Earthquake Days in Santa Barbara

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But now at last their chance has come,
The Earthquake beats his throbbing drum.
—*The Lyric West.*

IN California the Earthquake is not an event, it is an institution. But the poets and authors of the Golden State have not yet interpreted it to the world as they have other California institutions and attributes. John Muir seems to have come nearest to a sympathetic treatment of the theme. His earthquake experience was in the Yosemite.

"We had a glorious storm of the kind called earthquake. . . . It is delightful to be trotted and dumpled on our mother's mountain knee. I hope we will be blessed with some more. The first shock of the morning at 2.30 o'clock was the most sublime storm I ever experienced. Though I never had enjoyed a storm of this sort, the thrilling motion could not be mistaken, and I ran out of my cabin, both glad and frightened, shouting, 'A noble earthquake!' feeling sure I was going to learn something. . . . These earthquakes have made me immensely rich. I have long been aware of the life and gentle tenderness of the rocks, and, instead of walking upon them as unfeeling surfaces, began to regard them as a transparent sky. Now they have spoken with audible voices and pulsed with common motion. . . ."

Whether Muir's impressions would have been so idealistic had he viewed the earthquake amid the shaking walls of his own home to the music of broken crockery and furniture may well be doubted; for though John was what he himself described as a Godful man, he had a frugal Scotch instinct and took excellent care of his possessions. At all events it is safe to say that few persons whose houses were rocked by the Santa Barbara shake would voice their emotions in the precise words that Muir used to describe his.

An earthquake story begins with the weather. Whoever has loitered along the sunny coast of southern California must at some time have seen an old Californian cock his eye toward the sky and remark solemnly: Good earthquake weather! Those who study the earth's crust and its movements have never been able to trace any relation between earthquakes and the weather. Nevertheless, the earthquake at Santa Barbara on the 29th of last June fell in with the tradition of old California. For three days before the disaster the weather had been unusually warm and close, and for some days following it was extraordinary. The week included two thunder-showers, a hot wind from the desert, and a water-spout along the shore —an unprecedented record. Whether or not the earthquake and the weather have any connection, it is a fact that the weather misbehaved during the week of the Santa Barbara shock.

The effects of the earth vibration at Santa Barbara on the 29th of June varied widely in different parts of the city and neighborhood. A number of buildings were destroyed. Others were slightly damaged, losing chimneys or suffering other small injuries. Still others received no appreciable injury. These differences were due to a number of causes. Well-built houses on solid foundations suffered little. On the other hand, similar buildings on deep alluvial soil were badly injured. For example, the Lincoln School and the Wilson School, in different parts of the city, were identical in design and, so far as could be ascertained, precisely similar in construction. But one was much more seriously damaged than the other. A house upon solid rock receives almost no damage in an earthquake,

for the vibrations of the earth in solid rock are rapid but of very small amplitude. When these vibrations pass from the solid rock to loose soil they become slower but are greatly magnified, and even a well-built house upon such soil is likely to suffer severe damage unless there is a solid foundation for the whole structure upon which it can move as a unit.

The injuries to houses varied also with the quality of the construction. Well-built houses with roofs and walls firmly put together naturally suffered less than houses carelessly built or constructed with inferior materials. Adobe is very brittle, and adobe houses were badly broken. Concrete in which a poor quality of sand was used proved a very dangerous building material. Still another circumstance which affected the degree of injury was the nearness of the structure to the fault and the contour of the underlying material. A situation on the brow of a hill has long been known to be dangerous, since the earthquake wave, when it emerges at the brow of the hill, acts not vertically but laterally or diagonally. All of these causes contributed to the effect which any particular building would undergo through the earthquake shock and would naturally, to a large extent, fix the kind of experience which the people in the buildings would undergo.

My personal experience of the earthquake was in a well-built wooden house, on a good foundation, which suffered little damage. The first and most severe shock came about 6.45 A. M. I was occupying a sleeping-porch which looked out on the ocean and the mountains. I had just been wakened by the morning light, and was deliberating whether to pull the shades and have another nap when I heard the ominous roar of the oncoming earth movement. From a limited experience in Japan I was familiar with this feature of an earthquake, and the dwellers in Santa Barbara had reason, during the next few weeks, to become thoroughly acquainted with it. This roar could be heard two or three seconds in advance of most of the heavier shakes, but it was loudest and most terrifying as a forerunner of the first great movement of the earth. The noise has been often described.

