SCIENCE NEWS

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THE SANTA BARBARA EARTHQUAKE

By Dr. Bailey Willis

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The Santa Barbara earthquake was a movement on a fault that runs along the Santa Ynez range of mountains and passes through the Sheffield reservoir which held the city's reserve water supply. The general direction of the movement of the earth along this fault was apparently south to north, as shown by the scar made by the trail of the cannon mounted on the platform near the post office building. This showed that it moved sixteen inches south. The chimneys which were demolished on many houses, otherwise uninjured, were thrown in all directions according to the mechanical conditions surrounding them. In some cases they remained standing although twisted as much as thirty degrees at the line of fracture.

An inspection of the damage in Santa Barbara shows that the lessons of the San Francisco and Tokyo earthquakes could be applied here. I drove through the city within an hour after the shock and noted the buildings of various kinds—wood frame, brick, reinforced concrete, etc. Those that remained undamaged were well constructed. Badly designed reinforced concrete failed, as shown by the distastrous collapse of the San Marcos office building, an edifice of four stories in which one corner gave way. Brick veneers which were not tied to the frame fell out, as in the case of the California hotel, where the floors remain standing, although stripped of walls on three sides. In general good design and honest workmanship stood, while incompetency and bad workmanship were exposed in all their miserable nakedness.

The earthquake was not unexpected among seismologists. During the last seven years we have had the San Jacinto, Inglewood, Elinore and San Bernardino shocks, each one resulting from movement on one of the four great earthquake faults of southern California. The system of faults which outlines the San Gabriel range extends west through the Santa Paula Valley and skirts the Santa Ynez range had not, up to this time, shown any evidence of disturbance. It was well known, nevertheless, that a strong pressure exerted against the mountain range from the south has caused it to move gradually, so that Gaviota Peak, a triangulation point of the U. S. Coast and Geodetic Survey, has been pushed northward twenty-four feet in thirty years. As the last great earthquake shock in this region occurred sixty-eight years ago, in 1857, those who are familiar with the history of earthquakes in California expected a disturbance.

To a certain extent their expectations are now fulfilled, but fortunately the Santa Barbara earthquake is much less severe and much less general in effect than some seismologists have feared it might be. There is now little reason to anticipate any severe shock in the immediate future. We shall experience the usual crop of after tremors, but they will gradually die away as the rocks return to their normal condition of elastic strain.

The expectations of seismologists in regard to the coming of the Santa Barbara shock were of general nature only because we have not yet established the recording stations, which if set up throughout the coast region of California would enable us to foresee such occurrences. The Carnegie Institution of Washington is now engaged in establishing stations at Pasadena, Riverside, La Jolla and other points in southern California, where instruments designed to record local earth tremors will be set up.

All the stations will operate in unison under the central control of the principal stations at Pasadena and the records which they will yield will enable us to fix the focus of even the slightest tremors within fifty or sixty miles of the stations. As the records are continuous, we shall know exactly where the earthquake strain is gathering and how it increases or diminishes from day to day or month to month.

In the course of time a chain of stations of this character will no doubt be established from San Diego to the Oregon line. But it will have to be done through the cooperation of the communities interested and will not be accomplished until public opinion is educated to an understanding of the advantage of knowing all that we can about earthquakes and the methods of protecting ourselves against their effects.

NOTES ON THE SANTA BARBARA EARTHQUAKE

By Watson Davis

Managing Editor, Science Service

Again Mother Nature has had growing pains and again it is demonstrated that man does not learn by experience.

For while the delightful Pacific coast town of Santa Barbara is in ruins, without water, gas or electricity, while the whole length of its principal State Street is practically wrecked, there are some buildings that are essentially undamaged. Those buildings that came through their serious shaking nearly unscathed were those that were built well.

The lesson that can be learned from the disaster here which I have just witnessed is that in areas subject to earthquakes, engineer, architect, contractor and owner must insist that the structures that they erect must be as nearly earthquake-proof as modern engineering can make them.

This is a lesson that should have been learned from the disasters at San Francisco and Tokyo. Unfortunately, it will probably require many more earthquakes, many of them of much greater severity than this one, to cause men

to refrain from erecting death traps over their very heads. For earthquakes will continue to occur in California as well as in other parts of the surface of the globe.

Near the railroad station, at 6:44 A. M., there was a handsome hotel, recently erected at a cost of some $200,000. At 7:04 its guests found themselves exposed to public view on three sides of the structure. The shock had simply sliced the brick walls from the frame of the building. Such instances may be multiplied many times.

