ENGINEERING AND SCIENCE
April 1964, Volume XXVII, No. 7

Caltech's Seismological Laboratory goes to work on

THE ALASKAN EARTHQUAKE

by C. F. Richter

C. F. Richter, professor of seismology, checks the seismograph he has installed in his living room — always expecting the unexpected.

My wife at first was very dubious about having a seismograph installed in the living room. It seemed rather a brutally coarse intrusion among her neat furnishings. She soon found that all her friends found it interesting and exciting, a perfect conversation piece. Now she could hardly be separated from it.

The installation has been a timesaver during real emergencies and false alarms. I make a habit of checking it frequently, always expecting the unexpected.

On the evening of Friday, March 27, I interrupted a broadcast concert.

"There's a great earthquake recording."

"Yes?" (Very sleepily) "Where is it?"

That, I remarked, was indeed the question. I went on studying the seismogram, which was still making large swings as late waves arrived over long paths.

The record of a very large earthquake is often particularly hard to interpret because of the tangling of successive recording lines and the tendency of equipment to overload or drive the writing point off the paper. Before long I was fairly sure that the distance was moderate, of the order of two or three thousand miles. The magnitude, certainly, was high.

The concert ended. At this point I found that somehow the telephone unit had been off the hook. I put it in place, and almost at once got a ring.

It was Mr. Corcoran of the UPI, with early news of the Alaskan earthquake. I was able to confirm that it was a great and probably disastrous event, and to give a minimum magnitude of 8.

It seemed wise in so important a case to go to the Laboratory, where more recording instruments and more information were available. While driv-

ing the short distance (three miles) I was a little startled to hear myself already being quoted on the air (correctly).

Mr. Nordquist was already at the Laboratory; he had been called by the official sea warning service, and had already reported back to its Honolulu headquarters. The additional instruments gave little further information; those available at such hours for emergency use (writing in ink) have magnifications in the moderate range, and were overloaded, like my seismograph at home. Better information would have to wait until next day, when the regular seismograms, which are recorded photographically, would be unloaded from the drums and developed.

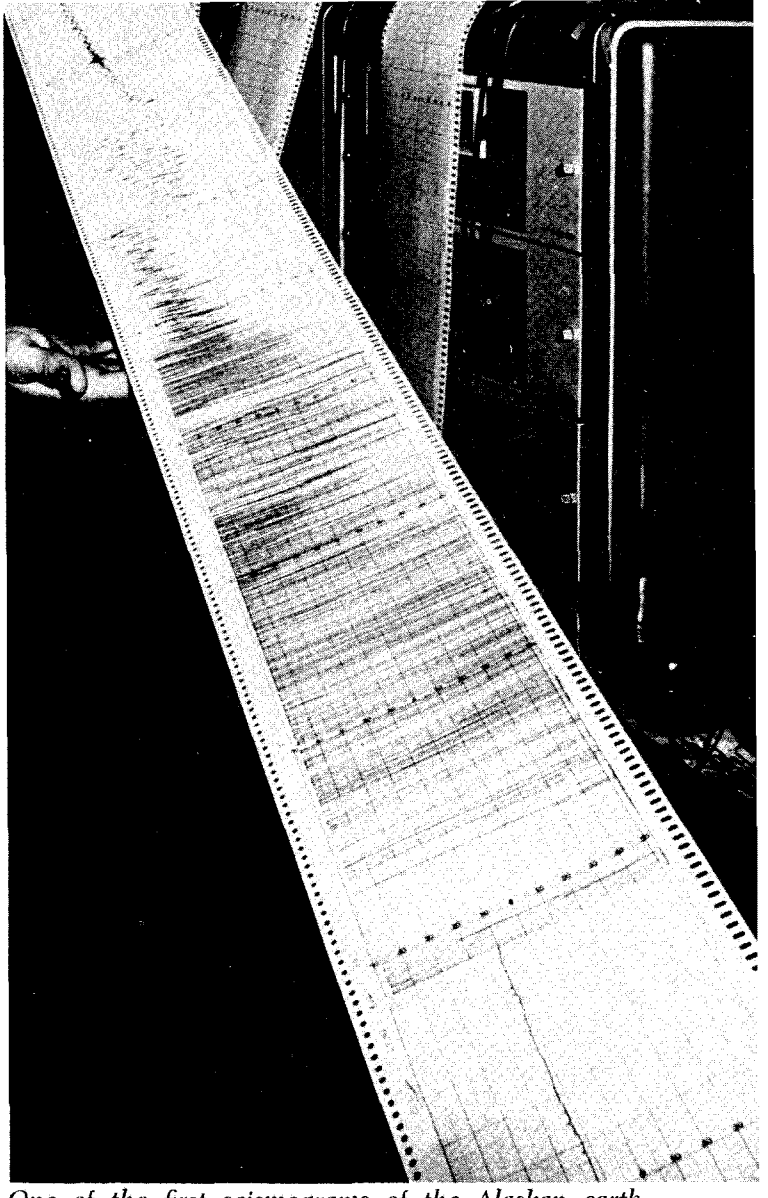
Most of this time the Laboratory telephones had been ringing; but since it was impossible to answer them without dropping the work on the records, and very little could be given out anyway, we simply let them ring.

