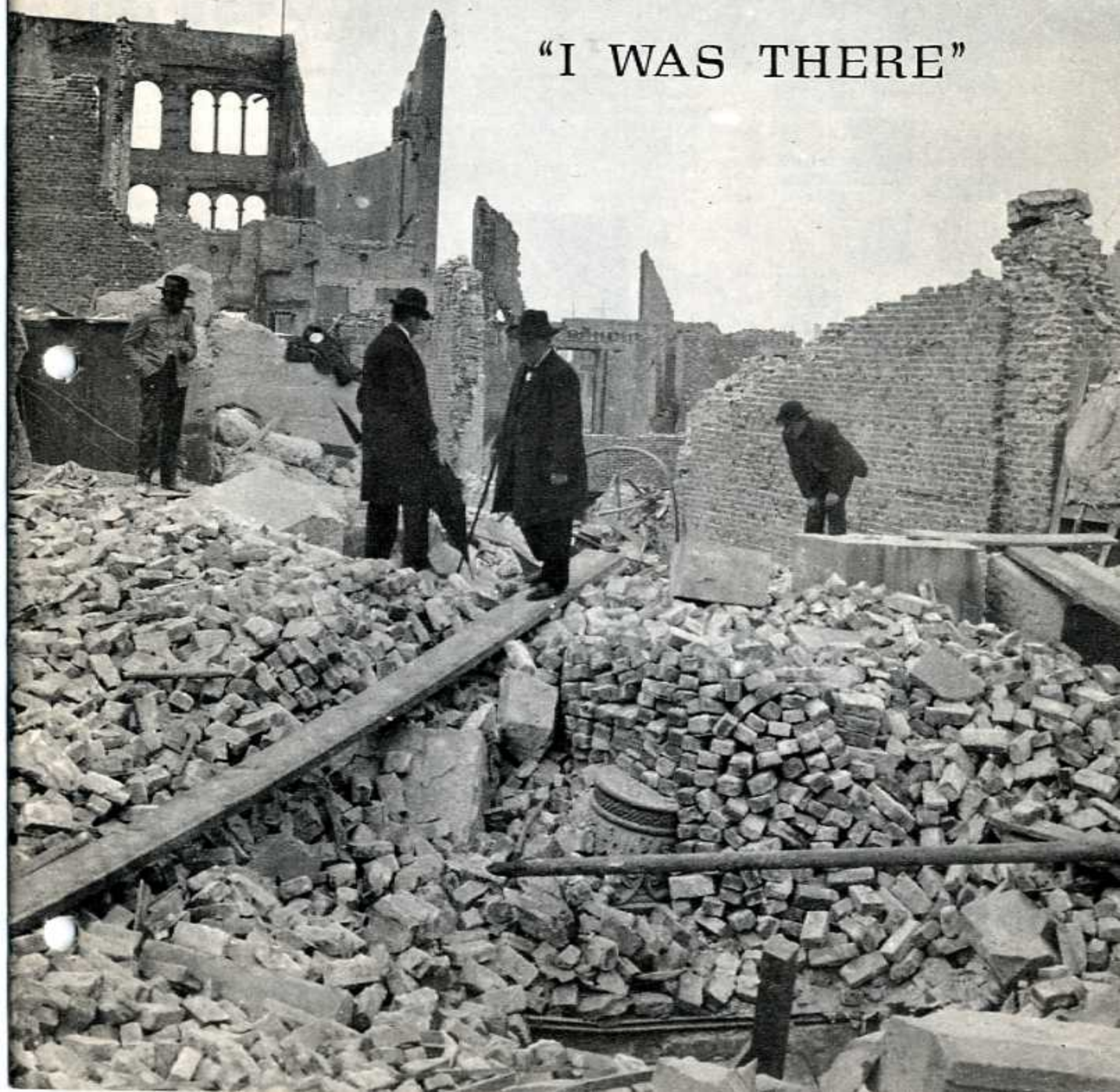


# CALIFORNIA GEOLOGY

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"I WAS THERE"





Few of us have been in as many earthquakes as the author of this article, a long-time subscriber to this magazine. He has given us his reminiscences: as a student-soldier and an engineer, as well as a careful observer. We are sure you will enjoy them . . . Editor

## I WAS THERE

By Stuart H. Ingram



Hamilton Square between Geary and Post, Scott and Steiner Streets, San Francisco, after the fire that followed the earthquake of 1906. St. Dominic's Church is in the background. Photo gift of O.K. Cushing, from Society of California Pioneers, San Francisco earthquake and fire folder 21A.

