its epicenter was finally fixed south of the Saguenay River in Quebec where considerable damage was done, especially to massive stone structures. Thus, the *Dubuque Telegraph-Herald* of March 3, 1925, reported the Roman Catholic Church at St. Hillarion was demolished during the quake. The edifice was only two years old and was considered one of the finest stone structures in Canada. Loss of life in the Quebec quake was small, fortunately, because the area was thinly settled.

The more populated areas in the east were especially apprehensive. New Yorkers were described as "nervous" in the report in the *Telegraph-Herald*.

No small part of the tenement population in this city's lower East Side still was fidgety. Incipient panics broke

out there with the first shocks Saturday [February 28] night. Apprehension was general among many who remembered the manner in which Manhattan had been burrowed from end to end with tunnels and tubes and how its buildings shoot skyward from small bases.

Seismologists and geologists, with few exceptions, gave assurances that study had convinced them and many of their ilk before them that the rock that makes Manhattan island is of such textures and so deeply set into the earth and sea that it is unlikely it ever will be jarred sufficiently to bring its skyscrapers tumbling down.

Although Iowa was far removed from the epicenter of this earthquake, the United States Coast and Geodetic Survey reveals how widespread the shock was felt in the Hawkeye State. The non-instrumental reports gathered through the United States Weather Bureau (WB) included:

Station	*Intensity*	*Source*
Charles City	1	E. G. Larson, WB
Des Moines	1	C. D. Reed, WB
Dubuque	3	L. Jellison, WB
Dubuque	1	M. Wills, WB
Keokuk	1	C. E. Hadley, WB
Mount Vernon	1	W. S. Ebersole
Sioux City	1	G. K. Greening, WB

The following report was made in the *Dubuque Telegraph-Herald* of March 3, 1925:

Mysterious tremors felt in Dubuque early Saturday night were due to an earthquake felt in practically all sections of the country, it was believed today.

Occupants of the Austin building departed hurriedly

after the first shock was felt, although at the time they did not know the cause. The structure rocked perceptibly, according to those residing there and the tremor was felt for about three minutes.

At the Julien Dubuque hotel the guests reported that they had felt the shock also. Dishes, it was also reported, had fallen from their places on sideboards while there were many other indications that the disturbance was an earth tremor.

In several stores in the lower end of the city it was reported that light advertising signs placed high atop display cases were thrown from their places.

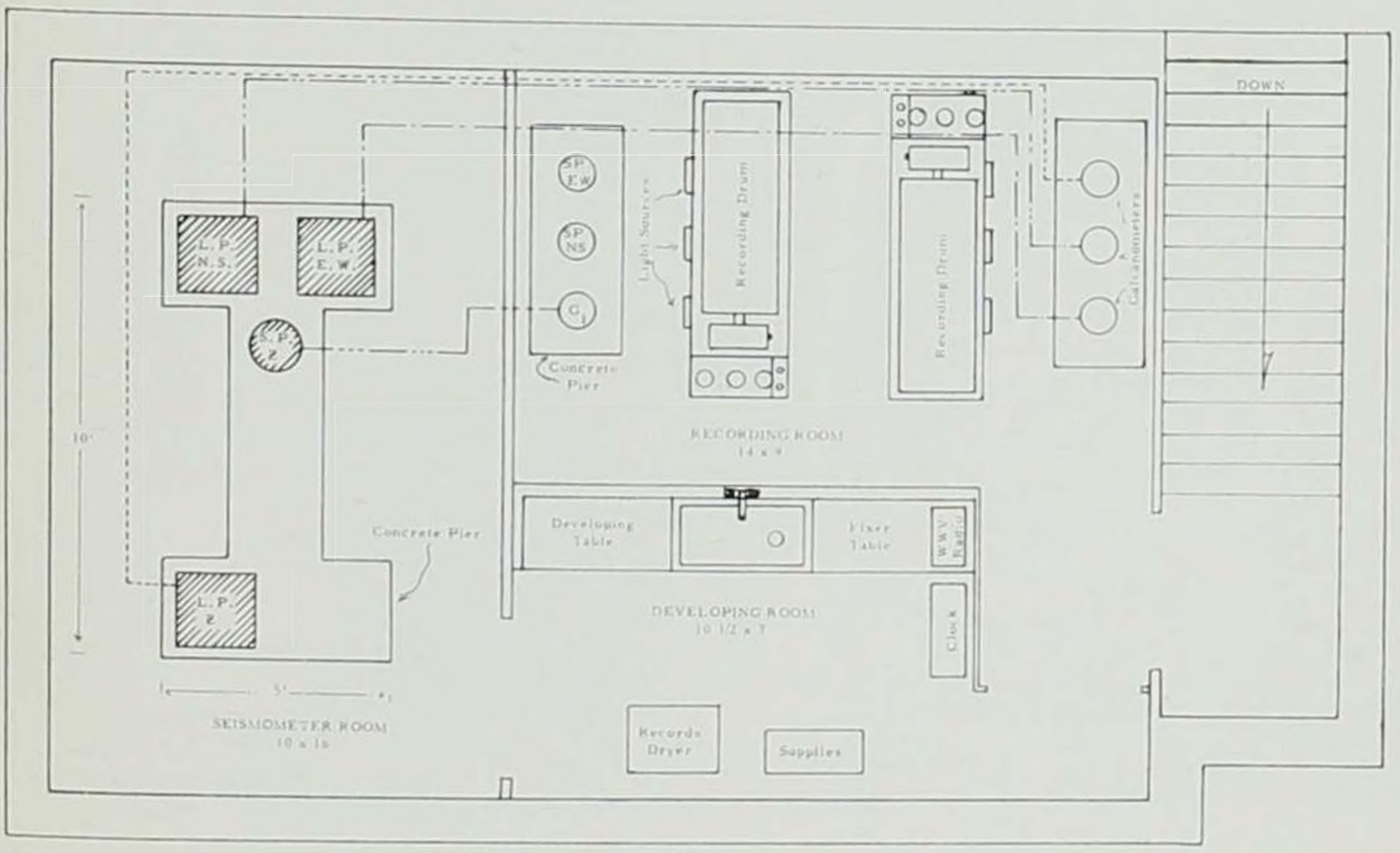
Reports from other sections of the city indicated that apparently no one had felt the tremor, although it is said the shock might have been too slight to dislodge anything.

The quake was felt in many towns in northeastern Iowa, but no damage was reported.

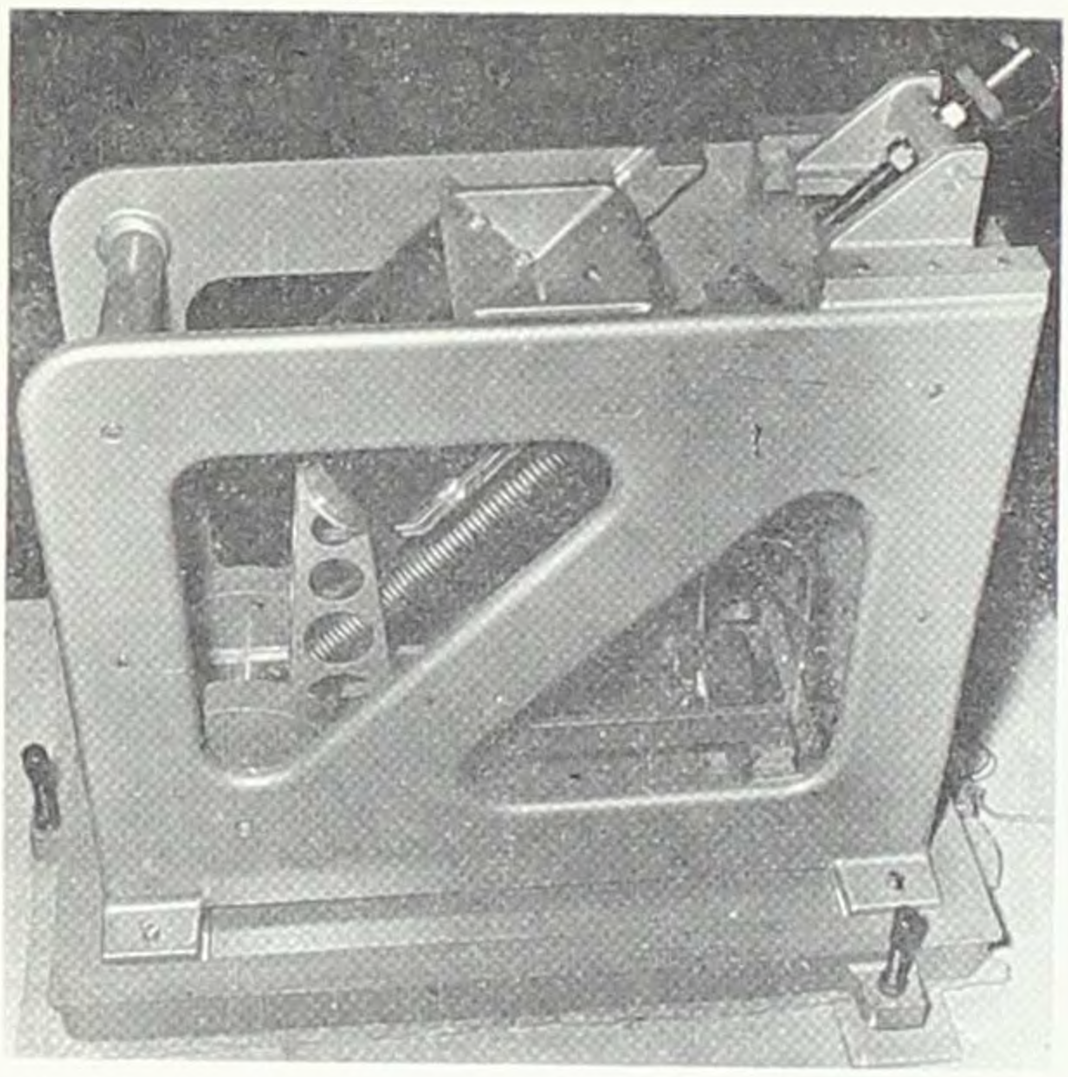
Ninety years have elapsed since the first earthquake was chronicled in Iowa. During this time, eighteen shocks have been recorded and a number of milder disturbances may have occurred but remain unknown. An average of one quake every six years might cause some alarm, but close analysis of the facts should remove all apprehension. During this period, although the shocks have ranged from 3 to 8 in intensity, not a single life has been lost and the damage to property has been negligible. The heavy glacial drift, which covers Iowa like a huge mantle, has served as a shock absorber for any seismic disturbances felt thus far.

