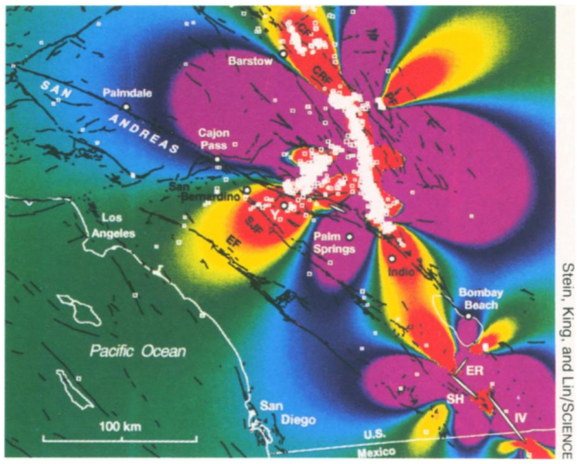
Landers earthquake provides prediction clue

In the late hours of June 27 and early the next morning, a set of 22 small tremors appeared in precisely the spot that would soon generate the Landers earthquake, the largest jolt to hit California in 40 years. A pair of seismologists studying those foreshocks has found they exhibit an unusual characteristic that could help scientists predict some future earthquakes.

James J. Mori and Lucile Jones of the U.S. Geological Survey in Pasadena, Calif., report that the small earthquakes immediately preceding the Landers quake were tightly clustered within about 800 meters of each other – a characteristic that distinguishes them from similar-sized jolts that had been rattling the region for weeks. The closely spaced foreshocks were all magnitude 3 or weaker, and they occurred within the last 12 hours before the main shock, which registered magnitude 7.5.



The Landers quake and its aftershocks (which form a white lambda shape near the center of the image) have increased stress on sections of the San Andreas fault and San Jacinto fault (SJF). Red and yellow denote added stress; pink areas show reduced stress.

"This is exactly the sort of thing we have been hunting for. It's been one of the big questions for us: whether there is anything that looks different about foreshocks," says Jones.

The two USGS researchers discussed their findings in San Francisco last week at a meeting of the American Geophysical Union, where theirs was one of 93 different presentations on the Landers earthquake.

Mori and Jones showed that the pattern of clustered foreshocks also preceded the magnitude 6.1 Joshua Tree earthquake, which occurred just south of the Landers epicenter in April. The Joshua Tree sequence began with a magnitude 4.6 foreshock, followed by five smaller tremors clustered within a kilometer of the spot where the Joshua Tree quake started two hours later.

Such discoveries led Mori to look at previous earthquakes. He found another tight clustering of tremors right before the magnitude 6.6 Superstition Hills quake in November 1987.

Because California faults produce many small earthquakes each day, seismologists have been trying to find some characteristic that sets apart those few tremors that represent foreshocks of a larger quake. The clustering discovery has intrigued researchers, yet they need to examine many more earthquakes to see whether this pattern occurs consistently.

Mori and Jones caution that the clustering test will not help predict most large quakes, because the vast majority do not have foreshocks. But such a technique would have tremendous value even if it helped predict only a few earthquakes.

"If we could predict 10 or 20 percent of all earthquakes, that's a lot better than we're doing now," says Jones.

Paul A. Reasenberg of the USGS in Menlo Park calls the work promising but expresses skepticism about its applicability. "My suspicion is that any simple filter like this will have limited success in predicting earthquakes. It may lead us toward understanding some of the physics of earthquakes," he says.

According to other work presented last week, Mori and Jones may have a chance to test their technique quite soon. Several independent research groups reported that the Landers temblor had increased stress on sections of the San Andreas and San Jacinto faults that scientists consider particularly dangerous, raising the risk that either fault will produce an earthquake. According to a group led by Ross S. Stein of the USGS in Menlo Park, the Landers tremor has hastened the next great earthquake on the southern San Andreas by a decade or more – a finding supported by other groups as well. Stein and his colleagues discussed some of their work in the Nov. 20 SCIENCE.

In a report issued Nov. 30, a panel of scientists and public safety administrators tried to estimate the near-term chances of a large quake in southern California. They noted that the frequency of sizable quakes in this region has increased dramatically in the last six years. This trend, along with the boost in stress from the Landers quake, has raised concern about the next few years. Using several statistical analyses, the panel forecast an 18 to 47 percent chance that a magnitude 7 earthquake will shake southern California in the next five years.

– R. Monastersky

Monkeys deal blow to silent cheaters

It's a jungle out there, but monkeys still often give rather than deceive, at least when one of them finds food and must decide whether to eat it all or share it, according to a new study.

A harsh incentive animates this cooperative spirit, asserts anthropologist Marc D. Hauser of Harvard University. Individual monkeys who emit distinctive calls that announce a food discovery suffer far fewer aggressive attacks, such as chasing, hitting, and biting, than monkeys who remain silent but get caught with food by other group members, Hauser contends.

Monkeys apparently make "a relatively complex assessment" of the pros and cons regarding keeping food for themselves or avoiding a hostile showdown through sharing, he reports in the Dec. 15 PROCEEDINGS OF THE NATIONAL ACADEMY OF SCIENCES.

Several researchers have suggested that withholding information from other group members should be the most common form of deception in many animal species, since this type of cheating proves most difficult to unmask. Even with the new data, however, the ways in which animals try to discourage tight-lipped trickery remain poorly understood, Hauser says.

The Harvard scientist directed experiments on a group of free-ranging rhesus monkeys living on a small island near Puerto Rico. Monkeys on the preserve eat commercial "chow" that supplements leaves, coconuts, insects, and other natural food sources. Observers discreetly videotaped trials with 28 adult males and 21 adult females, including those of high, middle, and low rank in their group.

When a monkey strayed from the view of the others, 15 pieces of chow or coconut were dropped near the individual. In nine control trials, experimenters dropped 15 sticks of wood about the same size as pieces of chow.

Discoverers ignored the sticks and made no sounds upon seeing them but called for companions on 18 of 40 food trials, Hauser points out. Fifteen females, compared to three males, produced at least one call.

Other group members detected a food discovery on 37 of 40 trials. Overall, vocal discoverers received less aggression than their silent counterparts. Silent male discoverers detected by a higher-ranking male were most likely to encounter aggression. Vocal females ate more food than silent females, since the latter often dropped pieces while being chased, Hauser notes.

– B. Bower

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