Tangshan quake: A Chinese report

With carefully chosen statistics and cautious phrases, Chinese scientists have disclosed in some detail for the first time the true extent of damage from the 1976 earthquake that devastated the industrial city of Tangshan, located some 90 miles southeast of Beijing (Peking). In papers and at a press conference given at the Second U.S. National Conference on Earthquake Engineering at Stanford University last week, the scientists confirmed that the temblor (Richter magnitude 7.8) was the "greatest earthquake that ever occurred in a densely populated industrial-mining city in China."

The delegation, headed by Li Jingzhao, Vice Minister of the State Capital Construction Commission, and Ye Yaoxian, Deputy Director of the commission's Office of Earthquake Resistance, still would not disclose the total number of deaths or value of property damage resulting from the quake. However, when asked about the widely quoted figure of 750,000 deaths, Li replied with a smile, "If that were true, there would be nobody left." He said the present population of Tangshan is about 600,000. Earlier in the decade, Western estimates of the population ranged between 800,000 and 1,200,000. Most of the deaths occurred in the city itself, Li said.

One thing *is* clear, however: Within the 47-square-kilometer area — including most of Tangshan — that suffered a peak shaking intensity of XI on the Mercali scale, building destruction was almost total. In the city, 95 percent of civil buildings, 80 percent of industrial buildings and 60 percent of highway bridges were severely damaged. The basic cause of this extreme degree of destruction, according to the Chinese, was that a major quake had not been expected so near Tangshan and building codes were designed only to allow buildings to withstand shaking of a maximum intensity of VI on the Mercali scale.

Ground cracks, some with offsets as large as 1.5 meters, extended along a complicated fracture line some 10 kilometers long. The delegation characterized the breaks as occurring along an old fault, whose destructive potential had not been realized. Thus, many buildings had been constructed of unreinforced brick or with reinforced concrete columns that did not have adequate bracing. Factory roofs, in particular, proved vulnerable to total collapse. However, "generally no collapse occurred in industrial buildings with strong columns, light-weight roofs and perfect bracing systems," the official report showed.

(Many U.S. scientists have recently expressed concern over the similar lack of preparation for large earthquakes in this country. Even in California, where the location of major fault lines has been well established, building codes have only recently included ductility requirements for reinforced concrete pillars to prevent their total collapse during a strong quake. In the eastern United States, many old fault lines — like the one underlying Tangshan — have not yet even been identified. See SN: 2/10/79, p. 90.)

Land offsets of 1.5 meters (below) and total collapse of buildings marked the near destruction of the city of Tangshan in 1976.

One of the most destructive, yet least understood, aspects of quakes like the one in Tangshan has to do with the phenomenon of "liquefaction" — the violent mixing of sandy soil and subterranean water under pressure that turns what appeared to be solid gound into a kind of quicksand. Two members of the delegation discussed this frightening phenomenon in more detail. Chen Dasheng reported that "damage caused by ground failure...is more closely correlated with the surrounding site condition than with intensity rating" — a finding confirmed by some U.S. scientists who are pondering the possible necessity of revamping both magnitude and intensity scales. Xie Junfei reported that placing more compact landfill over areas subject to liquefaction had been effective in minimizing damage, but that the area of necessary fill had proved difficult to estimate.

A related phenomenon, "sand blows," was also described in vivid detail by Chen. "A strange thing happened in a cultivated field about 1 km southwest of Luanxian County," he reported. "A great amount [more than five carts] of gravel fillet spouted out together with sand, water and some concrete lining from underground through an abandoned well and formed a 15-meter radius of gravel cone, with a water pit of 3 meters diameter in the middle." The area subjected to this sort of ground failure extended all the way from Tangshan to the sea, some 40 kilometers south.

According to the Chinese scientists, life is finally returning to normal in Tangshan and virtually all industrial buildings have been reconstructed — according to strict new building codes. (Some Western observers have expressed doubt about such optimistic estimates.) Peasants in the countryside have also received the "suggestion" that they reinforce their adobe houses with bamboo. Meanwhile, the 10-person delegation will spend three weeks visiting various U.S. centers for earthquake engineering research, including the California Institute of Technology and the Massachusetts Institute of Technology. □

U.S.-Japan quake research

Though "earthquake-proof" buildings can be designed (SN: 2/10/79, p. 90), few means — short of an actual quake — exist to test them. But a research agreement signed on Aug. 9 between the National Science Foundation and Japan's Science and Technological Agency and the Ministry of Construction intends to pool the two countries' skills and facilities in order to make the most of those few opportunities.

U.S. facilities for such work — no contracts have yet been signed by the NSF — can simulate earthquake stresses only on scale-model buildings. But a unique facility located at Japan's Tsukuba Science City — a "community" of national, private and university research facilities located 60 kilometers northeast of Tokyo — can test full-scale structures as high as seven stories. Called a strongback, an 8-meter-wide, 20-meter-high, 6-meter-thick vertical wall provides a test-stand, on either side of which is constructed an actual reinforced concrete building. A given design can then be tested for its response to "load" — more familiarly, the shaking of a quake. The first reinforced concrete structure will most likely be tested within a year, said an NSF spokesman. Matched funding for the project may total $6 million to $8 million for a five-year period. □

Pink plankton: Ice Age marker

Hunks of sediments pulled from the ocean bottom by the drill bits of research ships appear, to the naked eye, as just so much ooze. Different layers may appear brown, olive-drab, a little red or crusty-white with diatoms, but not until bits of the muck are subjected to chemical and microscopic scrutiny do they take on meaning. The presence of the skeletons of certain marine organisms may indicate at what depth and how many thousands of years passed since the sediment was formed; a change in the ratio between the isotopes of oxygen or strontium can reveal ancient sea surface temperatures. Such clues, few in number and painstakingly developed, are a researcher's only means of squeezing the earth's history from the