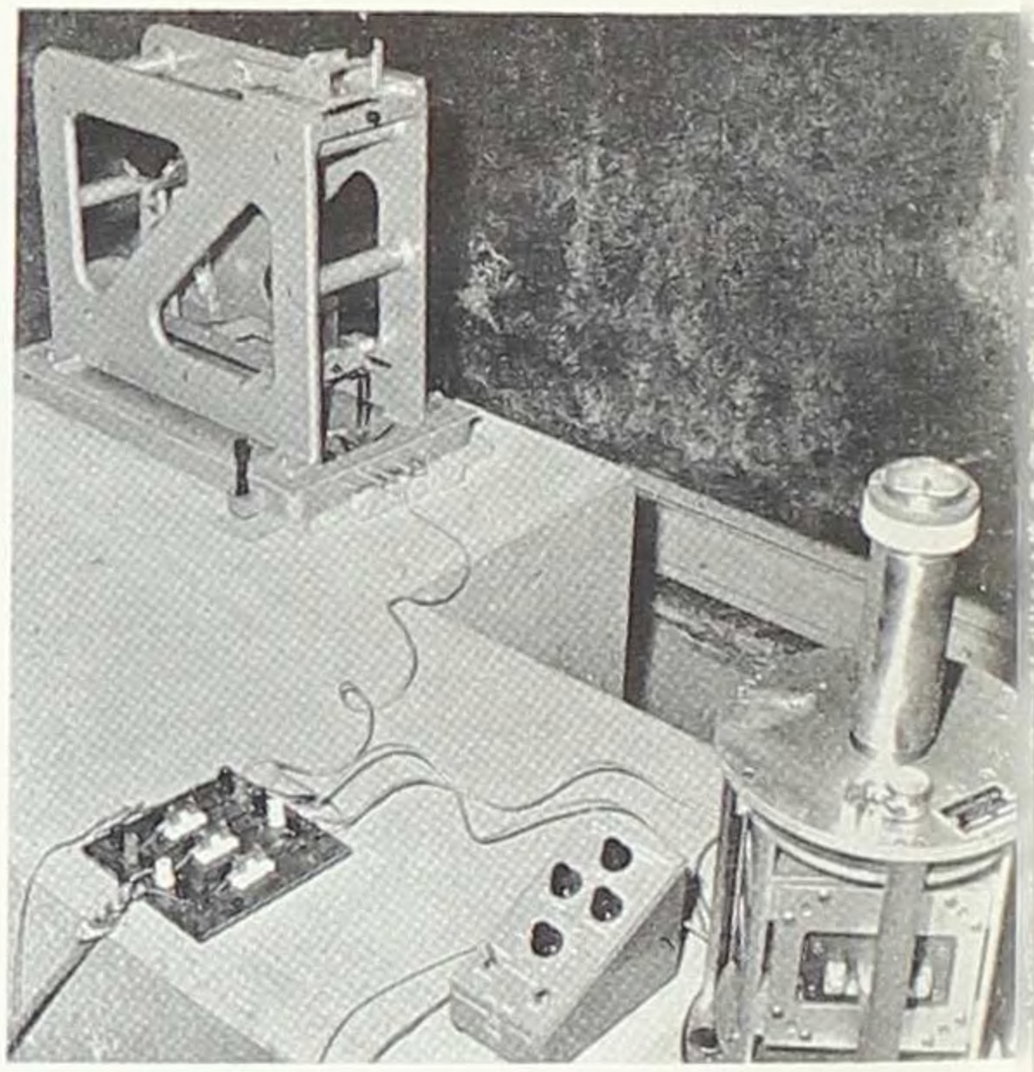
WILLIAM J. PETERSEN

Pictured near the entrance to the underground vault housing Iowa's only seismograph station and located on the Loras College campus at Dubuque are from left to right: Father Donald R. Hutchinson, chairman of the physics department; Dan Cash, physics instructor in charge of the Loras station; and Dr. William J. Petersen, Superintendent of the State Historical Society of Iowa.



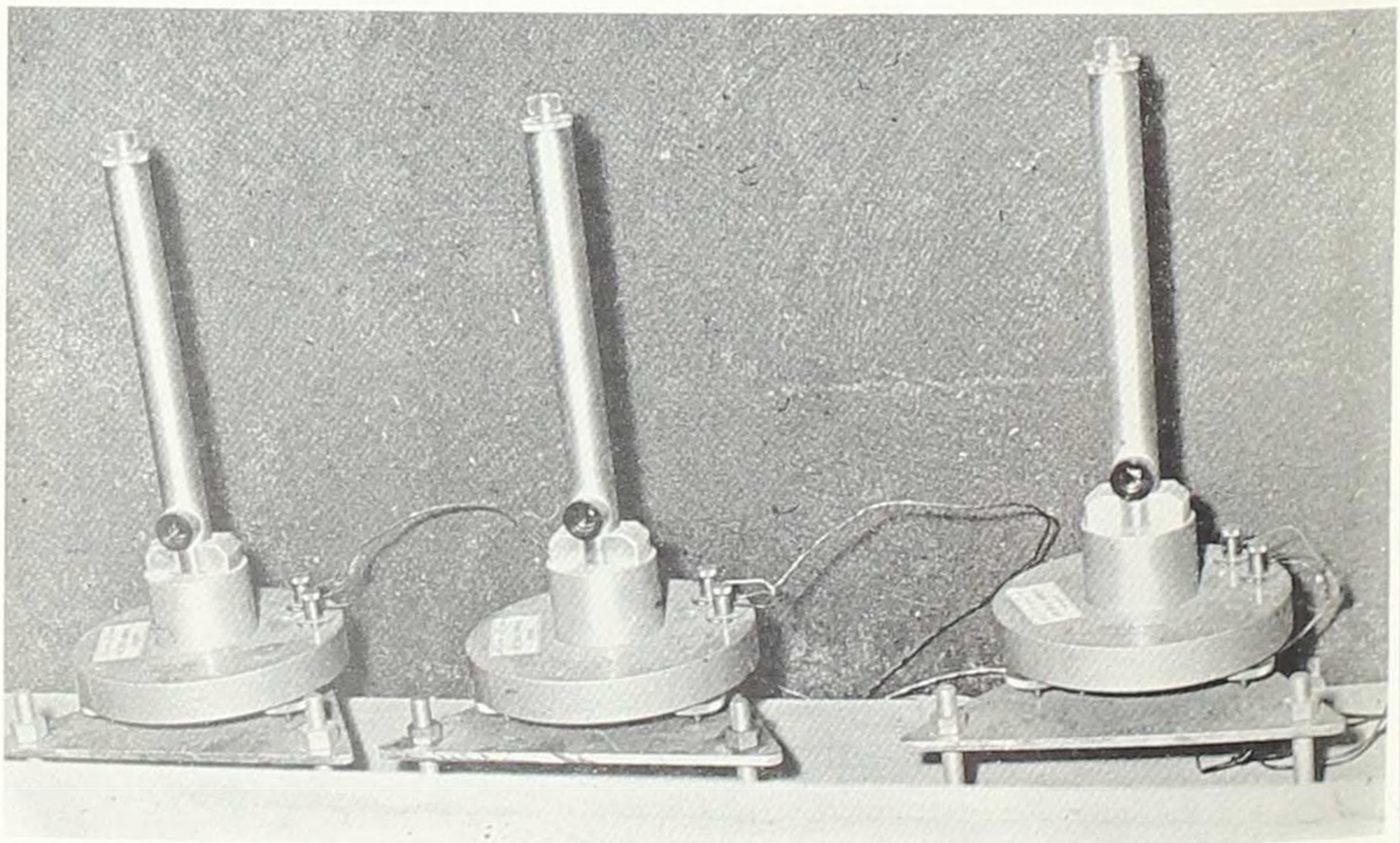
This picture shows the floor plan of the seismograph station on the Loras campus with the steps leading down into it. The pictures that follow illustrate the various instruments used to record earthquakes in Iowa.