Some of the small aftershocks which followed the main event gave useful details. Finally, I called in to the principal press services and newspapers, giving our time of recording and the same magnitude estimate of 8 or over. It chanced that my call was the first notice of the event to reach the Pasadena newspaper offices; the next regular edition being Saturday afternoon, they were on off-hours, and grateful for the alert.

I returned home, determined to get a sound night's rest; but at times during the night I received the radio news, noting the progress of the sea wave and the disaster at Crescent City.

Certain oddities and misunderstandings in the early news deserve notice. Among these are wrong guesses about the epicenter of the earthquake, or the fault on which it may have originated. Newsmen are very pressing for such statements immediately after the event; it is hard to explain to them that there simply isn't sufficient information for even a guess. Some seismologists allow themselves to be wheedled into guessing, whereupon the guesses are circulated as definite determinations.

This is probably the explanation of the frequent press mention of the Fairweather fault, a great feature of southeast Alaska which probably had nothing to do with this earthquake. Still more obvious was the report of "location" of the epicenter at Yakutat Bay, where a great earthquake did occur in 1899. There was also the report that a seismologist had placed the origin of this earthquake at a depth of 186 miles (300 kilometers, in case you're wondering). How, one wonders—considering all the evidence of origin near the surface? It is, indeed, a matter for reflection; probably a strong wave on the seismogram, representing an echo from the surface of the earth's core, was misidentified as an echo from the surface of the earth itself, which would mean that the riot started pretty far down.



One of the first seismograms of the Alaskan earthquake. The single line at the bottom of the seismogram shows the normal motion of the earth, which gives way to a sudden violent earthquake.

Then there were those "mysterious" waves along the Gulf Coast in Texas and Louisiana in the first hour, long before the great sea wave had reached the California coast. They were seiches — oscillations in the lagoons along the Gulf Coast, set up by resonance with the great seismic surface waves, traveling out from the source at speeds of two or three miles per second, with periods from fifteen or twenty seconds up to two minutes, correspondingly enormous wavelengths, and amplitudes of several centimeters (or inches) at various points, as reported to the press by a number of recording stations. At Pasadena we found an amplitude in

the 20-second periods of over a centimeter, making the full range (or double amplitude) about an inch; in the longer-period waves the amplitudes were still larger.