One's first earthquake is the worst, and my first was the one that hit San Francisco 18 April 1906, close after five o'clock A.M. So far, it is the worst in California for this century, and with two-thirds of it gone it may well end up as the 20th Century's worst for California. To most people the first shock brings a feeling of absolute consternation with the ground rolling and jolting, and apparently about to dissolve beneath you. Your brain freezes and your legs

melt, but within seconds a measure of conscious thought returns, and usually before the movement ceases you regain control of your body. If you can think that out promptly you may be able to laugh at your next earthquake, or at least act without panic. Earthquakes do not destroy men, they only destroy some of man's imperfect works. The original inspiration may have been faulty, the planning incorrect or the construction carelessly done. Earthquakes accompany

the adjustments within the earth to meet constantly changing conditions. Such adjustments have been going on for hundreds of millions of years, during which time Mother Earth has been preparing our planet for man's habitation and well being. Any destruction to man's works occurs only when they get in Earth's way. Such thoughts as these have been formed from my experiences in four earthquakes, all of them with high Richter seismic ratings.





Potrero Relief Camp 69 on 28 May 1906. Turrill and Miller official photo, from the Charles B. Turrill collection, Society of California Pioneers, San Francisco earthquake and fire folder 21A.

On that 18 April I was a Sophomore at the University of California in Berkeley and the shock woke me up. I was warm and comfortable, but the whole room seemed to be undergoing a rocking on its edges. My first thought was that it could not stand much of that sort of beating, and since I couldn't see the lower edges and corners I looked at the ceiling. It was O.K., and I lost the feeling of being in danger. By then I heard the noise of my fraternity brothers "getting the H out", so I threw on some clothes and joined them. The street was full of fraternity men and sorority sisters. The latter seemed to have gotten out as fast as the men, but in no time they realized the informality of their attire and started getting back indoors as fast as they came out. In those days the girls were truly modest. But while the girls furnished the first laugh, the 'quake came back with its discomforts. Our usually jovial Japanese cook, one Frank G. Sugitani, was in a foul humor for much soot had been shaken down into his normally spick and span kitchen. So, to keep out of his way, we abandoned ideas of breakfast for the time, got into proper clothes and went out to look over the damage. There was really very little, for Berkeley was almost entirely two-story frame dwellings with give enough to withstand the shaking. Chimneys were nearly all thrown down, but the campus buildings seemed undamaged, so we returned to the fraternity house to find breakfast ready with our cook back to normal.

After breakfast it was soon apparent that everyone was shaken completely out of orbit. The University announced that no classes would be held for that day. Later, news began to come in that San Francisco had been hard hit with buildings down, fires all over town, streets cracked up and filled with rubble, and no streetcars running. Many Berkeley commuters did not go to work, leaving people walking the streets, talking and worrying over San Francisco's sad plight. About noon the University announced that college work for the rest of the term was abandoned, all students graduated or promoted without the usual examinations. With the announcement the whole town took on a kind of holiday air of gaiety. As news continued to get worse the air of gaiety faded. San Francisco was hard hit, more fires started, and uneasiness began to arise that total demoralization was close, and the danger of riots would require National Guard troops.

The University had a cadet corps of about 500 Freshmen and Sophomores, and we heard that we might be sent in as a stop gap until the National Guard could be mobilized. That rumor grew

and was confirmed late in the afternoon by orders for the cadets to report to Harmon Gym after dinner in uniform with a blanket and lunch. It was about 7pm before we were assembled with rifles and bayonets, to which were added five rounds of ammunition. So we became soldiers. The normal transportation of train and ferry took us across the bay, but when we passed through the Ferry Building we seemed truly at the front. The pavement of Market Street was broken up, rubble from 'quake- and fire-destroyed buildings, coupled with fire hoses everywhere made the streets impassable. There were of course no streetcars.