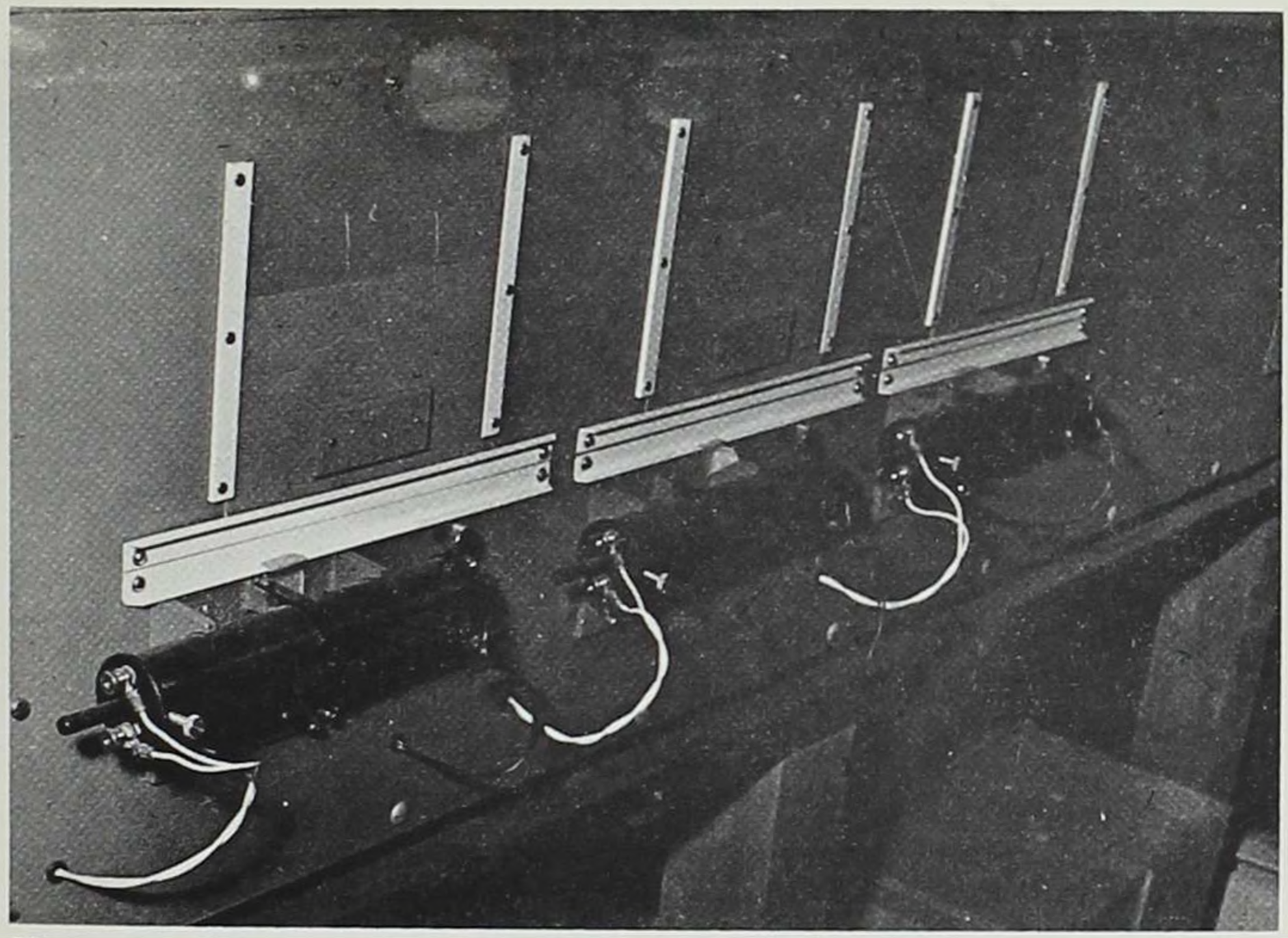


(*Left*) A close-up of one of the six seismometers in the Loras station. This instrument measure slow (long period) vertical motions of the bedrock. Mounted on the solid piece of concret which reaches 13½ feet into bedrock and is insulated from the floor of the vault, this instrumen causes a deflection of the galvanometer mirror which reflects a light beam through a slit in th rear of the cabinet housing the photographic recording paper. When the paper is removed fron the cylinders and developed, the recordings become readable.

(*Right*) Two different seismometers are shown in this picture of the inertia block. The wiring system is also shown. On the left is a long period instrument; on the right, a short period.

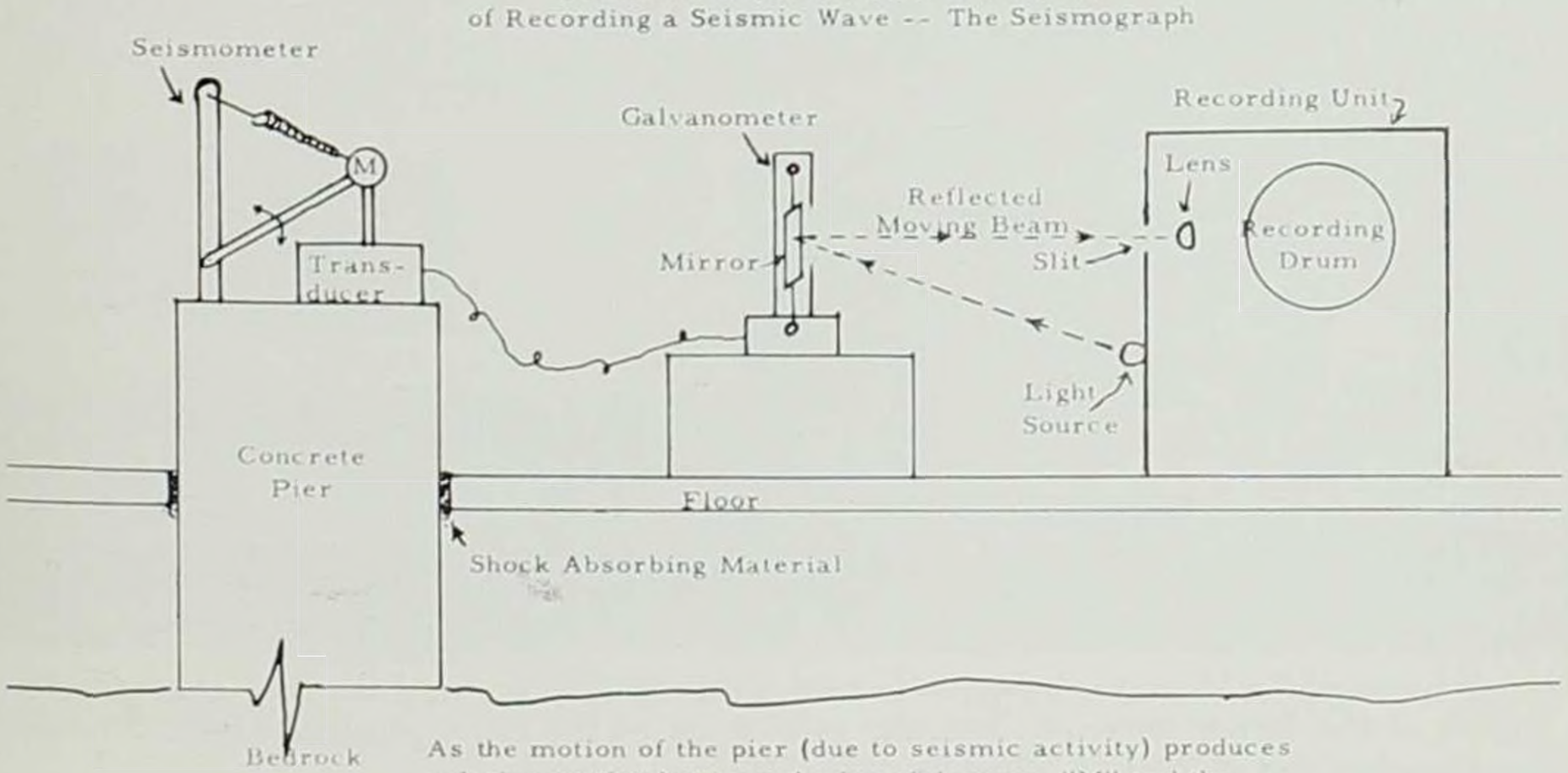


Here are the galvanometers which pick up the electric signals from the seismometers and reflect a light signal to the photographic paper. The small round objects near the base of the stems are the mirrors which reflect the light beams through the slit upon the photographic recording paper located in the cabinet containing the drum.

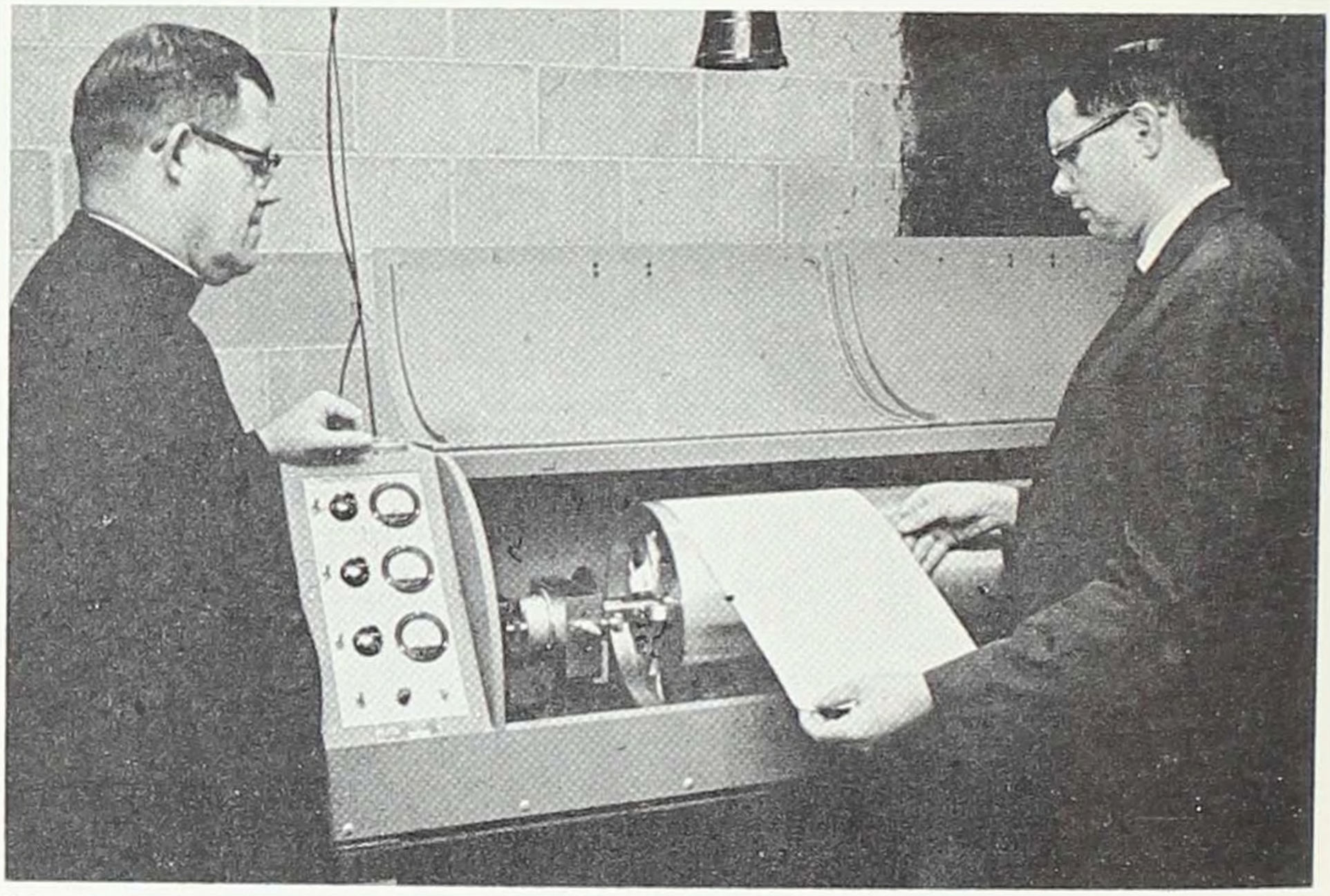


The center of the long white horizontal strips is the slit through which the beams of light enter the cabinet to reach the photographic paper which is mounted on a drum, revolving and moving laterally at the same time. The dark tubes below the slits house the lights which are reflected by the galvanometer mirrors.

