How the Armenian Quake Became a Killer

Bad luck and inadequate construction combined to produce the unusually lethal disaster that struck Soviet Armenia last month, according to the first impressions of a group of American experts who visited the area. The team of 18 seismologists and earthquake engineers was under the leadership of the U.S. National Academy of Sciences and the U.S. Geological Survey (USGS).

"What they got hit with was a worst case scenario," says seismologist and co-team leader John Filson of the USGS in Reston, Virginia. The town of Spitak, which was nearly leveled, sat less than 5 kilometers from the fault break. Just 4 minutes after the magnitude 6.8 mainshock struck, a major aftershock of magnitude 5.8 collapsed many buildings that had been weakened by the mainshock. The responsible fault had not been previously identified, but the area is sliced by many known faults.

Bad luck aside, it was buildings, some kinds more than others, that killed people. Structural engineer and co-team leader Loring Wyllie of H. J. Degenkolb Associates in San Francisco cites two types of nine-story buildings whose behavior during the quake displayed some lethal differences. Of the more than 50 frame buildings with precast components attached to column and beam construction, less than a dozen remained standing and even these were heavily damaged. In contrast, the 14 nine-story buildings in which panels and walls were connected in a different way "performed very well."

"There was very little reinforcing to tie some buildings together," says Wyllie. "The buildings basically came apart the way they were put together," notes team member Fred Krimgold of Virginia Polytechnic Institute and State University. Adds Wyllie, "Poor [construction] quality was certainly a factor."

In Leninakan, a large city about 50 kilometers from the epicenter, modern buildings did not fare as well as older ones. "The level of damage was almost inversely related to age," notes Krimgold; the new, high-rise, engineered structures tended to collapse while low-rise, unreinforced buildings were virtually unaffected. Krimgold says that Soviet authorities are planning to rebuild to heights not exceeding five stories using poured-in-place concrete rather than precast. Engineers will also develop new designs under the assumption that earthquakes as strong as this one will strike again; previous designs assumed a maximum shaking well below that experienced last year.

■ RICHARD A. KERR

Reuters/Bettmann Newsphotos

Spitak, Armenia: *Some buildings killed people, others did not.*

Double Exposures Reveal Mini-Comets?

They have not changed anyone's mind yet, but there are new telescopic observations being claimed as additional evidence of small comets pummeling Earth 20 times a minute. These comets are the 100-ton balls of fluffy ice whose physical implausibility and claimed huge abundance have outraged so many Earth and planetary scientists (*Science*, 10 June 1988, p. 1403). Researchers simply cannot imagine how they could have missed them.

When Clayne Yeates of the Jet Propulsion Laboratory announced last spring that he had detected small comets in the numbers proposed by their originator, Louis Frank of the University of Iowa, he hoped the matter was settled. He had slued the Space Watch Telescope on Kitt Peak across the sky in just such a way as to catch Frank's comets as they sped by Earth halfway to the moon's orbit. Any other search strategy and the short streaks recorded on the charge-coupled device (CCD) detector did not appear.

Noise, said CCD experts who saw the images. Everything from cosmic rays to random fluctuations in the CCD, they pointed out, can produce clusters or streaks of brighter-than-average picture elements, or pixels, among the 164,000 pixels making up a CCD image. The only convincing evidence, said these experts, would be the unequivocal detection of the same small comet in two consecutive exposures. That is the traditional requirement for the discovery of a new planetary body.

At the December meeting of the American Geophysical Society, Frank, John Sigwarth and John Craven of the University of Iowa, and Yeates had a poster presentation of their analysis of such multiple exposures. As was the case with all of Yeates's solitary images, they were made under his direction by Tom Gehrels of the University of Arizona, who runs the Space Watch Telescope. Out of 75 pairs of 12-second exposures, the group found 30 pairs of usable images. Out of the first exposures of those 30 pairs, they found five having apparent detections. Experience with the more numerous single exposures predicted that there would be about six detections. Of the five detections in the initial exposures, all five of the expo-