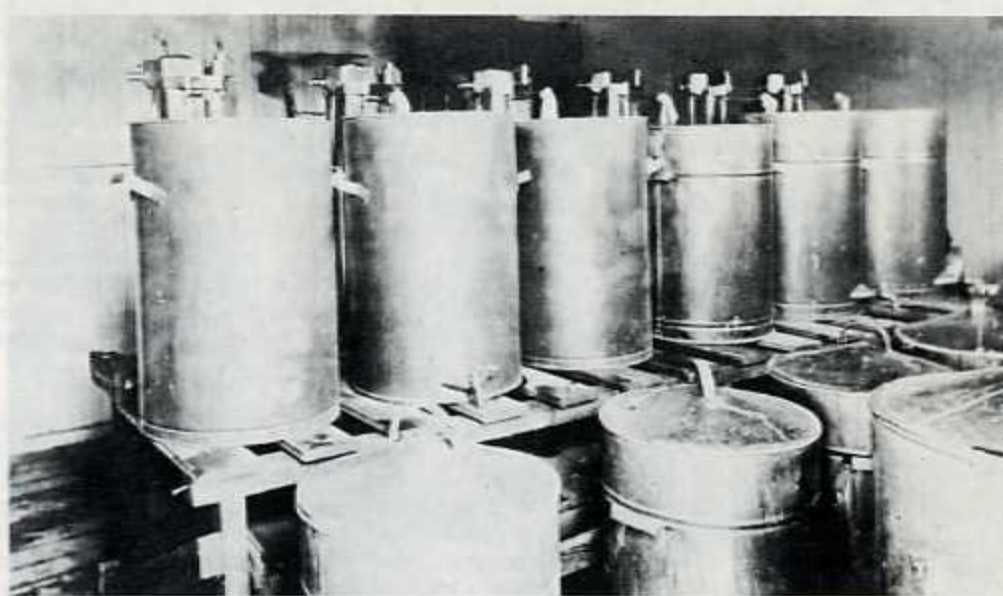
We were marched north, close to the waterfront to the vicinity of Telegraph Hill, then west along I don't know what street or streets to Divisadero St., then east to Ellis where we made our camp in the yard of a school. We had to march clear around the fire area, probably 4 miles, for it was 10 o'clock by the time we encamped. Half of us were immediately put on guard duty, and as I was one of them I was posted on a corner near our camp with orders "to keep order, and fire if necessary." As



An "ideal" street kitchen. Photo from Charles B. Turrill collection, Society of California Pioneers, San Francisco earthquake and fire folder 21A.



Sterilized water stored in tanks at Lobos Relief Camp (Funston Playground) after the 1906 earthquake. Photo gift of O.K. Cushing, from Society of California Pioneers, San Francisco earthquake and fire folder 21A.



the rest of the guard moved off I noted a small crowd being entertained by an Irishman who was evidently quite high. I felt very lonely and inadequate. The Irishman appeared to present a problem, and my rifle did not seem to be a proper weapon. I certainly did not want to kill anyone and I would have gladly traded rifle and bayonet for a good husky billy. The Irishman was pretty big and pretty drunk, and as long as he was in a good humor I did not want to start giving him orders, so I just ignored him. When I was relieved at midnight he was still good humored, still high and having a ball.

At camp I found my blanket. My lunch had been eaten hours before, so I found a place to sleep in a yard on the south side of Divisadero St., in someone's front yard behind a wrought iron fence. I tried to go to sleep, but the sidewalks were full of people — refugees from the fire area — and I was uncomfortable. A woman in one of the groups that passed saw me and said "Look, that poor soldier has no pillow. Let's give him one." And with that she tossed me in a sofa pillow. I murmured a thank you, stuffed it under my head and soon was asleep. I woke up about dawn feeling groggy, and asked some of my fellows if any of them knew where to get a cup of coffee, for we were in a residential district. One of them said "Sure. Go up Ellis half a block to a little side street leading off to the right. Go down it about three or four houses, on the south side and you will see a low wall with some coffee cups on it. Take one of them, go in the side door, along a dark hall to the kitchen and they will give you coffee." It sounded like a fairy tale, but I wanted some coffee and took a chance. Sure enough, there was the street, the wall, the cups, the side door, the dark hall which I followed, entered the kitchen and asked for coffee. A woman near the stove said sure, filled my cup and handed it to me with the usual cream, sugar question, and motioned me to a chair. The coffee was hot, and I thankfully sat and stirred it.