The roar which preceded the first shock was that of a grinding, crushing process, not a comforting sound to hear. I had barely time to realize that a sharp earthquake was at hand when the shaking began. The vibrations seemed to come from the north, and for half a minute or such a matter the house rocked and jumped. One felt as if he were on the back of a bucking horse, with no control of the horse. The house seemed uninjured, although, like Muir in the Yosemite, I could scarcely understand why anything remained standing.

The members of my household made haste to clothe themselves in slippers and wrappers, and to reach the garden at the back of the house before the next shake, which came in about five minutes. While not so violent as the first shock, the impression made upon one in the open was more terrifying than that in a well-built house. The plainly visible motion of the wave in the ground gave a sense of utter helplessness. These waves appeared to be about twenty-five feet long, and one could see them as they crossed the lawn or travelled down a hedge. Trees bent over as the wave came up and returned to an upright position after the wave had passed. The whole effect upon the face of nature was uncanny. The earth seemed to shudder in distress.

During the first fifteen minutes there were seven of these shocks of diminishing intensity. Thereafter, during the day, tremors of greater or less strength kept coming, but none comparable to those of the first fifteen minutes. A hundred and ten such vibrations were recorded the first day from Santa Barbara on the Pasadena seismograph.

While the earthquake of June 29 was not reckoned by seismologists as one of the first magnitude, nevertheless the city of Santa Barbara suffered a great disaster. The business section of the city, built upon rather deep soil, suffered most. The main street was one mass of débris from fallen buildings or from buildings that had been partially destroyed. Had the disaster come at a later hour, there would have been considerable loss of life. As it was, some fourteen persons were killed. Not only business houses, but hotels, churches—including the Old Mission—schools, and private houses, both small and great, suf-

fered damage varying from total destruction to the loss of chimneys or the cracking of plaster. In half a minute of time a prosperous community in one of the most charming places of the world, and living in a peaceful sense of security, found itself confronted with an overwhelming disaster.

The behavior of the people of the community under these trying circumstances was such as to hearten one's faith in the resourcefulness and courage of the American people. Within two hours the streets were patrolled by ex-service men, appointed by the city authorities. Registration of men for service had been opened in the Plaza and active work begun for the rescue of any who might be caught in the ruins, for the clearing up of débris, and for the restoration of business. Effective patrol prevented any looting. This patrol was taken over on the second day by five hundred Marines, landed from a warship, in whose hands the policing of the city was admirably and effectively carried out. The members of the community, rich and poor, rallied to the common work of succor and of restoration in the most admirable spirit. Santa Barbara has maintained for some years an active Community Arts Association which has done much to knit the community together. The fruits of its work were evident in the community spirit in the face of this disaster.

There were not wanting notable instances of individual bravery and presence of mind. The electric-light switches were shut off and the gas mains were closed by men who not only thought quickly but who carried out these duties at grave risk. In the ruins of one of the largest buildings there was heard, an hour after the disaster, the cries of a woman, deep down beneath the mass of débris. This mass was being shaken at frequent intervals by fresh shocks, and threatened to overwhelm any one who approached it. A plain, every-day American with an acetylene torch, a chisel, and a hammer worked his way slowly down through the tangled ruins, and, at the end of six hours, after cutting away the concrete block which held the poor woman a prisoner, succeeded in bringing her safely to the doctor who was waiting to minister to her needs. She completely recovered, notwithstanding her frightful experience.

It was clear from the beginning that emergency aid would be needed beyond that which the community itself could at once furnish. Hospitals had to be rebuilt. Emergency schoolhouses to shelter children in the autumn term must be got ready. Families whose houses were destroyed or seriously injured must be assisted. The charitable institutions, such as the Associated Charities, must be housed in order to serve the community.

To deal with these public causes, to collect such emergency funds as could be obtained, and to disburse them, a committee of citizens was appointed by the Common Council, and through this committee was carried out such public emergency rehabilitation as could be effected through funds secured partly by outside aid and partly by subscriptions in the city of Santa Barbara itself.

No appeal was made to the nation at large, though Santa Barbara would have welcomed it. There was a feeling in California that the State itself ought to care for such a disaster as had fallen upon one of her cities. An appeal was therefore made through a state-wide organization for $1,100,000 for emergency purposes for which cash was needed. Some weeks elapsed before this appeal could be laid before the people of the State. The story had, by that time, grown cold and the response was slower than had been hoped for. In the end some $600,000 was raised throughout the State, and this sum, with approximately $260,000 collected in Santa Barbara itself, constituted the relief fund. With it the more immediate emergency needs were met—personal and family relief, restoration of public charitable buildings, such as those of the hospitals, of the Associated Charities, and of emergency structures to enable the public schools to receive their pupils in the autumn. Some 300 families were assisted in the rehabilitation of their homes. This work was admirably carried out by a unit of the National Red Cross detailed for this purpose. Part of the relief fund was used to obtain expert advice in planning the restored city, in testing materials, and in inaugurating a sound building code.