Yet Professor Bailey Willis, president of the Seismological Society of America, who was in Santa Barbara and experienced the quake, says that it was a moderately severe, but not a very severe, shock, and that it was not a shock in which any decently built house should come down.

That the shaking was comparatively slight I can personally attest, for I had the great privilege of going through this earthquake totally unconscious of what was happening. I was asleep. I was on the last overnight Southern Pacific train to pass through Santa Barbara before the shock. At the instant of the first shock this train had reached three miles south of Santa Barbara, where it was nearly derailed by the force of the earthquake. The engineer stopped until the six severe shakes within nineteen minutes had passed away, and then proceeded cautiously toward Los Angeles. I supposed that the motion was due to normal train operations and slept through it all. The reports of the other passengers caused me to hurry back to Santa Barbara on the first Red Cross relief train leaving Los Angeles.

One eminent geologist, Professor Bailey Willis, has already made a rapid but careful investigation of the disaster and his results are given in a signed article written exclusively for *Science Service*. Dr. Arthur L. Day and Dr. H. O. Wood, in charge of the earthquake investigations of the Carnegie Institution of Washington, with headquarters at Pasadena, are now *en route* to the disaster scene.

In spite of the coincidence of the two earthquakes, seismologists state that there is no relation between the Montana shocks of Saturday and Sunday, and those at Santa Barbara. Both of these disturbances will, however, be the subject of detailed investigation by competent scientists.

THE CAUSES OF EARTHQUAKES

EIGHT to ten thousand earthquakes are recorded every year in various parts of the world, and probably four times as many as this occur, but far from being alarming this is a very reassuring fact, Dr. William Bowie, of the U. S. Coast and Geodetic Survey, told representatives of *Science Service* recently. This is because the earth is thus shown to be a body capable of yielding to stresses and strains. If it were not the case, the strain would accumulate until great enough to produce disruptions far more violent than any that have ever occurred, and perhaps sufficient to wipe out all the works of man.

While the earthquake in California followed so closely upon the heels of the one in Montana, this is only a coincidence, said Dr. Bowie, and there was no direct connection between them, except that the shock of the Montana quake might have been the trigger to set off the one in California. This could not have occurred, however, unless the conditions had been ready for a tremor, and any one of a number of things might have been the last straw. Dr. Bowie thinks it possible that the rising of the tide might do it, as a depth of water of only eight feet, when extended over an area of hundreds of square miles, would exert a pressure of millions of tons.

The real cause of earthquakes, he said, is erosion, by which rains carry soil from mountains to valleys, and sedimentation, by which rivers and streams carry material to their mouths and deposit it there. These work gradually, but in time the amount of material moved is enormous, and the distribution of weight on the earth's surface is greatly altered. Because of the earth's ability to yield, the crust gives, and a fault, or crack, develops, along which future quakes may occur. A recognized fault passed through Santa Barbara, and is shown on a map issued by the Seismological Society of America showing the California faults. The Santa Barbara fault was supposed to be dead, however, as no tremor had occurred along it within historic times. The famous San Andreas fault, which caused the San Francisco earthquake in 1906, extends for many hundreds of miles, but does not pass near Santa Barbara.

In spite of the great damage done by the California shake, it was not nearly so violent as the one in Montana, said Commander N. H. Heck, in charge of the Coast and Geodetic Survey's seismological investigations. This was indicated by the seismographic records obtained by the survey's stations at Cheltenham, Md., and Tucson, Ariz., as the records of the Montana quake were much more distinct, and was borne out by the reports of the area affected. In California, only about four counties felt the tremors, while three states besides Montana were shaken.

ITEMS

THAT the monkey has a true color sense has been demonstrated by a series of experiments reported by J. A. Bierens De Haan in an article in the forthcoming issue of *The Journal of Comparative Psychology*. At the Physiological Institute of the Free University at Amsterdam, Holland, Mr. De Haan carried out 3,100 experiments with one monkey and 800 with another to determine their abilities to distinguish between different colors. Colored papers were used, and the monkeys were found to be able not only to distinguish red, blue, green and yellow papers from each other, but also to distinguish the colored ones from each of a series of thirty gray papers ranging in continuous gradation from white to black. Factors such as special smells, texture differences between the colored and gray cards, and special marks on the cards were carefully avoided so that the monkeys would not be influenced by anything other than differences in color.