A man across the room looked me over closely saying "Bub, you look like you could use something stronger than coffee." I said, "you are right," and handed him my cup. He took it and laced it well with whiskey. That was 67 years ago but I still remember it as one of the most welcome drinks ever.

Just as I finished the coffee I heard the order from camp to "Fall in" and I hurried back, with as yet no breakfast. During the night our officers had reorganized our companies, and being a Corporal, I was given my regular squad. We were marched east to Fulton St., south on Fulton to Arguello. I was given Arguello from the Panhandle west to guard, so I posted my men, one to a block, for seven blocks. The street was lined with nice two-story homes, then quite far from the fire zones, but gas and electricity had been turned off, all lights and fires in the buildings forbidden. The residents were uneasy, fearing orders to abandon their homes and move farther out. While waiting they were making the best of it, and each family had built a little fireplace in their gutter with bricks fallen from their overthrown chimneys. The residents were all out cooking breakfast, each family on its own little fire. Before I had gone half a block I was invited by one family to have breakfast with them. Naturally I accepted, and afterwards, when I continued my walk down my street I received at least one other breakfast invitation per block. Later I

was told that each of my men had similarly breakfasted well, and thereafter we never suffered from our lack of a commissariat. All such invitations were given with an air of "we haven't much but come and join us." We reciprocated by helping them in little ways whenever possible. My squad had a block of the Panhandle to guard, and it was filling rapidly with camping refugees from town, forced out by advance of the fire. The campers were scantily supplied with bedding, food, etc. and were self contained, each family in a nook between the trees. The lack of sanitary facilities soon appeared, but I handled it by canvassing houses facing the Panhandle on its west side, with requests to open toilets to the campers. There was no lack of volunteers, each posting entrance signs, male or female, according to their wishes.

One comment here on the San Francisco Police. They were apparently concentrated along the fire line and I only saw two of them in the 3 days of day guarding. The first came through our cadet guarding area. He had been on two-day duty, and was trying to get home for a rest. We had been instructed that anyone entering our area was to be questioned as to where he was going and why. If his trip sounded normal or necessary he was escorted by the cadet on that block who turned him over to the next one of our boys. I asked him how the system was working. "Well" he said "It's kind of slow this halting each block. But I sure felt safe." I saw



the second one when I investigated a complaint from one of our residents that a corner saloon was still open, against standing orders. I found the front door locked, but a back yard gate opened when I pressed the latch. In the back yard were several men drinking beer in a quiet way. One was a policeman, who was off duty, one was the proprietor, the others were customers. I told the bunch it did not look to me like cricket, and they all seemed abashed, they sort of slunk out, the proprietor locked the gate, and I heard no more complaints.

Another example of high morale came from the proprietor of a small corner grocery. He hailed me and said that he thought the fire would reach his store, that it was impossible to remove his stock, and that if I would have a couple of my men keep it orderly he would like to throw his doors open and let the neighbors and neighboring campers come in and help themselves. He seemed to feel that all the neighbors were customers anyway, and that the refugee campers needed all the help they could get. I told him I appreciated

his spirit, and I called in one man and the two of us ran his charity show. We let in 25 at a time, then cleared the store for another 25. There was no crowding, everything went off quietly, and the proprietor was thankful. He showed his appreciation by giving each of us a long, slim loaf of French bread, a square of honey in the comb, and a half pint of whiskey. In my youthful idealism I thanked him for the bread and honey but refused the whiskey as an improper gift for a sentry doing his duty to accept.

