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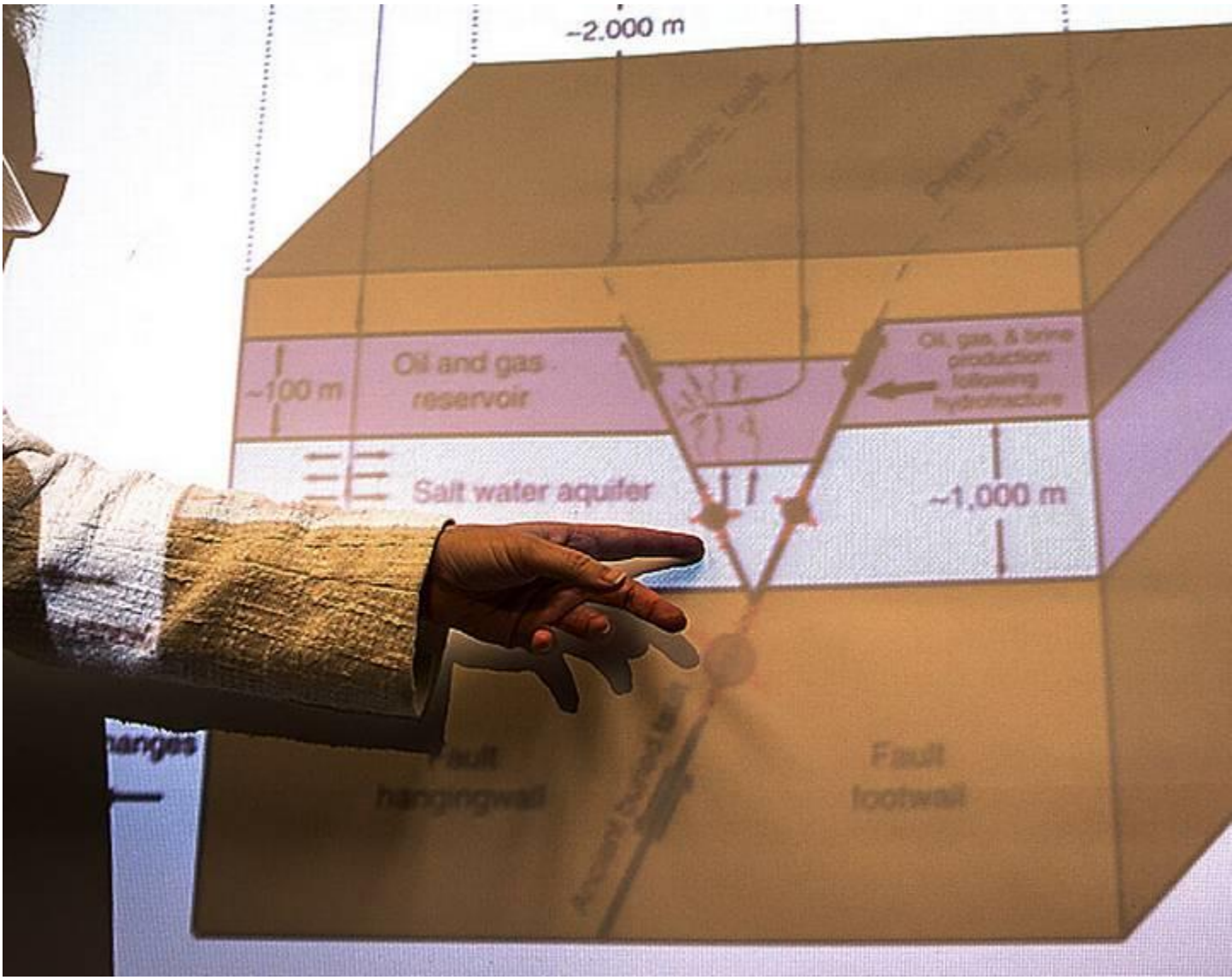
XTO map presents detailed, if unverified, picture of North Texas faults



Heather DeShon, associate professor of geophysics at SMU, discussed drilling's effect on North Texas in April. An SMU-led seismology team found that oil and gas operations are the most likely cause of dozens of earthquakes around Azle.

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The fault lines on the map are clear and strikingly large. They slant north to south across Dallas, Tarrant and neighboring counties.

Some have nicknames. One is the Big D Fault, a thick, red gash at least 14 miles long that cuts below Oak Cliff, Love Field and the Medical District. To the west is the Airport Fault, which runs beneath Dallas/Fort Worth International Airport.

Developed by a unit of the energy giant ExxonMobil Corp., the map provides new information about the existence of underground features that could be contributing to the earthquakes that have been jolting North Texas for the last several years.

But exactly what the map means is under dispute. To energy companies like Exxon, it shows that at least some of the temblors are probably natural and unrelated to oil and gas activity. To scientists who have been studying the quakes, the map is merely a tantalizing glimpse of the kind of information they need to understand where earthquakes may strike and how strongly they could shake the ground.