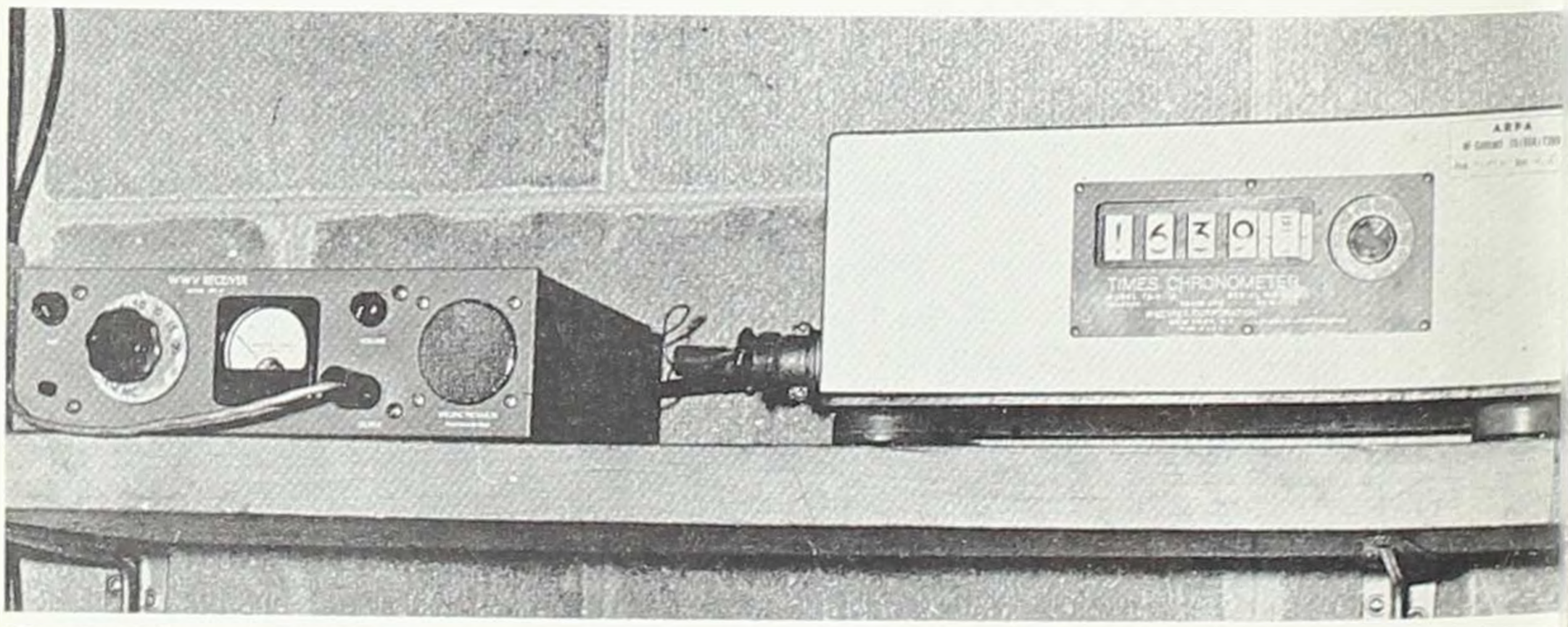
Schematic Representation of Process
of Recording a Seismic Wave -- The Seismograph



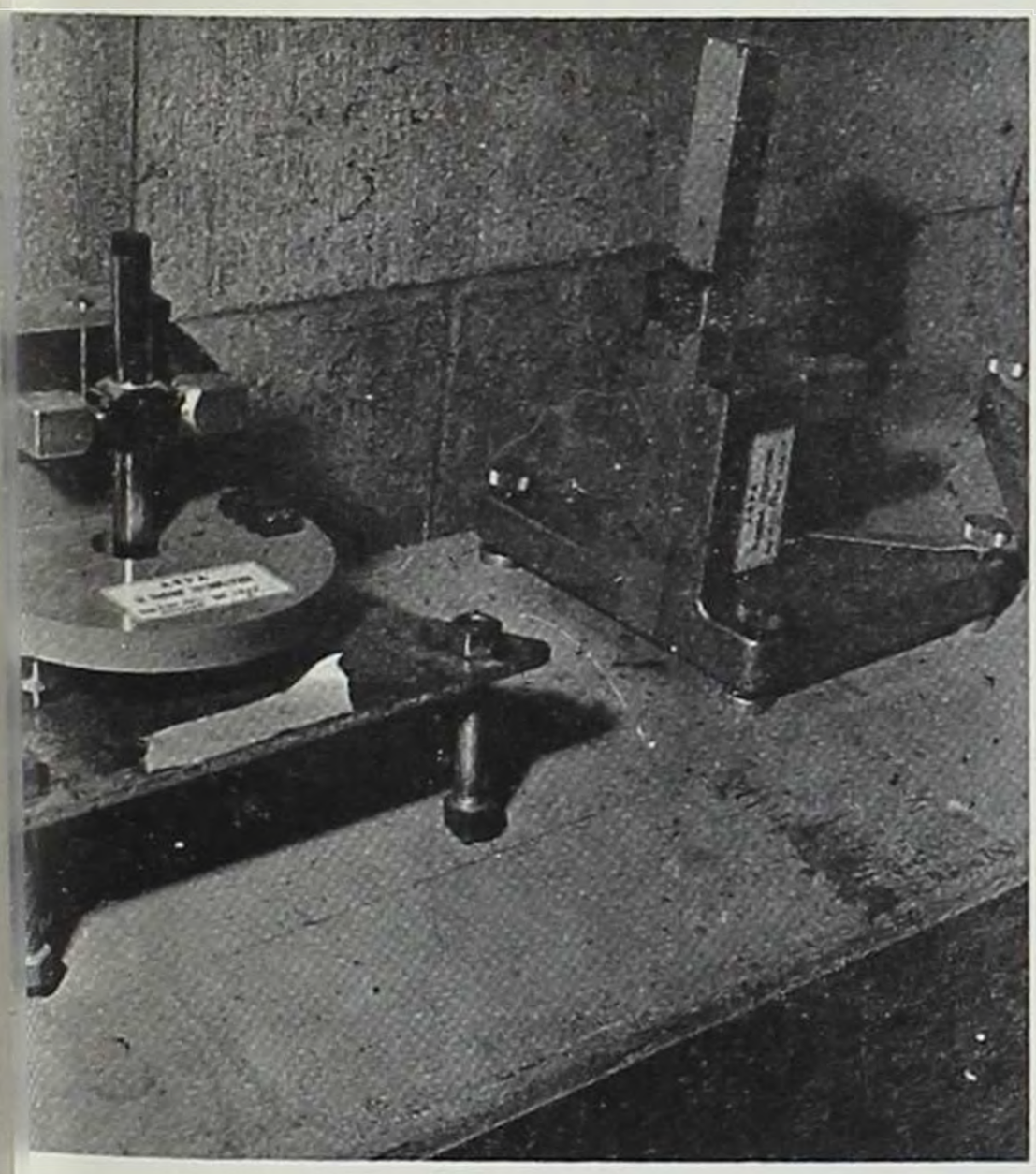
As the motion of the pier (due to seismic activity) produces relative motion between the inertial mass, "M" and the transducer, the transducer "converts" this motion into electrical impulses. These impulses cause the galvanometer mirror to oscillate which in turn causes the reflected light beam to move back and forth on the photo sensitive paper on the recording drum, producing a trace, or seismogram, which can be interpreted in terms of motions of the earth.

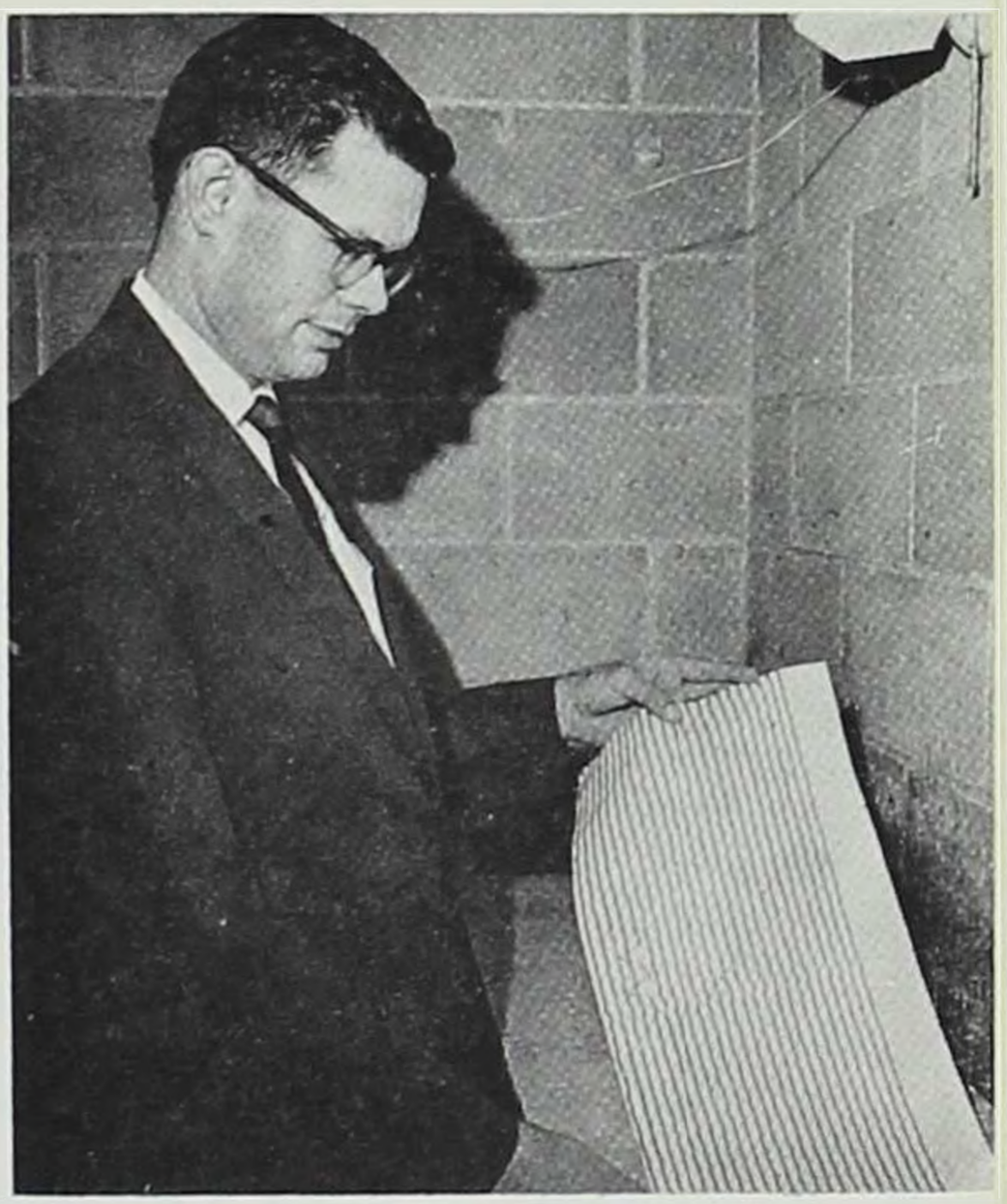


Mr. Cash is shown changing the paper on one of the drums in the recording unit with Father Hutchinson looking on. The cylinders on which the paper is placed are about three feet in length and take three of the long sheets of photographic paper.