We were late getting back to headquarters that night, it was cold and dark, and I couldn't find my blanket. One of my squad offered to double up with me in his blanket, but the cement floor of the school was cold, the blanket insufficient, and my only comfort was the sofa pillow I acquired the first night. Consequently the next morning was cold and dreary, breakfast along the street not nearly ready, and as I posted my squad I began to regret bitterly my highminded foolishness of the night before, in refusing the whiskey. I started to wonder if any was left of

the half pint of my companion. His post was in the Panhandle end of the street, so after posting the guard I had to trudge the seven blocks to find him, to see if there was a "wee drop" left. But when I got to the Panhandle he was not there and I could not find him. My morale dropped to zero. I sat on some cold steps thinking "Where is he? Has he deserted his post, gone A.W.O.L.? Will I be held responsible?" He was just checking through the campers and soon showed up. When I asked him had he finished his half pint he just reached into his pocket, brought out the bottle and handed it to me with the words "I thought you were off your nut when you refused yours last night." That one has joined the drink I got the first morning with my coffee, in my permanent memory.

We were returned to Berkeley the next afternoon, the National Guard or the army, or both, taking our places, to find the town a hive of activity. My fraternity house, and practically all the other houses were jammed with San Francisco relatives and friends: burned out refugees. Whole families



Scene in Jefferson Square after 1906 San Francisco earthquake. Photo by Miles Brothers, from Charles B. Turrill collection, Society of California Pioneers, San Francisco earthquake and fire folder 21A.



were stacked in, one room per family, the football field was a large camp of small tents, complete with commissariat and round-the-clock guards. The beds in my house were doing double duty, one lot in the early evening, the second on the graveyard shift. Everybody was happy, even Frank G. Sugatani, all smiles now, though cooking for double his usual number, and with no extra pay. College was over for the year, and within a few days I left for my home in Los Angeles, taking with me a memory of a part of a week with people of a city who faced desolation and destitution, and faced the problems of rebuilding cheerfully, in a spirit of mutual helpfulness.

My next earthquake was in the Imperial Valley in 1914. It had none of the jolting shocks I had noted in Berkeley, but apparently a greater amplitude of motion. I assume the alluvial soil, hundreds of feet in depth, and miles from solid rock on the surface, just shook like a bowl of jelly. I witnessed it from the living room in a house lighted by a kerosene hanging lamp. Under the earth movement the lamp went into a circular orbit with constantly increasing diameter. There are few fire hazards equal to a kerosene lamp in an earthquake, and my brother and I grabbed the lamp to steady it. Being suspended from the ceiling it was not feasible to take it down. In the nearest town, Holtville, all houses with brick chimneys lost them, a corroboration of my observation of the circular vibration. In El Centro, 10 miles to the west, the movement was in an east west direction and the plate glass windows on Main Street which ran east and west were shattered diagonally. All north to south fire walls on all the small store buildings were toppled. One garage, which was mainly two north to south side walls, collapsed completely. The Barbara Worth Hotel, almost new and supposedly of Class A construction, was split down the middle of its Main St. frontage with a crack from top to ground. The building seemingly was not too badly damaged for it was repaired, not torn down. The 'quake was quite different from the San Francisco one, for to this observer the amplitude of movement seemed equal, total damage was very light, and I never heard of any human damage. Terror was there at least for one citizen working in his office at 9 p.m. When the 'quake started



People waiting in line for fire wood near Relief Camp 5 in Golden Gate Park. Photo gift of O.K. Cushing, from Society of California Pioneers, San Francisco earthquake and fire folder 21A.

he went through his window intending to jump to the ground. When the ground seemed too far off he instantly changed his mind, jumped across a narrow air well, across that office into a corridor, around through hallways, past his own office and down the stairs into the street. He was the last one out of the building, and was greeted with cheers by those who preceded him, for the earthquake was over and all movement had ceased. His friends called him "the man who lost the 'quake."