Public-spirited citizens co-operated in a

common effort to make the new Santa Barbara a city built upon sound principles of construction and one that should be beautiful in the fitness and grace of its architecture. These splendid purposes are on the way to accomplishment. A charming new Santa Barbara will replace the city that the earthquake shook so rudely. To this task its people are addressing themselves patiently and bravely. The great, busy world has forgot it.

The aid given to Santa Barbara, and for which its citizens are most grateful, sufficed only for the most urgent emergency needs. It did not include the churches, some of which were entirely destroyed and some, among them the famous Mission, sadly injured. It did not include the public library, which was badly shattered. It was characteristic of the spirit of the community that within two weeks the library was in full operation in a large stable, kindly loaned by the owner for that purpose, and fortunately provided with a strong loft, built, in the days before automobiles, to hold many tons of alfalfa, and therefore able to carry many books. And books make a heavy load, even though many of them are classified as light literature. This library in a stable was a most cheerful spot throughout the earthquake days. The horse-stalls made excellent alcoves, and under a spreading oak-tree was the outdoor reading-room that was a joy to readers. No one thing did more to hearten the community than to see the library carry on in a stable, with readers coming and going notwithstanding the recurring shakes.

Throughout historic time the world has been more quick to respond to the aid of the community visited by an earthquake than to any other form of disaster. In the year 224 B. C. a terrible earthquake occurred on the Island of Rhodes. The entire Greek and Roman world united in the effort to minister to the stricken island. Enormous amounts in money and supplies were sent to the sufferers, accompanied by messages of sympathy that even to this day stir the heart. To commemorate it a beautiful monument was erected in the market-place at Syracuse showing Rhodes crowning Sicily in her act of sympathy. For the world of our day the American Red Cross stands fully organized, alert and ready for such emergencies. That we should maintain such an agency is one of the finest evidences of a growth of human sympathy that knits together all mankind in works of mercy.

The popular notion of an earthquake pictures it as a momentary cataclysm. The actual earthquake experience of a community is quite different. The earthquake begins with a sharp shock followed by others, generally in diminishing strength. In the first fifteen minutes of the Santa Barbara earthquake there were seven strong shocks, of which the first was far the strongest and of longest duration. Throughout the first day other shocks—some fairly sharp but mainly small tremors—continued. The second day the number greatly diminished; on Wednesday there were still fewer; and on Thursday Mother Earth was so peaceful that there was a general feeling the affair was over. But at half past eight on Friday there came what was locally described as a "humdinger," another at ten-thirty, a third at one in the afternoon. This day tried the morale of the town more sorely than any other. Persons who had business elsewhere found Saturday a good day to go and attend to it. From this date the vibrations diminished both in number and in intensity. By September 15 there had been recorded on the Pasadena seismograph 285 records from Santa Barbara shakes. Of these, some 40 were designated as strong. These shakes still continue at intervals six months after the disaster. It is the common history of this kind of an earthquake. In the Messina earthquake of 1908 the shocks continued for over a year. Light tremors followed the San Francisco earthquake for six months or more. When a great section of the earth's crust has slipped, even by a small amount, it requires a long time for the mass to settle into its final position. In the process these minor shakings are inevitable. To really appreciate an earthquake season one needs to live some months with it. This is what the community as a whole must do. In the end it accepts the earthquake as a part of the order of nature.

Two questions were in the mouth of every visitor to the scene of the Santa Barbara disaster. What caused the earthquake? and Why are there more earth-

quakes on the borders of the Pacific Ocean than along the shores of the Atlantic?

The first of these can be answered with reasonable certainty. Upon the second there is not entire agreement among the students of the physics of the earth's crust.

The earthquake was long regarded as a visitation of divine wrath. We know now that these movements of the earth's crust, commonly called earthquakes, are among the most usual and natural of all the phenomena of our globe. They occur in every part of the world. Between ten and twenty thousand such movements in the earth's crust are recorded annually on the seismographs scattered over the earth's surface. Nothing is more in accordance with the process of nature than these earth movements.