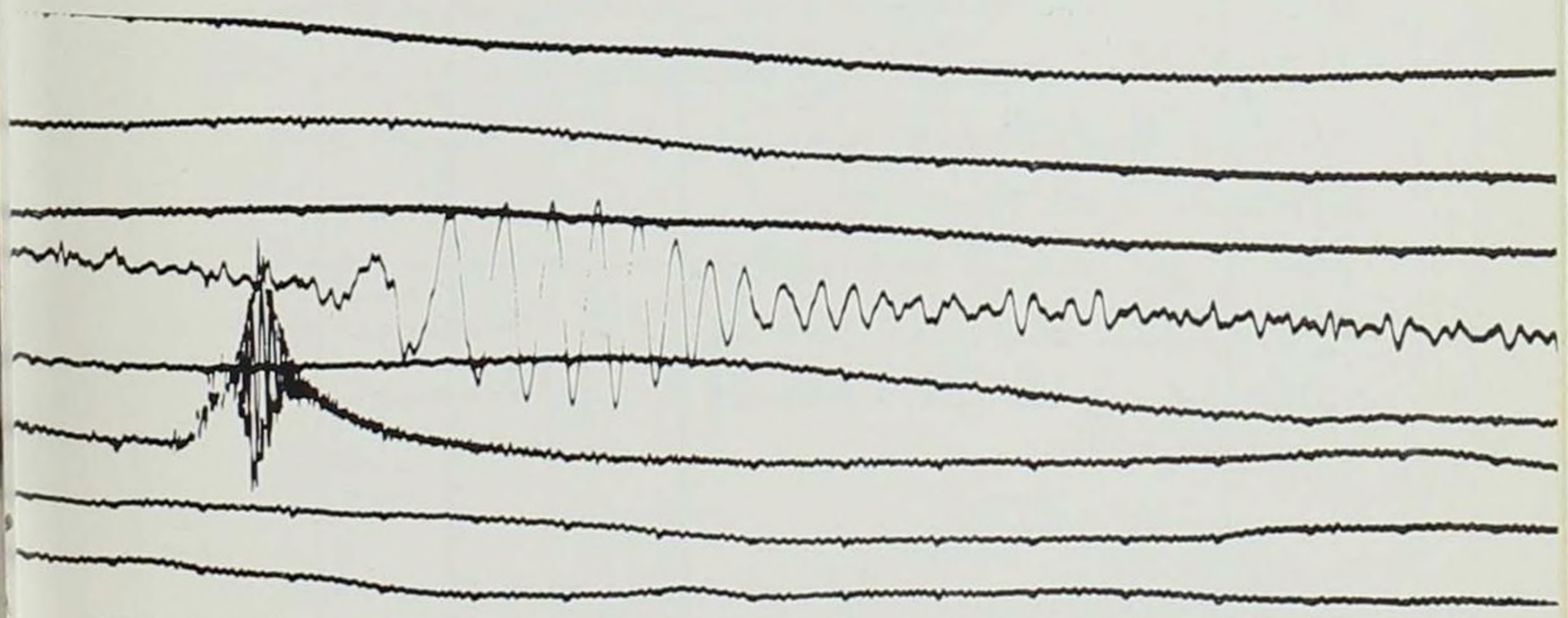
On the left is the WWV radio receiver for time calibration pulse and the time chronometer (clock Each minute of the day is designated on the recordings of the Loras station. If the chronometer is error by more than 0.3 second an adjustment is made.





(*Left*) This close-up shows a reflecting type galvanometer which records signals from the short period vertical series located in the adjacent room and Wood-Anderson (short period - N - S) type seismometer on the right.

(*Right*) Mr. Cash here removes from the developer one of the seismometer records, which are shipped to the home station of the network of five stations at St. Louis University. There the records of all five stations are studied by seismologists.



The dark diamond-shaped area on the above picture is the recording of the fall of 1965 quake which was felt in parts of Iowa and other Midwest states. This photograph was slightly retouched for newspaper reproduction so that the high and low points would be more readily observed on newsprint.

April 24th 1906

Dear Sarah -

I am alive. I lived on Crackers & water two days. Then walked ten miles to get something to Eat - about in five 3 hours. to get - something to Eat - Then Collapsed - and they all thought I was dead we are being fed - I was alone in my house and it rocked like a cradle Last - still I stood up. Then the fire burned it and I had to run for my life to the mountains - Lost Every thing - No one can Ever Describe the horrible things that took place - They put the wounded & dying in the square & Chloroformed them to Keep them from being burned alive. They did it to Keep them from suffering - little children the father & mother Dead lying on the streets helpless & dying. We had no water or light -

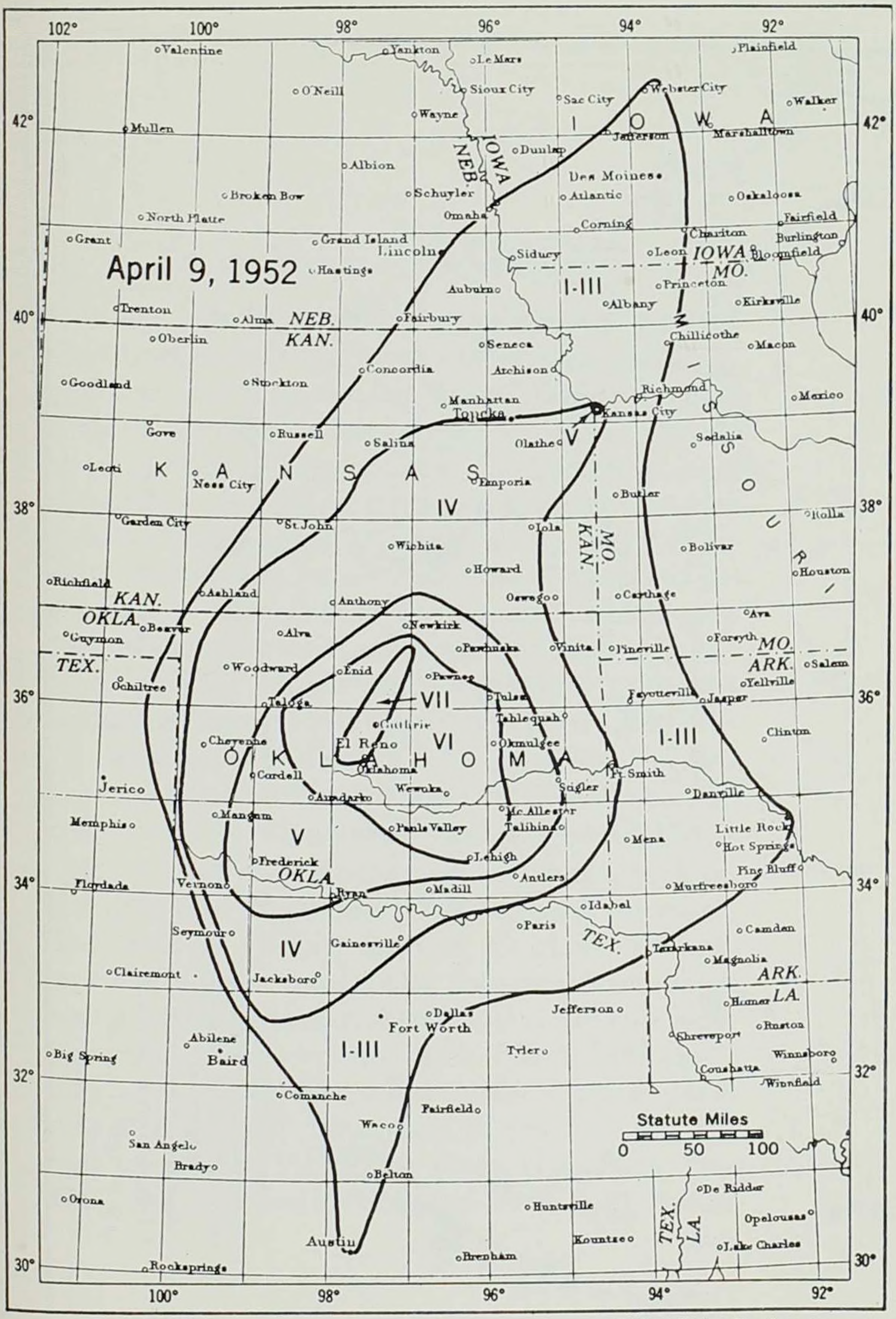
I am so nervous can not think - dont write I have no place yet to stick my head into

Nettie

If there is no Epedemic now we will pull through.

