LONG ISLAND WEEKLY

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Long Island Q&A: **Dr. Charles Merguerian**

What Would Happen to Long Island in an Earthquake

By TERRY CONSIDINE WILLIAMS

INCLUDED in the student geology laboratory manual of which Dr. Charles Merguerian, a professor of structural geology at Hofstra, was a co-writer, is a depiction of a catastrophic earthquake in New York City. The objective of the exercise, Dr. Merguerian said, is to acquaint students with the plausibility of earthquakes here.

Dr. Merguerian, 46, traces his interest in geology from his childhood, when he crawled over a large outcropping of rocks near his grandmother's house in the Bronx. He grew to appreciate the abyss of time in 25 years of geological mapping and structural analyses of deformed and earthquake-prone terrains.

A graduate of City College, where he also received a master's in field mapping, Dr. Merguerian received another master's in geology from Columbia University, where he did doctoral work in tectonics.

Dr. Merguerian lives in Westbury with his wife, Myriam, and their two sons.

What have you found in your studies of the New York City water tunnels?

My detailed work in the tunnels has shown a multitude of faults that show no surface expression whatsoever. But they are there all over the place, hundreds and hundreds of faults in the crystalline bedrock. Of course, not all of them are major failure zones.

Q. Could those faults cause earthquakes?

A. Nobody can predict earthquakes. But pre-existing faults or dislocations in the Earth's crust produce earthquakes. And pre-existing faults tend to localize new earthquakes, just as earthquakes produce new faults. So it seemed very important to me to know where the faults are. That's when I started examining the distribution of brittle faults in New York City. Brittle faults are the potential failure zones for new quakes.

Q. Does your research suggest that there is an earthquake in Long Island's future?

A. Given the geology of East Coast North America, where Long Island sits, sure there's a tremendous possibility. The same faults that have been mapped in the New York tunnel project are also in the subsurface of Long Island. And the faults found to the north of us in Connecticut project southward across the Long Island Sound into the subsurface of the Island. So an earthquake occurring in midtown Manhattan could just as easily occur here in Hempstead. If you had to pick a place in the New York City vicinity where an earthquake could occur, take a dart board with a map of New York City and Long Island, and the earthquake could occur anywhere. It could be beneath our feet here on the Island, offshore in the Atlantic or in midtown Manhattan or the South Bronx or Staten Island or anywhere in the vicinity.

Q. Where are the fault lines on the Island?

A. There is no map of the faults, because they are not exposed to the surface. But we know from geophysical data, meaning data acquired from indirect sounding methods, that there are a number of faults in the subsurface or within the crystalline bedrock of the Island. These have been described in many publications, and some of these faults you can just project from Connecticut southward or from Manhattan and the Bronx toward the southeast.

Q. How deep is the bedrock?

A. Here at Hofstra, which is mid-Island, it's down about 1,000 feet. On the South Shore it's down about 1,500 feet. On the North Shore about 600 to 700 feet.

Q. Are the seismic problems in the bedrock?

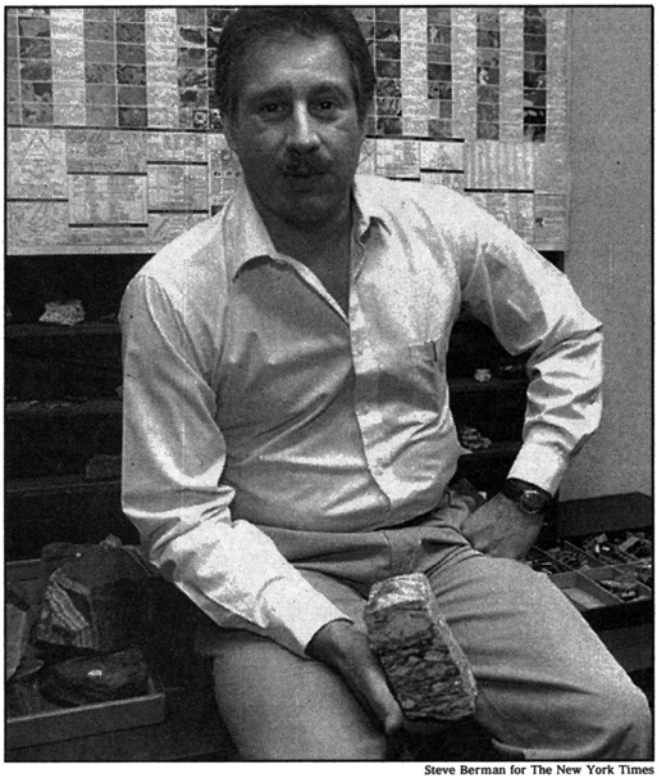
A. That's where the earthquakes would be generated, and then seismic waves would propagate upward through the sediments. The sediments here consist of a couple of layers that are overlaid by a veneer that is glacial sand, silt and clay. Collectively these are the aquifers, the layers where our drinking water is stored.

Q. What might happen to that sandwich in a major earthquake?

A. It's possible in a major earthquake which would be generated in the bedrock that some of those clay, sand and glacial layers would move and possibly liquefy. That could bring about the "shake like jelly on a plate" situation. That's what happened in the Kobe, Japan, earthquake.

