

California's Staggering Earthquake Count

By Charles Petit
Science Correspondent

That California is earthquake country is a commonplace. For the first time, however, records dating back to centuries-old Spanish documents are being scoured to find out just how shaky the state is.

The massive California Earthquake Catalog Project, under way since 1972, has sent researchers thumbing through musty newspapers and diaries, explorers' reports, records of conversations with Indians — anything that might reveal when an earthquake occurred, where, and how big it was.

One clear message verified by the State Division of Mines and Geology so far: for some reason, the last century was less stable than this one.

But even in this century the earthquake count is staggering: 39,578 quakes of all sizes from 1900 through 1974 in California or near-

by regions offshore, in western Nevada, or north Baja California. Of these, 3602 exceeded 4.0 on the Richter scale, the point at which a quake is easily felt.

"There isn't much you can say about earthquake risks that is as good as a map," said Charles Real, a state seismologist and co-leader of

the project with Toussou R. Toppozada, another seismologist.

"A map shows better than anything else where the risks are high, such as the Bay Area, and low, such as most of the Central Valley." One benefit of the project, he said, is to give land use planners a clear idea of seismic risks of various

regions.

Compiling data on earthquakes from this century has been relatively easy — mostly just a matter of comparing the records of the University of California at Berkeley, Caltech in Pasadena, and the U.S. Geological Survey, and removing discrepancies and duplications.

For the past two years, the earthquake catalog project has been in its most difficult phase: locating and measuring all pre-1900 earthquakes. Without seismographic data to go on, the researchers have resorted to estimating earthquake sizes and locations from written reports of damage.

Some 7500 newspapers and other documents were examined. Before 1846, when the first California newspaper was published, the only information was in documents such as letters and reports of exploration parties.

Earthquake magnitudes were estimated first by putting them on the "modified Mercalli" scale, a measure that relies on the sensation and level of damage that an earthquake causes. For instance, a I on this scale is a quake "not felt except by a very few under especially favorable circumstances," a IV creates a "sensation like a heavy truck striking a building" but little damage, while a top-of-the-scale XII creates "total damage, waves seen on ground surfaces, lines of sight and level distorted, objects thrown upward into the air."

The modern Richter scale is a purely objective measure of the amount of energy released by an earthquake. The conversion from Mercalli to Richter, Toppozada said, "can never be perfect," but was estimated by combining Mercalli-scale measures of the intensity of an earthquake's effects with the size of the area over which it was felt.

As an example, the big quake that ruptured the Hayward fault on Oct. 21, 1868, was estimated at magnitude 6.7 based primarily on reports from 266 different editions of 66 newspapers from as far north as the Mendocino Democrat in Ukiah and Weekly Humboldt Times in Eureka, south to the Monterey Gazette, and east to the Nevada Daily Gazette.

One newspaper report, Real said, "contains several useful descriptions: The duration of the shaking was estimated, placing a

'The People Are Crazy With Terror. . .'

The Colorful Accounts of Earlier Jolts

As state geologists pored over newspaper accounts of pre-1900 earthquakes to estimate their sizes and locations, they found many memorable descriptions — some grim, some amusing.

The Daily Dramatic Chronicle (forerunner of today's Chronicle), reported on Oct. 9, 1865, a quake that struck the previous day, starting with this colorful passage:

"The earth quaked, and the inhabitants thereof. A gigantic earthquake seized the earth and shook it as a big terrier worries a small rat. The earth shuddered as if in pain, and windowpanes flew into fragments. The shock was severely felt on Sacramento Street, and it was expected that the earth would open and swallow up the Alta office (A Chronicle competitor in those days) — if it had, it would have thrown it up again in disgust."

A subsequent passage declared, "Dr. Lord, chiropodist, left the study of cutaneous eruptions to look out for an eruption of Mt. Diablo; lawyers had a writ of ejectment served on them in their offices in the third stories; real estate agents felt shaky and wished to sell out; sober deacons of the church staggered. Everyone was upset."

If the style of this unsigned piece seems familiar, a reporter and earthquake aficionado named Samuel Clemens — Mark Twain — was contributor to the paper in late 1865, but its authorship cannot be certain. The earthquake, state geologists believe from accounts in 36 different papers, had its



This is how cartoonist Ed Jump reconstructed the biggest San Francisco earthquake before 1906, a temblor that struck Oct. 21, 1868. His impressions were more dramatic than the quake itself, which damaged only flimsy buildings on filled land.

lower bound of intensity III, people were awakened (which suggests) intensity IV, while some occupants rushing into the streets indicates a level of V."

The earliest earthquake thus far reported was described in an account by Indians to Spanish explorers in 1790, who were told that about 80 years earlier a large quake struck the Owens Valley area.

That earthquake is considered roughly comparable to the huge magnitude 8.0 quake that hit Owens Valley in 1872.

So far, only 125 earthquakes, almost all of them over magnitude 5.0, have been counted prior to 1900, "but considering how much of the state wasn't even populated, it is clear that the last half of our recorded history (this century) was distinctly quieter than the first half," Toppozada said.

Specifically, he said, the entire San Andreas fault system was significantly more active during the last century than this. Counties which, unaccountably, had more earthquakes last century than this include San Diego, Santa Barbara, Inyo, Stanislaus, Solano, Lassen and Del Norte.