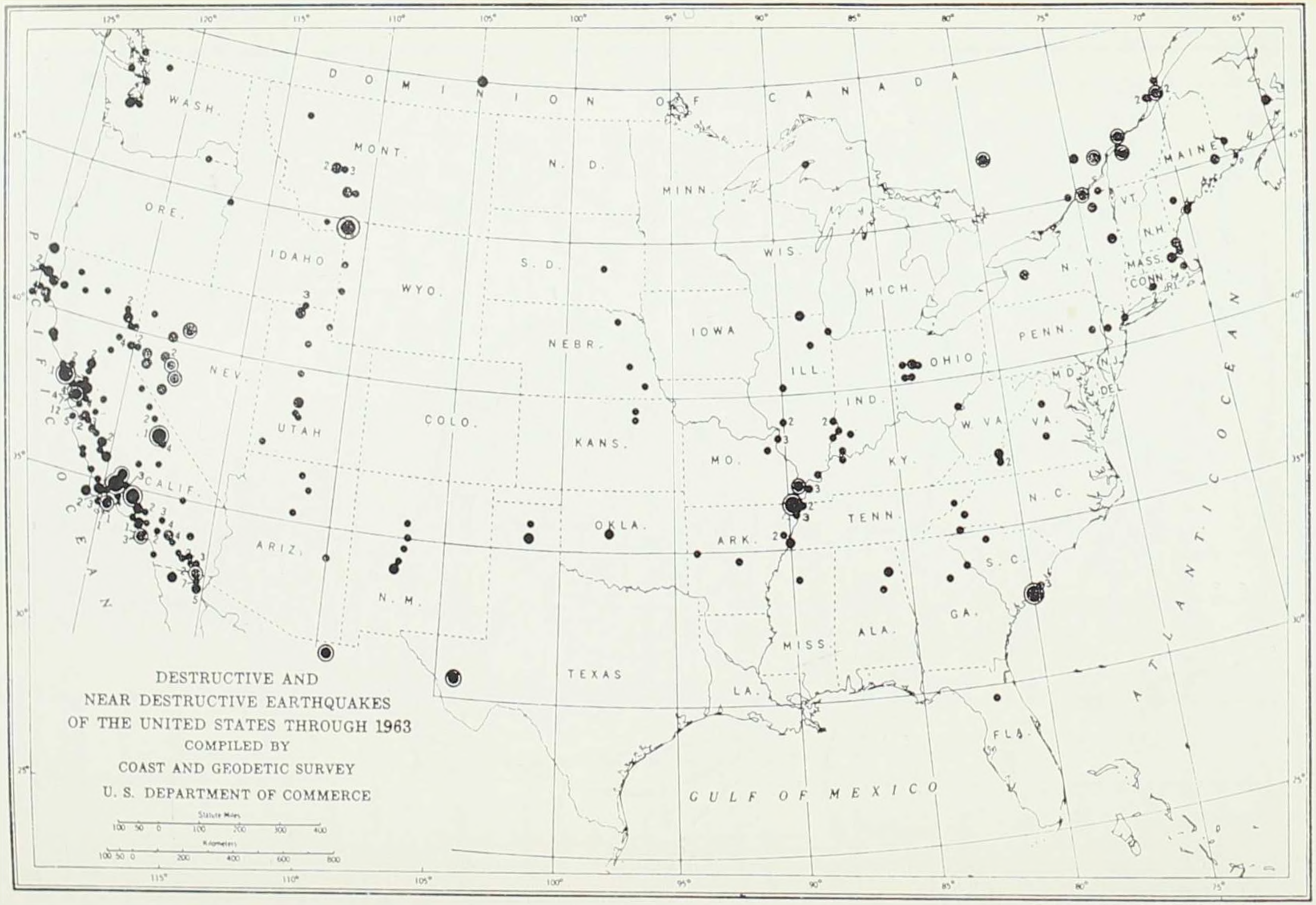
Courtesy Dr. H. P. Field of Decorah

Graphic letter written to a Decorah relative by a victim of the San Francisco Earthquake of 1906.



United States Earthquakes, 1952

Area affected by the earthquake of April 9, 1952. Note spread from Austin to Webster City, Iowa, the northern most point reporting the tremors.



United States Earthquakes, 1968

Destructive and near destructive earthquakes in the United States through 1963. Note particularly the Charleston, New Madrid, Los Angeles, San Francisco and St. Lawrence River Valley as sources of great or numerous earthquakes.

Long Beach to Anchorage

It was Good Friday in Anchorage and most of the citizens of the metropolis of Alaska had scurried home for their evening meals. Suddenly, and without warning, a disastrous earthquake struck, leveling much of metropolitan Anchorage in shattered ruins. It happened just a few seconds before 5:36 p.m. on March 27, 1964, a day that will be long remembered by all Americans as well as by Alaskans. The Alaska earthquake, which was both devastating and terrifying, demolished buildings, buckled streets and highways, crumpled bridges, destroyed 546 homes, damaged 1,246 others, and directly affected 3,319 families. In Anchorage alone, 215 homes were destroyed, and 157 commercial buildings were rendered unuseable.

It was not only Anchorage that was struck on this grim and tragic day. Other Alaska communities, such as Valdez, Seward, Cordova, Kodiak, and Kenai, were hard hit by this cataclysm which was described by many seismologists as "the most powerful quake ever to strike North America." The tidal waves that followed the Alaska quake caused death and destruction at points as far distant as Siberia, Japan, the Midway Islands, Hawaii, and the North American coast from British

Columbia to southern California. The Alaska earthquake had a magnitude of at least 8.4 on the Richter scale, compared to 8.25 for the devastating San Francisco earthquake of 1906.

Stunned by the appalling destruction (which Governor William E. Egan described as "a calamity such as no state has suffered since the Civil War"), Alaskans set resolutely to work to rebuild their homes and cities. President Johnson declared Alaska a major disaster area and appointed a former Iowan, Edward A. McDermott of Dubuque, then Director of the Office of Emergency Planning, to supervise the rebuilding of Alaska. It was a Herculean task since the property damage was estimated at $750,000,000.

The Alaska earthquake was recorded on seismographs throughout the world. Fortunately for students of seismology, the first seismograph station in Iowa had been placed in operation on the Loras College campus at Dubuque late in June of 1961, making it possible to detect earthquake tremors. A Loras News Bureau dispatch of July 3, 1961 declared:

> Six seismometers are housed in the underground vault, along with two photographic tracers. The equipment was installed by John Whitmore, director of seismograph stations for St. Louis University, and Tom McEvilly, research assistant from St. Louis. The Loras station is one of a new midwest network surrounding the principal station at St. Louis University. Others are at Kansas State University,

the University of Indiana, and Missouri School of Mines.

Reverend Donald R. Hutchinson, Ph.D., chairman of the physics department at Loras, will supervise the new station. Readings will be taken daily. Records of the Loras station will be the property of the United States Government.

The Loras College seismograph station is a valuable addition to this State's scientific apparatus and henceforth will play an important role in recording all tremors, many of which could not otherwise be detected in Iowa. In the case of the Alaska earthquake, the original shock was so great that it knocked one of the six Loras seismometers out of commission at the start of that violent convulsion.

The Alaska earthquake may bear comparison with two California quakes — Santa Barbara in 1925 and Long Beach in 1933. These are especially interesting because they were in an earthquake center and because both of them took place in a heavily populated urban area with many commercial and industrial buildings. Of the Santa Barbara earthquake. Professor K. F. Mather, Harvard University seismologist, wrote:

A moderately severe earthquake destroyed or damaged a number of poorly constructed buildings in Santa Barbara and startled southern California at 6:44 a.m., June 29. Because of the emptiness of the business district at that early hour, only 12 or 13 lives were lost. Switches were pulled and gas mains closed by the engineers on duty in the power house so that no fire added to the seismic de-

struction reported as more than seven million dollars. . . . Aftershocks were numerous and continued for several days.

The Long Beach and Los Angeles earthquake, on the other hand, was far more destructive, both in lives and property. L. D. Leet, seismologist in charge of the Harvard Seismology Station, reported approximately 130 killed, 5,000 injured, and property damaged to the extent of about $50,000,000 in the vicinity of Long Beach and Los Angeles by an earthquake that occurred about 5:55 p.m. on March 10th. The origin of the quake was placed a short distance off the coast between the towns of Huntington Beach and Newport Beach. The Seismological Laboratories at Pasadena reported as follows:

Damage was most extensive at Long Beach, which happened to be the largest center of population near the origin. Apparently stronger shaking at certain points where considerable destruction occurred was very probably due to the water-soaked alluvial character of the ground. At all points, spectacular damage was confined almost wholly to bad or improperly designed construction.

From the above three earthquakes one can readily see that damage to property and loss of life is in large measure governed by the intensity of the shock, the nature of the soil cushion, the presence of buildings and dwellings, and the density of settlement. The following statistics prove that not only Iowa, but the Nation as well, has been singularly fortunate in the relatively small losses of life

and property resulting from earthquake disturbances.

SOME MAJOR EARTHQUAKES SINCE 1811

From: United States Coast and Geodetic Survey

Year	*Place*	*Deaths*	*Year*	*Place*	*Deaths*
1811 Dec. 16	New Madrid, Mo.	———	1950 Aug. 15	India, Assam	1,500
1819 June 16	India, Cutch	1,543	1951 May 6	El Salvador	400
1822 Sept. 5	Asia Minor, Aleppo	22,000	1953 Feb. 12	Turud, Iran	530
1828 Dec. 28	Japan, Echigo	30,000	1953 Mar. 18	NW Turkey	1,201
1868 Aug. 13+	Peru and Ecuador	25,000	1954 Sept. 9-12	North Algeria	1,657
1875 May 16	Venezuela-Colombia	16,000	1955 Apr. 1	Philippines	435
1897 June 12	India, Assam	1,542	1956 June 10-17	North Afghanistan	2,000
1898 June 15	Japan, sea wave	22,000	1957 July 2	Northern Iran	2,500
1906 Aug. 16	Valparaiso, Chile	1,500	1957 Dec. 13	Western Iran	1,062
1906 April 18	San Francisco	452	1957 Dec. 13	Outer Mongolia	1,200
1907 Jan. 14	Kingston, Jamaica	1,402	1960 March 1	Agadir, Morocco	12,000
1908 Dec. 28	Italy, Messina	75,000	1960 May 21-30	Southern Chile	5,700
1915 Jan. 13	Italy, Avezzano	29,970	1962 Sept. 1	NW Iran	10,000
1920 Dec. 16	China, Kansu	180,008	1963 Feb. 21	Barce, Libya	300
1923 Sept. 1	Japan, Tokyo	143,000	1963 July 26	Yugoslavia	2,000
1932 Dec. 26	China, Kansu	70,000	1964 Jan. 18	Taiwan, Formosa	107
1935 May 31	India, Quetta	60,000	1964 Mar. 28	Alaska	114
1939 Dec. 27	Turkey, Erzingan	23,020			

The loss of life sustained in other parts of the world is truly appalling. Earthquakes, frequently accompanied by fires or tidal waves, have exacted a heavy toll. The slight tremors experienced in Iowa illustrate how fortunate citizens are who live in the Hawkeye State.