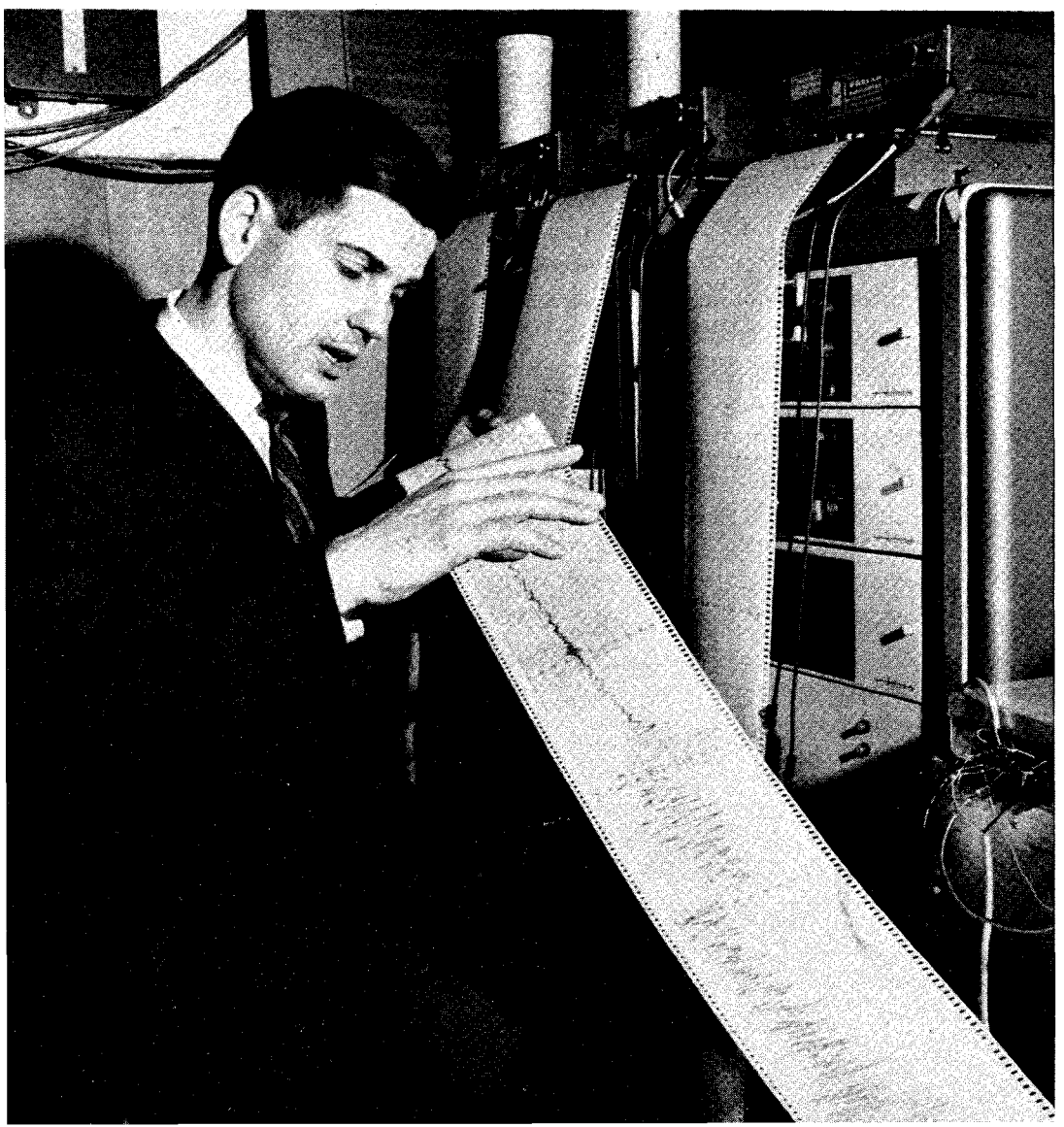
Seiches were probably started here and there all over North America. There were numerous accounts of oscillations in ponds and swimming pools. A correspondent sent me a clipping from the Louisville *Courier-Journal,* detailing the local mystification over the oscillation of two lakes in Kentucky. The seiche in Lake Washington at Seattle was observed by many persons, and recognized as due to the earthquake, since it coincided in time with other effects like the swaying of chandeliers, and occurred while first reports from Alaska were arriving. Well recorders must also have run wild almost everywhere, but only a few reports of the kind have as yet come to my attention.

