The quake gap: Waiting for magnitude 7

The aftershocks grew progressively weaker during the five days following eastern California's 6.1 magnitude earthquake on July 21 — signaling an end to the week-long swarm of seismic activity in the Chalfant Valley. Besides the main shock, there had been three quakes above magnitude 5 — a 5.5 magnitude foreshock and 5.2 and 5.1 magnitude aftershocks. (According to seismologists, none was related to the 5.9 magnitude quake that struck near Palm Springs on July 8 or the 5.3 quake that hit the ocean near Oceanside on July 13.)

Now, the Chalfant Valley might remain quiet for weeks, months or even years. But before another 30 years go by, it's likely to get a much bigger quake — a ground-splitting magnitude 7 quake, seismologists say.

They base this prediction on the valley's location along a 300-mile, north-south line, stretching from northern Nevada to east-central California, in which magnitude 7 earthquakes have occurred periodically since at least 1872. The Chalfant Valley, 10 miles north of Bishop, is the largest link in the line that so far has not been fractured by a magnitude 7 quake. Because the valley lies along the western side of the White Mountains, it has come to be known as the White Mountain gap in the earthquake chain.

Alan Ryall of the Center for Seismic Studies in Arlington, Va., first identified this gap in the mid-1960s, while working at the University of Nevada at Reno. The line, known as the central Nevada seismic zone, begins near Winnemucca, Nev., where a magnitude 7.8 quake hit in 1915, and stretches south to the southern Owens Valley in eastern California, where a quake estimated at magnitude 8 struck in 1872, Ryall says. The Owens Valley quake cut a north-south escarpment nearly 50 miles long — and in some places 10 feet high — between Big Pine and Lone Pine.

The White Mountain gap lies just north of this escarpment and south of the Cedar Mountains of Nevada, where a 7.2 quake occurred in 1932. North of the Cedar Mountains is the Dixie Valley, where a 7.1 earthquake struck in 1954.

The swarm of quakes that shook the Chalfant Valley in late July was enough to damage most homes in the area but not enough to split the ground to match the rest of the line. "It would take a magnitude 7 quake to fill the gap," Ryall says.

Additional evidence that a major earthquake may be imminent is the White Mountains' steep rise from Chalfant Valley, according to Edward J. Corbett, research seismologist at the University of Nevada at Reno. The mountains rise nearly 10,000 feet within 10 miles of the valley floor, which demonstrates that the area has experienced significant seismic activity throughout the last 3 million years.

Some seismologists find further evidence for a quake prediction in the fact that seismic activity during the past few decades has tended to circle the center of the White Mountain gap. This suggests the pattern of a "Mogi Doughnut," a ring of seismic activity that often precedes a great quake. But the Mogi Doughnut theory may not apply, Corbett says, because it was developed for Japan, where earthquakes are caused by one of the earth's plates pushing under another. In eastern California, earthquakes occur in the "basin and range" faults that lie alongside the mountain ranges, Corbett says.

None of this evidence helps seismologists pin down exactly when the magnitude 7 quake will occur. "We just know there is an obvious gap in the historic pattern of seismicity in the western Great Basin," Ryall says. "And in this area, there has been a pattern of seismic activity that in other areas has preceded large quakes." — *M. Murray*

New look for an old dinosaur: Armor plates all in a row

For more than a century, paleontologists have argued about the proper arrangement of the bony plates that stuck out of the back of the stegosaurus, the large, armored dinosaur that roamed the earth 150 million years ago. Some scientists have contended that pairs of these plates were aligned in two matching rows, while others have maintained that the two rows were staggered.

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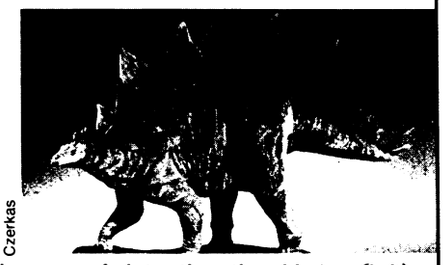

Czerkas

A new stegosaurus model (right) has one less row of plates than the old view (left).

Now a dinosaur artist and paleontologist says he has put this debate to rest by showing that neither approach is correct. Stephen Czerkas, who works with the Natural History Museum of Los Angeles (Calif.) County, believes instead that stegosaurus was crowned by a single row of plates. His work "answers questions that have long been bothering people," says James Farlow at Indiana University-Purdue University in Ft. Wayne. Czerkas's explanation also would alter thinking on the plates' role in metabolism.

Most scientists had concluded that stegosaurus had two rows of plates because the upper parts of the plates in the neck and shoulder regions of fossils were found overlapping one another. The bases of these plates are also asymmetric, suggesting to some that another row of plates was required to make the animal symmetric overall. The most complete stegosaurus skeleton, found in North America in 1886, does not have two rows, but because it was missing some of its tail, scientists argued that additional plates must be missing too.

In carefully reexamining this skeleton, however, Czerkas noticed that the plates over the animal's *back* neither overlap nor have asymmetric bases. Moreover, he says, the bases of the neck and shoulder plates do not overlap at all, so there is no reason to assume that the plates emanated from two rows in this region either. He thinks these neck and shoulder plates, with their thick and asymmetric bases, pointed up and out at an angle so that the animal could move freely.

Czerkas also concluded that the fossil has all of its original plates. The bases "filled out the entire length of the vertebral column perfectly, allowing space for the tail spikes," he says. "The fossil was much more complete than anyone had ever realized."

If Czerkas's findings are correct, scientists will have to revise their pictures of stegosaurs found on other continents and rethink the function of the plates. In his studies, Farlow has found that double rows would have been ideally suited to cooling the stegosaurus by channeling air across its back. This was one line of evidence that led some scientists to think stegosaurs were warm-blooded, according to Czerkas. But with only one row, the plates may have acted as conductors, used more for warming the animal. Other scientists, however, think stegosaurus used the plates to defend itself. — *S. Weisburd*