On November 12, 1934, a front page headline in the *Davenport Democrat* read: "Tri-Cities Shaken by Earthquake." The quake occurred about 8:44 on Monday morning. The *Democrat* reported in part as follows:

The quake was distinctly felt in all parts of the Tri-cities, and also at points as far south as Monmouth, Aledo, Alexis and Roseville, Ill., apparently extending over a larger area in Illinois than in Iowa. Buildings shook very perceptibly but there were no reports of any serious damage. . . . The offices of The Democrat and other Tri-city newspapers were swamped with telephone calls immediately after the shock. . . . In Davenport and Rock Island homes and buildings shook, dishes and windows rattled and there was much excitement. . . . Mrs. R. S. McKenzie, Rock Island, a former resident of Santa Barbara, Cal., said that the shock was as distinct as any she had experienced in California. . . . The disturbance today was the first that has been felt in this section since Jan. 2, 1912. A previous shock was felt on May 26, 1909, but there was no damage on either occasion.

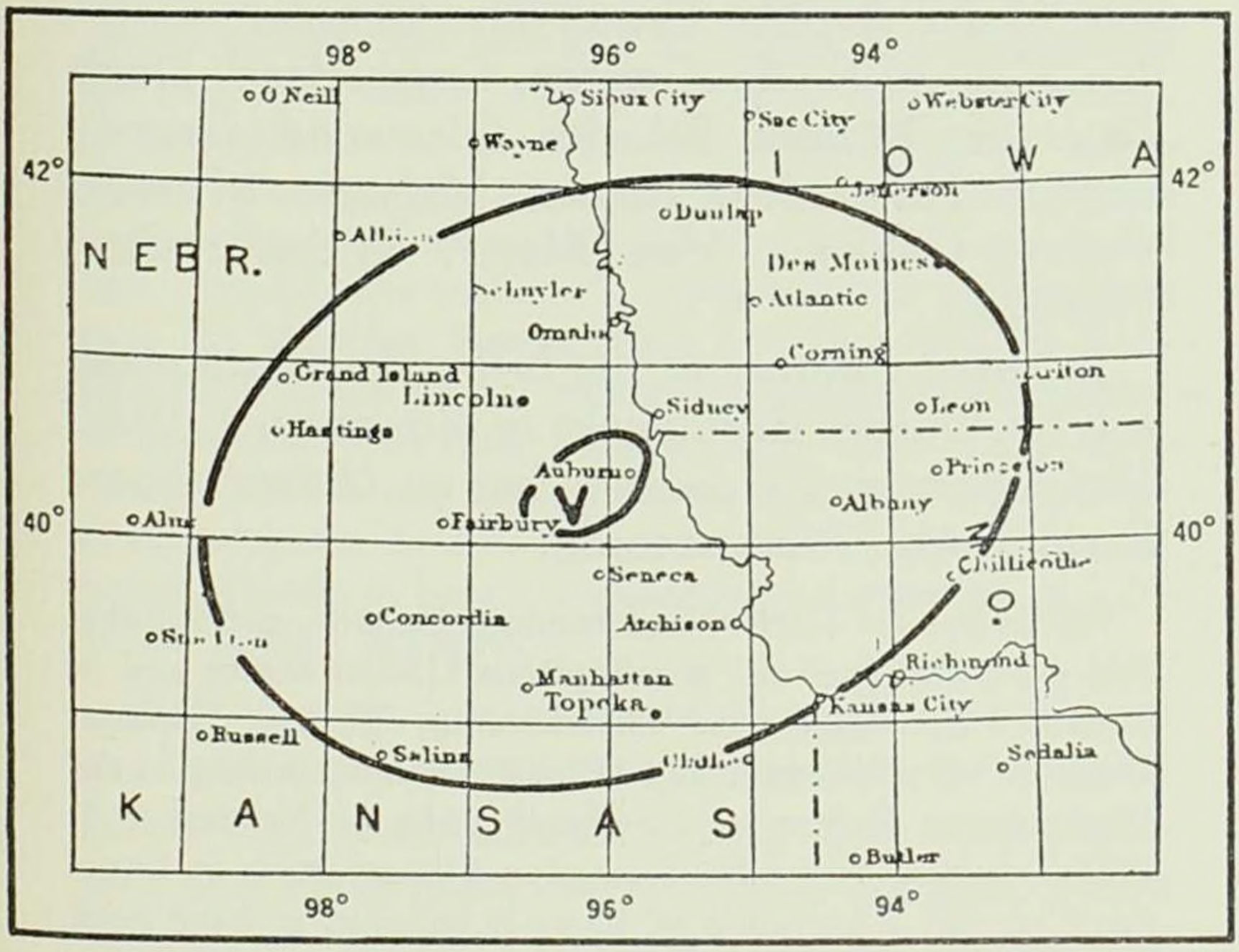
The earthquake was recorded on the seismograph at St. Louis University at 45 minutes and 33 seconds after 8 a.m. It was described as a "very mild quake" by Father James E. McElwane, who had charge of the St. Louis station.

Four earthquakes were felt in Iowa in 1935. On January 5 two distinct shocks were felt in Davenport and its sister cities across the Mississippi. Dishes rattled in the kitchen cupboard and windows shook, but no damage was done. The following month, on February 26 at 8:15 a.m., two "abrupt trembling shocks" were felt at Burlington. They were accompanied by rattling of dishes but no damage was reported.

A third shock had its center in southeastern Nebraska and was felt throughout southwestern

Iowa. The official Coast and Geodetic Survey report, *United States Earthquakes, 1935,* reads:

March 1: 5:00 Nebraska. Intensity VI. See map on this page. Two shocks, 4 minutes apart, the first strong, the second weak. Felt in Nebraska, Kansas, Iowa, and Missouri. The point of maximum intensity was near Tecumseh, Nebr., where chimneys were cracked and a few collapsed. A few windows were broken, and cracks appeared in plaster and stone walls. Several other places reported intensity V as indicated by the smaller ring on the map. The epicenter was at approximately 40° 20′ north, 96° 12′ west, and the area affected close to 50,000 square



United States Earthquakes, 1935

miles. The shock was recorded on seismographs at St. Louis, Florissant, Ann Arbor, Chicago, and Des Moines,

Iowa. This earthquake is attributed to a slight slip along the old fault which delimits the east side of the buried Nemaha mountains.

According to *United States Earthquakes, 1935,* an intensity of V was recorded in Riverton where all felt the shock. Deep cemented wells were cracked causing water to leak out. An intensity of IV was recorded in Clarinda, Emerson, Keosauqua, Mt. Ayr, Tabor, and Thurman.

The following Iowa towns recorded an intensity of III: Albion, Anita, Atlantic, Bedford, Carroll, Cedar Rapids, Centerville, Chariton, Corydon, Council Bluffs, Creston, Cumberland, Davis City, Des Moines, Elkader, Glenwood, Grundy Center, Hawarden, Logan, Melrose, Missouri Valley, Oakland, Van Meter, Webster City, Winterset.

In sharp contrast to the Nebraska Earthquake was the Quebec Earthquake of November 1, 1935. The Coast and Geodetic Survey *United States Earthquakes, 1935,* records:

November 1: 1:04. Timiskaming, Canada, earthquake. Felt generally over the northeastern United States and in Canada. Epicenter near Timiskaming, Quebec, Canada, at about 46° 47′ north, and 79° 04′ west, according to the "Preliminary Report of the Earthquake of November 1, 1935," published by the Dominion Observatory at Ottawa, Canada. The depth of focus is believed to have been normal or very slightly greater.

The earthquake was felt over an area of nearly 1,000,000 square miles in the United States and Canada.

. . . In the epicentral region the damage was relatively slight, largely because of the sparsity of population. Cracks were found in gravel, sand, and soft earth, but none in bedrock.

An intensity of III was recorded at Dubuque according to the Geodetic Survey report. The *Telegraph-Herald* of November 5, 1935, carried the following brief notice for additional information:

> The Local Weather Bureau office has received several reports of the recent earthquake disturbances being observed in Dubuque. Some of the disturbances being reported included the swinging of mirrors and pictures and the rocking of chairs, and quivering or shaking sensation of individuals. Anyone who had such experience in this locality at about the time reported for the recent severe earthquakes in Montana [October 11 and 18] and in the east [Quebec, November 1], is requested to communicate with the Weather Bureau office, and to furnish as much information as to time of occurrence, and general evidences of earthquake vibrations. Apparently there was no local damage, but if any was observed, it should be reported along with the date and time, nature of damage, movements of walls or house furnishings, and sensation of individual making the report.

This search for widespread confirmation of a quake at the time it occurred has always been important in determining the extent of an earthquake. Not that earthquakes were readily forgotten! On November 6, the *Telegraph-Herald* carried the following dispatch from Cedar Falls:

> The wave of earthquakes over the northern United

States today brought to the minds of old timers the fact that a quake rocked Cedar Falls about 40 years ago.

Roger Leavitt said he didn't remember the exact date [it was October 31, 1895] but that it "gave everybody a good idea of what a quake was."

It did little more than to make pictures on the wall "dance tangoes," and to "give everybody a good scare," he said.

On November 23, 1939, an earthquake that had its epicenter in the southern Illinois area, a short distance south of St. Louis, was sufficiently strong to cover an area of 150,000 square miles. It occurred at 9:15 a.m. and was reported in six states — Indiana, Illinois, Missouri, Iowa, Wisconsin, and Kansas. At Keokuk several persons phoned the *Gate City* to report the tremors. Iowa City felt the tremors, the latter apparently being the northernmost point in Iowa. At any rate the *Davenport Democrat* referred to the quake in Keokuk and Iowa City but made no mention of local detection, even though Davenport is credited with an earthquake the following day at 1:45 p.m.