Those who studied geography fifty years ago were taught that the earth's crust is a thin, solid shell enclosing a highly heated liquid interior. Many a child as he eyed this thin shell, as pictured in the geography of that day, walked gingerly for a time lest he break through into the molten interior!

The researches of the last fifty years have completely changed these conceptions. We know now that the earth behaves under the differential attraction of the sun and moon with the rigidity of steel, and that while the interior is, no doubt, quite hot, the enormous pressure keeps it solid and rigid. This heat is evidenced by hot springs and volcanic lava, but these originate at very shallow depths, probably not over five or ten miles. They are like pricks in the skin of a man's body.

The study of the physics of the earth indicates that about 40 per cent of its mass is made up of iron. Oxygen, silicon, magnesium, and nickel are the next most common materials. These five substances constitute about 95 per cent of the whole mass of our globe. If one could make a section from the circumference to the centre of the earth, he would probably find some such condition as the following, as described by Doctor Washington, of the Geophysical Laboratory.

At the centre a huge sphere of metallic iron or nickel-iron extending more than half-way to the surface. Near its outer border particles of stone are scattered through the metal, and these increase in quantity as one goes toward the surface, until the material becomes finally stone, sprinkled with relatively small masses of metal. At a depth of perhaps one thousand miles from the surface the iron almost disappears and the material becomes wholly stone. These gradually pass into lighter layers of rock near the top. The beds of limestone, sandstone, shale, coal, and disintegrated rock in the form of soil which compose the surface are so thin that their mass is negligible when compared with that of the earth as a whole. The metals constitute a minute fraction of the surface.

On this light shell of surface rock and soil we live. As the heat slowly escapes from the interior the surface shell will contract, and strains necessarily occur in the surface which result in cracks, called by the geologists faults. How deep these faults go we do not know. The smaller ones may not be more than a mile in depth, the longer ones are probably to be measured in tens of miles. These lines of fracture in the earth's surface, known as faults, split up various sections of the surface into irregular blocks. The rocks in which the faults occur are firmer and more highly elastic than they are at the surface.

An earthquake is simply an elastic shock which originates in a slip along some fault where the rocks have been held by friction, under increasing strain, until they yield and send vibrations sometimes far along the surface, sometimes through the globe. This last would be impossible if the interior of the earth were liquid. The transmission of these earthquake vibrations is itself one of the proofs of the solidity of the earth. The only message we ever get from the depths of the earth are those that the earthquake vibrations carry.

The Santa Barbara earthquake of June 29 was the result of a slip along some of the faults which characterize the rocky foundations of the mountains, the coastal plain, and the submarine slope of that region. The exact location of the faults along which the slip occurred must be a matter of further study by the geologists. But the phenomenon itself was entirely characteristic of the earth movements

which have been usual in this region for an indefinite period. The preliminary examinations made by Professor Bailey

greater or less intensity is experienced. The slipping relieves the strain for the time.

"Ef'n she is a black gal, it's good luck."—Page 600.

Next Case

BY THOMAS RIPLEY

ILLUSTRATIONS BY E. W. KEMBLE

BACK and forth, back and forth, Colonel Tobias Peckworth paced the narrow confines of his shabby office. From window to door and from door to window he trod, not swerving from his course by a hair's breadth. His slender fingers, interlaced at his back, gripped nervously; his gaunt figure hung forward as if laboring under a load which seemed to grow with every step, and his square jaw worked grimly. Once he had stopped in his tracks to look at the photograph of a charming young woman on his littered desk, and he had spoken sharply, harshly:

"Confound it, Nellie! if it hadn't a-been for you—" He caught himself and said no more, for if there was one person in the world to whom Colonel Peckworth was a slave, that person was his beautiful and talented daughter. Being a widower, he had lavished all upon her. He had sent her to college and afterward raked and scraped for the wherewithal to make her life one of pleasure and comfort. Perhaps he would have taken the hundred dollars from Jim Russell anyhow, he told himself over and over in his misery. "Confound that nigger!" he mouthed. "Here he comes like a fool and pays the whole bill when I told him as plain as day that the retainah fee was twenty-five dollars and the balance was to come if I got him free of that chicken stealing chawge!" He parted his mustache and spat vigorously at the spittoon. The colonel's talking to himself was as much a habit as his drinking.

"Durn his skin, why don't he come on!" He had faced many a reverse in life, but never before had he brought himself to disgrace. And here he stood so near the brink of disaster that his head swam with the very dizziness of the drop which confronted him. Of course it was bad enough to be poverty-stricken, with naught but a greenish-black Prince Albert