On Saturday, with Dr. Stewart Smith holding off press representatives and other visitors, I went to work on the photographically recorded seismograms, with the results on amplitude already mentioned. These, plus comparison of the main shock with aftershocks, led to a magnitude at first conservatively stated as 8.2, but revised to 8.4 later.

At this time I was very glad to see Mr. Graham Berry of our News Bureau, since I had a very delicate problem. The aftershocks, to that point, hadn't been large enough. "Båth's law" requires that an 8.4 earthquake should have at least one 7.2 aftershock. (Even the latest large aftershock, April 16, seems not to have exceeded 6.7. Is a larger one still to come?)

Nothing would be easier than to raise a dangerous alarm. Headlines ANOTHER BIG ONE EXPECTED could disturb people and perhaps delay needed relief work. Yet some warning seemed called for. We decided to point out that the aftershocks to date had been smaller than usual for so large a main shock, adding that no later shock would be expected to approach the main one in magnitude (also a slightly risky statement, since unexpected large later shocks do happen).

Sunday at the Laboratory was mercifully quieter, and I could settle down in peace to getting the recorded times of the aftershocks. For the first three hours there was a hopeless tangle of small shocks



Stewart W. Smith, assistant professor of geophysics, examines a record of the Alaskan earthquake taken from an experimental, long-period seismograph that he is developing. This instrument differs from other seismometers in that it is especially designed for the very long-period vibrations of the earth, which can be likened to the ringing of a bell. It records directly on a magnetic tape that can be processed by a digital computer, where a type of spectrographic analysis is done that separates the various "tones" of the vibrating earth. This experimental instrument was put into operation only a few hours before the Alaskan earthquake.

In the measuring room of the Laboratory, Charles F. Richter studies a seismogram of a 24-hour period including the main Alaskan quake. Here, seismograms from the 16 outside stations maintained by Caltech, and those from many other countries, are measured for intensities and timing of quakes. This seismogram was recorded with the east-west instrument at Goldstone, California.

superposed on the large waves of the main earthquake; but in the following ten hours about 50 shocks of all sizes were measurable. (Still more, of course, were found later on the records of our more sensitive outpost stations.) We wished to get these data to the U. S. Coast and Geodetic Survey center at Washington as promptly as possible, since the location of epicenters of these small shocks casts much light on the main event.

Monday was as turbulent as might be expected. On this and the next day I spent more than half my time on the telephone. Most of this was legitimate exchange of information with the press and official sources; some of it was most unnecessary — free lance feature writers trying to intrude and snatch material; cranks; and news sources insisting on repetition of material already issued and in general circulation.