My third earthquake was the one in 1933, called the Long Beach Earthquake, because that city suffered the greatest damage. I felt it in my mother's house in West Los Angeles, where it was not too bad, but bad enough for a "terror victim", my mother's maid. She stood in the middle of a room during the entire time of movement yelling or moaning something that sounded like "whoeei" over and over. When it was over she had to be put to bed, a wreck: symptoms, frozen brain, liquid legs. Driving to my home in Pasadena I was not surprised to see no damage to the buildings on the streets I passed through, but later, the radio reported much damage in Compton, Torrance, and mostly Long Beach, where small residences suffered. Whole blocks of them were jostled off their foundations. The greatest and most ser-

ious damage was to schools over the area, well up into Los Angeles.

For years southern California's population had been increasing rapidly and the new schools required threw great financial stress on all the school districts. To meet the situation Los Angeles did not try to keep up to Class A building standards, but with the idea of maximum safety with minimum expense developed a method which used reinforced concrete central corridors, with classrooms out from both sides. The classrooms had outer walls of brick — usually reinforced with steel — ceilings, floors and inner walls of frame, lath and plaster. The scheme was generally successful against fire, but the earthquake showed fallacies. Most schools were comparatively large on "L-", "E-", and "H"-shaped plans, with corridors at right angles. During the 'quake, wherever a corridor was parallel to the axis of movement, the parallel wall acted as a battering ram against corridors normal to it, destroying both. A minor fault was in the decorations around entrances, which were apparently added to the facade with insecure locking to the main wall. All over the area such decorations were quickly shaken loose with resulting showers of brick and concrete. Fortunately the 'quake occurred late in the afternoon, several hours after school closing and





Concrete curb adjacent to the campus of Compton Junior College. Cracks in the curb resulted from motion during the Long Beach earthquake of 1933. Photo by O.P. Jenkins.

no loss of life from that cause was reported; but had the 'quake been 2 or 3 hours earlier, the loss of life among pupils and teachers would have been ghastly.

In all districts steps were immediately taken to remove all such decorations still standing, and the Los Angeles city started a study in depth of all schools. The first step was soil-bearing tests on each one. At that time I was employed by Smith, Emery Co., Chemists and Engineers, who received contracts for making bearing tests on 30 or more schools, and the actual work of conducting the tests became my responsibility. Most of the schools were large, two-story structures and in several the battering force mentioned earlier was plain. A striking exception was the Dominguez school, located between Los Angeles and Long Beach, close to the line of most visible damage. It was a small school, six or eight rooms, rectangular, one corridor, and the soil a silty, fine sand with the lowest soil bearing of the tests I made, yet the building was undamaged. Another surprising fact was the effect on foundations through change of usage of the soil. Southern California soils, except where under cultivation are on the dry side, but in two of the schools I tested, the excess of water used for irrigating bushes, lawns, etc., had penetrated to a depth of 20 feet, to the bottom of the foundations. The soil was serpentine, and at that depth was so saturated as to be almost soupy. Possibly at points actually beneath the foundations, the soil was drier and with some bearing power, but it showed the necessity of geological-chemical knowledge to determine bearing power under change of soil usage.

As far as I know, the earthquake caused no deaths, and the only injuries I personally knew of were two. One was a man hurt by falling material as he ran from a building, the other a man who broke his leg jumping from a window, both examples of "earthquake terror". The widespread residential damage would indicate a widespread terror area. The following story that circulated shortly after the 'quake is illustrative. The story goes that a young couple from the east, touring in California in their Ford coupe with a rumble seat, visited Long Beach the day after the 'quake. In one residential block every house had been shaken off its foundations and a woman was also viewing the scene. She pointed out to them the house she had been in, and said "It was terrible, but nothing like it is going to be on the ninth of next month". She said that she was going to her mother's, and when they offered her a lift, she climbed into the rumbleseat. When they got to her mother's the woman was not in the car. With a sense of responsibility the man rang the doorbell to report. The woman who answered said "Don't worry. It was my daughter who was killed in the 'quake. She has been seen by others." In retelling the story the teller would fix his own date, and when I retold it to a certain man who I knew feared earthquakes, I set the date as "next Tuesday". He was a chemist, and while I told the story he was titrating an analysis, with one hand regulating the flow of reagent, the other hand stirring. When I reached the punch line he stopped stirring, the reagent kept running, and he lost his end point. He came to, looked up and said "That was a message from over the beyond". I tried to kid him out of it, but it was too

serious to him. The real punch came that Tuesday, when one of the many of the small after shocks that followed the main one hit the town. I called him to see how he had taken my prophecy (?) and found that when the shock started he left his desk, his job, and the city. Later I heard that he had moved to Tucson. Earthquake terror is real.