Q. How large an earthquake would that be?

A. I would suspect a 6 magnitude of the Richter scale. That's larger than we've had here in the New York area. The last big one was offshore near Brooklyn in August 1884. That has been calculated, since it was before the Richter scale was devised in 1935, as a 5.5, and reportedly there were sand boils on Coney Island from liquefaction of the soil. In December 1737 we had an estimated 5.0 that was felt in Oyster Bay. Both of these were eclipsed by the devastating 7.1 in 1886 in Charleston, S.C. And that could happen here, because the geologic structure there is no different from what we have here.



Steve Berman for The New York Times

Dr. Charles Merguerian in geology department at Hofstra.

Q. Isn't the East Coast considered an inactive seismic zone?

A. Not any more. I know I was brought up as a student to think we don't have earthquakes here. But if you look you'll see there have been at least 50 events that have struck the New York area over the years. Most of them have been magnitudes of less than 3, and there have been a couple of 4's. But these big ones of 5.5 and in that range can occur, have occurred and will occur.

Q. Why?

A. Because the East Coast of North America is basically in a vise. We ride the middle of the North American Plate. That plate is being pushed by the growth of the mid-oceanic Atlantic ridge. While that's happening, the San Andreas system in California is hindering our plate from going any farther West.

Q. Do you concur with the theory that earthquakes in the middle of tectonic plates like those in our region tend to be much more damaging than quakes at the edges of plates, like those in the West?

A. I have been saying for years that earthquake damage here on the

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East Coast could far eclipse what you get out West, given the same magnitude event.

Q. Why?

A. It's partly the geology of the area, but it's largely because of the weakness of the infrastructure. All the systems built 100 years ago are failing now without any seismic activity. Nothing here is built with any resistance to earthquake shaking.

If the earthquake that occurred in New York City in 1884 occurred today we would be looking at a tremendous loss of life and a severe monetary problem. But nobody talks about earthquakes here. We have no specific plan.

Q. What does it mean to say that the bedrock here has a very strong directional capability?

A. It means that the energy from earthquakes can travel great distances through our bedrock. Seismologists call that High Q, and in New York the High Q favors transmission in crystalline bedrock in a northeasterly direction. For example, the 1988 earthquake in Montreal that was felt in New York City traveled right down the spine of the Appalachians.

Q. How would that affect the Island?

A. Anything occurring north of the Island could travel down beneath the Island. The energy of an earthquake occurring anywhere along the Connecticut River Valley, for instance, could be focused southward beneath the Island. So, you wouldn't have to have an earthquake directly beneath Long Island to have the effects of an earthquake transmitted here. The 3.5 quake Long Islanders felt in October 1981 was reported as being centered in Long Island Sound, directly south of Madison, Conn., and about 10 miles northwest of Greenport.

Q. Would bedrock's being closer to the surface on the North Shore than on the South Shore make a difference in a quake?

A. Yes. It would probably create a situation where the North Shore residents would feel it more. Not necessarily sooner, just more intensity.

Q. Do the two lines of faults intersect?

A. Yes. The prominent Northeast and Northwest families of faults meet somewhere near the Nassau-Suffolk border. And the point I always try to make is that the crevices or cracks where they do meet are the areas that I think are particularly liable for seismic activity.

Q. Would liquefied soil and boiling sand contaminate water supplies?

A. I don't think so. There might be some compaction of the aquifers, if we had a big enough earthquake, where you'd lose some storage capabilities but not much.

Q. Would underground objects like oil tanks and septic systems be affected?

A. Ground slumping because of liquefaction could cause local building collapse, particularly in older high-density neighborhoods. Septic systems and fuel-oil storage tanks could begin polluting the ground-water aquifers. Gas mains could fail and fires could result. In addition, I think the Nassau North Shore cliffs, which are inherently unstable, would react poorly in an earthquake, because of the shallow depth of the crystalline bedrock under them. Amplification of seismic wave energy might result in major landslides. Expensive North Shore property could be severely damaged.

Q. How would the Long Island Rail Road and airports be affected?

A. Local track failure is a possibility, particularly in areas underlaid by artificial fill or glacial-lake deposits, which are scattered throughout the Island. Airport runways built on fill may not fare too well in an earthquake. Large crevasses may open such as the 12-foot-long 10-foot-deep ones reported in the 1884 quake.

Q. What do you see as the major problem in a quake?

A. Generally we're in pretty good shape on Long Island. In most places we have a relatively flat terrain. We wouldn't suffer from landslides. If there were any disruption of road surfaces it would be from breaking of roads due to shaking of the soils. What's more, we're not constructed vertically, with lots of tall buildings.

But a major problem for the Island might be tsunami, a Japanese term for harbor waves or seismic sea waves. Those can be very destructive, because they can have wavelengths of up to 900 feet, be up to 90 feet high, travel up to 500 miles an hour and in general last for 10 to 60 minutes. If we had a 6.0 earthquake offshore we could be dealing with very serious tsunami. And sometimes earthquakes occurring on land will send a compressional wave out, and the water will be pushed away and then come back as tsunami. ■