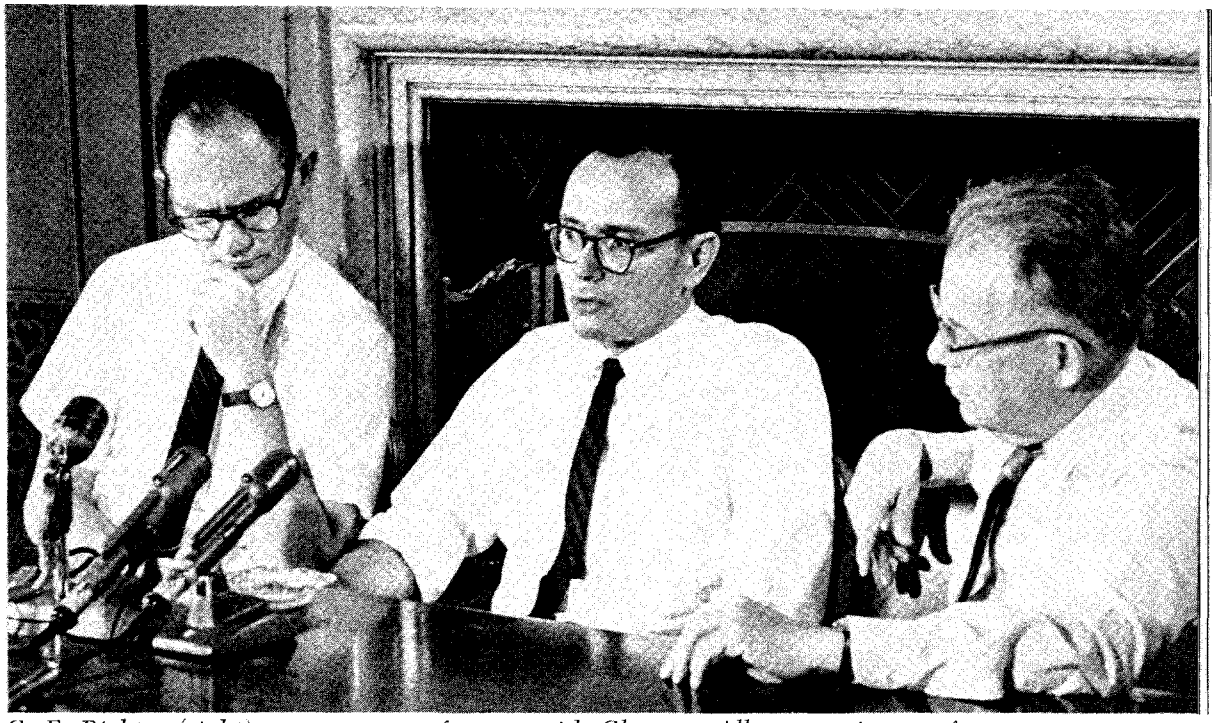
The office at Washington was most efficient and effective. Late in the day we began to get preliminary epicentral locations and other information. The main earthquake had centered near the coast between Anchorage and Valdez; epicenters of aftershocks were in a band extending offshore to the vicinity of Kodiak Island. This band presumably outlines the extent of faulting in the main event. An earthquake next day, off the British Columbia coast, was apparently independent.

News pictures in the daily press, showing effects at Anchorage, confirmed previous suspicion that the spectacular breaks in the ground do not represent faulting. They are the result of slumping, or rather of lateral lurching, in the loose ground of a terrace, under the shaking of the seismic waves from the earthquake source, which was about 60 miles distant.

Journalistic interest in the large oscillations of the whole earth "ringing like a bell" — to use the phrase which has been stuck on it — was a blessing to me, since it diverted attention to Dr. Press, Dr. Stewart Smith, and others concerned in that work.

An unmitigated curse were the calls which began, "We hear continuous rumors that this earthquake is going to touch one off on the San Andreas fault . . ." Perhaps this scare started spontaneously, but it seems to have been kept alive by news sources repeatedly badgering busy scientific men for denials. One of the best ways to lay ground for a panic is to keep broadcasting "There is no cause for alarm, there is no cause . . .", instead of merely reassuring individual Nervous Nellies and keeping the scare quiet.

It should be said that the general level of reporting on this occasion is a credit to the press. Information was factual, even when the facts were incompletely understood. Rumors were not extensively circulated. Lack of information from the most seriously affected area was emphasized, and caution in drawing conclusions was evident.



C. F. Richter (right), at a press conference with Clarence Allen, associate professor of geology and geophysics; and Frank Press, director of the Seismological Laboratory, who report on studies of the Alaskan earthquake made in a flying visit to the area in early April. In Alaska, the men installed special seismological stations to facilitate location of the aftershocks, so that eventually it will be possible to map the fault that was responsible for the main quake.

Much of the damage in the Alaskan earthquake seems to have been caused by sliding earth, rather than shaking — as in the Turnagain area of Anchorage shown here.