To residents who have seen the map, it's unnerving. Cathy Wallace, a member of the group Irving Impact that is working to raise awareness about the relationship between oil and gas operations and earthquakes, found them in a document posted online by *The Dallas Morning News*.

She made copies and shared them with neighbors and members of the Irving City Council.

"It's stunning how many faults are here," she said.

Behind the map

Andrée Griffin, vice president for geology and geophysics at XTO Energy, a subsidiary of ExxonMobil, presented the map before the Railroad Commission of Texas last June.

She was speaking at a hearing that the RRC had called in response to a published study linking an XTO wastewater disposal well to a cluster of earthquakes near Fort Worth. She used the maps to describe North Texas geology and to argue that the faults have been active throughout geologic time.

In the study, scientists argued the opposite: that the faults in North Texas had been dormant for hundreds of millions of years until oil and gas operations kicked them into action.

XTO created the map using seismic data that it had gathered as well as data that it had purchased from other companies, Griffin said during her testimony.

As companies explore for oil and gas, they deploy equipment that, in essence, creates ultrasounds of the Earth. Sound waves bounce off underground structures and highlight petroleum deposits as well as fault lines.

“XTO routinely conducts regional geologic studies in the basins where it operates as part of being a responsible operator and through its normal course of business,” the company said in a statement emailed to *The News*.

The data is expensive to gather and to purchase, which is why it rarely makes its way into the public realm.

But XTO has shared data with scientists working to understand the recent uptick in Texas seismicity.

Hazard predictions

The raw data behind maps like XTO’s are one of many pieces of evidence that scientists use to determine an area’s earthquake hazard.

“But they’re a very important piece,” said Rall Walsh, a doctoral candidate at Stanford University who studies human-triggered earthquakes. “And, sometimes, they’re the piece of the puzzle that is missing.”

Generally speaking, earthquake size scales with fault size. But the vast majority of faults found in the middle of continents are relics from a more turbulent time and no longer pose any danger.

“There are thousands of faults that are hundreds of kilometers long and represent virtually no hazard,” said Matthew Hornbach, a geophysicist at SMU.

Mark Petersen, who leads the U.S. Geological Survey’s efforts to understand the hazard associated with human-induced earthquakes, said he wasn’t surprised to see large faults beneath North Texas. In fact, his team had assumed their presence when calculating how large of a quake the region could have.

His team compared the Central and Eastern United States with geologically similar parts of the world and predicted that Dallas-Fort Worth residents could realistically expect a 6-magnitude temblor. But he said he couldn’t rule out an earthquake in the 7-magnitude range.

According to the USGS, a 6-magnitude earthquake would cause “slight to moderate” damage in “well-built ordinary structures.” But Petersen said damage could be more serious, especially in an urban area.

A 5.6-magnitude quake that struck near Prague, Okla., in 2011 injured at least two people, buckled parts of a highway, and destroyed 14 homes, according to a USGS summary. The 2014 6-magnitude quake in Napa, Calif., injured more than 250 and caused half a billion dollars worth of damage.

Dead or dangerous?

The News obtained high-resolution copies of the maps through a public information request to the Railroad Commission of Texas. A reporter then showed the maps to experts at the USGS, SMU, Stanford University and the University of Texas at Austin.

Scientists said they need more information to understand whether the faults in the XTO map pose a hazard.

Only faults that are under a significant amount of natural stress are of concern. In that case, even a small amount of pressure from fluid injections could make them rupture.

The faults may also need to be oriented just the right way relative to the tectonic stress in the Earth.

Scientists also cautioned that the map reflects one company's interpretation of a complex set of data.

"You can look at 10 different interpretations of the same data set, and they will often not agree," said SMU's Hornbach, who is working with his colleagues to verify the map.

An effort to figure out which faults run the highest risk of slipping is underway in Oklahoma, where the state's geological survey is working with energy companies to map faults across the state.

Jeremy Boak, director of the Oklahoma Geological Survey, said that fault maps can provide more detail than the USGS's seismic hazard predictions.

"You may be able to give some guidance on where to not put a well, or where to limit the injection capability of a well," he said.

Persuading companies to share proprietary seismic data can be challenging, said Boak, but he and his colleagues have found a middle ground. Some companies have shared fault "traces," which are lines on a map; others have shared raw seismic data below the level where deposits of oil and gas can be found.

"Right now, we are just hungry for anything," he said.

A similar effort is getting started in Texas. Scott Tinker, the state geologist and head of UT-Austin's Bureau of Economic Geology, is working with oil and gas companies in the bureau's newly formed Center for Integrated Seismicity to gather enough data for a comprehensive map.

Scientists at the center, along with Stanford geophysicists, are creating a “stress map” of Texas that will be paired with the fault map to determine which, if any, fractures are primed to rupture, he said.

“Everybody’s goal is to understand this better,” said Tinker.

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