The *Iowa City Press-Citizen* of November 23, 1939, records:

> Employees on the sixth floor of the Iowa State Bank and Trust Co. building were alternately frightened and amazed at 9:20 o'clock this morning as pictures rattled on the wall and office equipment quivered in response to what apparently was the first earthquake ever felt in Iowa City as such. . . . Miss Mona Newkirk, secretary for the law firm of Hart, Dunlap and Carson, was alone in her sixth

floor office when the quaking occurred. "I was so frightened I just froze!" she declared later. When she realized that the picture hanging against the west wall of the room was actually rattling, Miss Newkirk says she barely subdued an impulse to run out into the hall. Just then she noticed persons emerging from other offices on the same floor all of them astonished and curious as to what it was all about.

The tremors lasted for about 30 seconds and the bulk of the reports came from those occupying the fifth and sixth floor of the Iowa State Bank Building.

Among those reporting the tremors were Dan Dutcher, R. G. Popham, H. W. Vestermark, and Hal Stewart. University authorities were quoted as saying that "probably the last important earthquake felt in this part of the country" was in 1811 but Prof. C. C. Wylie cautioned "there is not a region in the United States immune" from earthquakes. Both the St. Louis University and Marquette University seismographs recorded the earthquake although the latter indicated it as a "mere tremor" probably caused "by the fall of huge rocks in caverns deep in the earth."

Possibly one of the weakest and in some respects the most mysterious earthquakes occurred at Iowa City on April 19, 1948. On that balmy spring day Dr. J. W. Wells of the College of Dentistry at the University of Iowa decided to have a quarter-mile-long ditch dynamited on his 80-acre farm a few miles south of Iowa City. Some 800

sticks of dynamite were placed in soggy ground, each stick being set about one foot apart. The dynamite was touched off with deafening results, throwing a solid sheet of mud and water over two hundred feet into the air. The desired results were obtained — Dr. Wells had his drainage ditch but hundreds of Iowa Citians, unaware of the blast, were scared out of their wits and began deluging the police department and other centers of information with telephone inquiries. It was some time before the exact cause of the detonation and tremors was satisfactorily explained.

The following day word was received from Reverend Henry F. Birkenhauer of the John Carroll University staff at Cleveland that at exactly 16 minutes and 51 seconds after 8 o'clock on Monday night (Central Standard Time) the University seismograph recorded an earth disturbance centered in the vicinity of Iowa City. The 8:16 tremor was so weak it went undetected by Iowa Citians, who one hour earlier had been thoroughly alarmed by Dr. Wells' man-made earthquake. The *Iowa City Press-Citizen* of April 20, 1948 wisely concluded: "Even if the tremor had stopped for a half-hour rest in Chicago on its way to Cleveland, it couldn't be the same that shook houses here at 7:10 p.m." Although *United States Earthquakes* sets the date as April 20 both the dynamite blast and the actual earthquake recorded at 8:16 p.m. in Cleveland occurred on April 19.

On April 9, 1952, southwestern Iowa was visited by an earthquake that centered in Oklahoma. It was described by Dr. Ross Heinrich, professor of geophysics at St. Louis University, as "one of the strongest shocks ever recorded in the midwest." The U.S. Coast and Geodetic Survey in its *United States Earthquakes, 1952,* records:

April 9: 10:29:15. Epicenter 35.4° north, 97.8° west, 5 miles southwest of Oklahoma City, Okla., W. Felt over a 140,000-square-mile area, including Oklahoma, except the panhandle section, eastern half of Kansas, southeastern tip of Nebraska, northern and central section of Texas, and throughout the western section of Iowa, Missouri, and Arkansas. Slippage along the Nemaha Fault was effected by slight displacement of the buried granitic ridge beneath. The felt data conforms to the known trace of the fault, i. e., the strike is northeasterly from Oklahoma City toward Kansas City and Des Moines, an echelon faulting at the hinge point in the Oklahoma City region, then a southerly strike toward Austin, Tex. (See Pix insert.) Damage was not extensive. Portions of chimneys fell in El Reno and Ponca City. Bricks loosened from a building wall and tile facing of commercial buildings bulged at Oklahoma City. Maximum intensity VII. Magnitude 5.5.

The magnitude of the 1952 earthquake is revealed by the map showing that from Webster City on the north to Austin, Texas, in the south, citizens described the tremors. Points in southwestern Iowa were especially numerous. For example, the *Red Oak Express* of April 10, 1952, recorded the reactions of numerous citizens who had felt and witnessed the tremors. Those report-

ing were invariably on the second or third stories of buildings. Charles Reese, whose office was in the Enquist Building, said the building "seemed to weave as if in a high wind and that he could see the walls of his second floor office move. He estimated the length of the tremor at 30 seconds. Tom Lomas, who has an office across the hall from Reese, also felt the shock."

People on the second and third floors of the Montgomery County courthouse experienced the shock but those on the first floor did not detect it. An artist at the Thomas D. Murphy Company plant said "his drawing board shook and light fixtures trembled." Another Red Oak office employee experienced "a rocking sensation leaving an effect of being slightly ill."

In Shenandoah, venetian blinds "rattled" and some observers saw buildings "sway slightly." In Des Moines, James L. Cooper, who had been in a Seattle earthquake a few years previously, declared: "It felt about the same as my Seattle experience, but not quite so violent. My chair swayed a little. It was kind of a sinking feeling."

Occupants of numerous tall buildings in Des Moines experienced the tremors. In the new State Office Building women employees said "the shock made them feel dizzy and faint." Several grabbed filing cabinets to keep from falling. Desks and chairs rattled and swayed, and light fixtures swung like clock pendulums.

At Webster City, the northernmost point in Iowa reporting the earthquake of 1952, Mr. and Mrs. A. C. Schuneman, who lived in an apartment above the Isis theater, reported that "plaques fell off the apartment walls and a bridge lamp swayed back and forth about three inches at about 10:30 a.m. today."

The most recent earthquake recorded in Iowa was felt in eight Midwestern states on October 20, 1965. An Associated Press dispatch from St. Louis declared:

> It started at 8:01 p.m., C.S.T., and lasted for 14 minutes on the seismograph at St. Louis University. However, residents of Kansas, Missouri, Arkansas, Nebraska, Iowa, Illinois, Kentucky and Tennessee felt it only for a few seconds.
>
> Dr. Carl Kisslinger, chairman of the university's geophysics department, said the quake was recorded at between 4.5 and 5 on the Richter scale. The disastrous Alaskan quake of 1964 hit 8.4 on the scale. "There's no doubt about it," said Kisslinger, "it was an earthquake, and it was a significant earthquake for this part of the world. If the center had been under a city, there would have been a lot of damage."

Dr. Otto Nuttli, another St. Louis University geophysics professor, declared it was the "most widely-felt quake in the Midwest since 1917." He placed the center of the quake in Reynolds County in the Ozark Mountains about 100 miles southwest of St. Louis.

Although the tremors were not sufficient to make

many Iowans aware of it, the quake was nevertheless reported at points as widely separated as Des Moines, Ottumwa, and Burlington. An Associated Press dispatch indicated the tremors were felt in St. Joseph's Hospital in Ottumwa, particularly by those patients and nurses on the fourth floor. Several reports were made in Burlington, where one man, who had been in an earthquake before, said a building he was in shook, "and it wasn't just the building." The operator of the control tower at the Des Moines Municipal Airport said there was a rumble as if a big jet was taking off, only there was no jet. Three firemen in Des Moines also reported evidences of the quake.

The earthquake of 1965 may have made newspaper headlines but it did little else. The vast majority of Iowans were totally unaware of the tremors which were actually felt by relatively few citizens in the affected area.

MODIFIED MERCALLI INTENSITY SCALE OF 1931

(ABRIDGED)

I. Not felt except by a very few under especially favorable circumstances. **(I Rossi-Forel scale.)**

II. Felt only by a few persons at rest, especially on upper floors of buildings. Delicately suspended objects may swing. **(I to II Rossi-Forel scale.)**

III. Felt quite noticeably indoors, especially on upper floors of buildings, but many people do not recognize it as an earthquake. Standing motorcars may rock slightly. Vibration like passing of truck. Duration estimated. **(III Rossi-Forel scale.)**

IV. During the day felt indoors by many, outdoors by few. At night some awakened. Dishes, windows, doors disturbed; walls make creaking sound. Sensation like heavy truck striking building. Standing motorcars rocked noticeably. **(IV to V Rossi-Forel scale.)**

V. Felt by nearly everyone, many awakened. Some dishes, windows, etc., broken; a few instances of cracked plaster; unstable objects overturned. Disturbance of trees, poles, and other tall objects sometimes noticed. Pendulum clocks may stop. **(V to VI Rossi-Forel scale.)**

VI. Felt by all, many frightened and run outdoors. Some heavy furniture moved; a few instances of fallen plaster or damaged chimneys. Damage slight. **(VI to VII Rossi-Forel scale.)**

VII. Everybody runs outdoors. Damage *negligible* in buildings of good design and construction; *slight* to moderate in well-built ordinary structures; *considerable* in poorly built or badly designed structures; some chimneys broken. Noticed by persons driving motorcars. **(VIII Rossi-Forel scale.)**

VIII. Damage *slight* in specially designed structures; *considerable* in ordinary substantial buildings with partial collapse; *great* in poorly built structures. Panel walls thrown out of frame structures. Fall of chimneys, factory stacks. columns, monuments, walls. Heavy furniture overturned. Sand and mud ejected in small amounts. Changes in well water. Persons driving motorcars disturbed. **VIII+ to IX— Rossi-Forel scale.)**

IX. Damage *considerable* in specially designed structures; well-designed frame structures thrown out of plumb; *great* in substantial buildings, with partial collapse. Buildings shifted off foundations. Ground cracked conspicuously. Underground pipes broken. **(IX+ Rossi-Forel scale.)**

X. Some well-built wooden structures destroyed; most masonry and frame structures destroyed with foundations; ground badly cracked. Rails bent. Landslides considerable from river-banks and steep slopes. Shifted sand and mud. Water splashed (slopped) over banks. **(X Rossi-Forel scale.)**

XI. Few, if any, (masonry) structures remain standing. Bridges destroyed. Broad fissures in ground. Underground pipelines completely out of service. Earth slumps and land slips in soft ground. Rails bent greatly.

XII. Damage total. Waves seen on ground surface. Lines of sight and level distorted. Objects thrown upward into air.

Airplane view of Loras College from the east. The seismograph station is hidden by shrubbery on extreme right of the campus.