My fourth earthquake was the recent one in the San Fernando Valley. At my home in Pasadena it had a horizontal jerkiness similar to the San Francisco one, but with a vertical movement as well, something I did not feel in other 'quakes. The axis of movement was definitely east-west with a tendency to knock books or grocery store goods off from shelves. Its force was greatest in the northern part of the valley, where much residential damage was reported. Afterthought always gets the best of an argument, but I have driven through the area numberless times, and often had the thought that the intersection of two mountain ranges, naturally of different ages, plus a nearby coastal plain was almost an assurance of faulting. In the general neighborhood is the location of the St. Francis dam disaster of, I believe, the 1930s. At the time its failure was attributed to one of the abutments resting on a rock weakened by a change in water saturation, but to me it seemed possible that the ravine it bridged was actually on a fault. Similar to the San Francisco earthquake, with 119 deaths reported in the Agnew Insane Asylum, was this one with nearly all of the reported 'quake deaths divided between patients and attendants in the Veterans Hospital. It illustrates the extra care necessary to protect those physically unable to help



Small guest house at Veterans Hospital after the San Fernando earthquake of February 1971. The tile walls of the house have fallen away from the frame. Photo by J.E. Kahle, California Division of Mines and Geology.

themselves. The mitigating feature of this 'quake is the greatly increased interest in the study of these manifestations of nature, by those most qualified—seismologists and geologists. We are fortunate that in California the personnel employed by the state have been the forefront of seismological research, and that new observation posts are constantly being established. I was pleased to note from a recent issue of *California Geology* that there are numerous tilt meter stations scattered through the state.

#### Conclusions

Each of these earthquakes has provided much food for thought.

The smallest one, that one in the Imperial Valley, showed that when great damage and loss of life do not cloud the view, humor can poke its head through and let us laugh at the comical antics of those under the spell of "earthquake terror", and possibly, humor offers the best cure to that terror.

The Long Beach earthquake, covering a much larger area than its name would suggest, threw critical light on some "sacred cows" in the building codes of many southern California cities, instigating many changes. To me, its most important lesson was shown in a comparison between the little Dominguez school and the larger, more complicated grammar and high schools of Los Angeles. It showed conclusively that simplicity of design, where all components, wall-to-wall and roof-to-foundation can be bound together to act on a common center of gravity, will allow the building to follow the earthquake

vibrations as though it were a part of the earth. A building with many centers of gravity might be said to contribute to its own earthquake damage, through internal impact and grinding.

The lesson I got from the San Fernando Valley shake-up is that it showed an educational gap between geologists and seismologists on one hand, and the architects and structural engineers on the other. The earth scientists could contribute much by eliminating of many treatises written for each other, and directing some to what might be termed the great geologically "unwashed". On the other hand the engineers seem to believe that when they state in specifications that foundations must be "carried down to solid rock", that they have "done it all". They may believe that "solid rock" is the last word in permanency but some of us know better. Acquiring knowledge of the basic geologic facts should be a part of all university courses, mandatory to all training for structural pursuits.



The San Francisco disaster comes last because it furnished the best lesson of all. My grandfather used to say jokingly  
A woman, a dog, and an old hickory tree,

The more you bust them the better they be.

Change woman to *man* and the rhyme became truth in San Francisco when its citizens rose from apparent destitution to their greatest heights. I say destitution, for all one afternoon I watched an unending procession of people trying to save a pitiful amount of small necessities, and going—where? Anyplace they could lay their heads. Man can conquer Nature temporarily when he has to, but he will do it more easily by working with her than in fighting her.

Maybe our youngest generation will get the proper idea. Just after the start of the San Fernando Earthquake, my grandson burst into our living room with a grin on his face from ear to ear, yelling "Gee Nana and Granddad, it's an earthquake!" ☼