Research offers new evidence about the Gulf of Mexico's past

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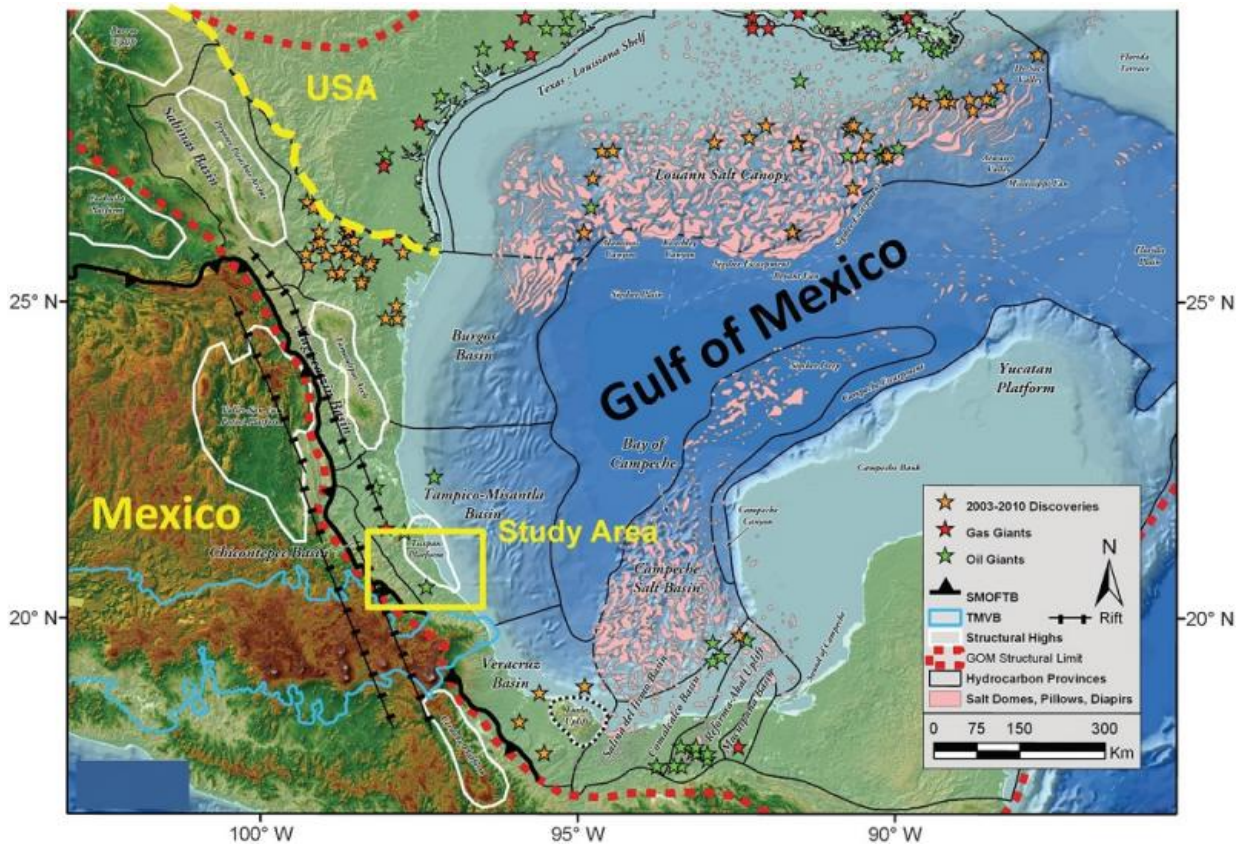

Map shows the study area along eastern Mexico and the Gulf. Credit: Anthony B. Rodriguez

Geologists studying a region in the Mexican state of Veracruz have discovered evidence to explain the origin of the Wilcox Formation, one

of Mexico's most productive oil plays, as well as support for the theory that water levels in the Gulf of Mexico dropped dramatically as it was separated from the rest of the world's oceans and the earth entered a period of extreme warming.

The drop in water levels and the warming, known as the Paleocene-Eocene thermal maximum (PETM), occurred around 55.8 million years ago. The Gulf refilled about 850,000 years later.

Geologist Don Van Nieuwenhuise said the study, published in the February edition of *Interpretation*, explains the distribution of the Wilcox Formation from onshore Texas and Mexico into the deep waters of the Gulf and offers insight into the episode of extreme warming more than 55 million years ago, with potential implications for climate change today.

Van Nieuwenhuise, director of professional geoscience programs at the University of Houston, is an author of the study, along with lead author Stephen P.J. Cossey, Joseph Davis, Joshua H. Rosenfeld and James Pindell. Cossey, Davis, Rosenfeld and Pindell are independent geologists.

The findings support the theory that the Gulf of Mexico was landlocked as the Paleocene Epoch morphed into the warmer Eocene, punctuated by a massive loss of water due to evaporation and, millennia later, was inundated again.

Van Nieuwenhuise said oil producers long have been puzzled about the Wilcox Formation's appearance in the Gulf's deeper waters, hundreds of miles from where it appears onshore. This new information could mean there are still-undiscovered sections of the formation, also known as the Paleocene/Eocene Chicontepec Formation, he said.

But while the research offers a better understanding of where additional oil reservoirs might be located, Cossey said it also expands what is known about the history of the Gulf.

"There have been geologists working in the Gulf of Mexico for decades," said Cossey, who is based in Durango, Colo. "After all these years, we're still finding out things we didn't know. This is important for oil and gas exploration, but it's also important in the history of the Gulf of Mexico and our knowledge of climate change."

The researchers said waters in the Gulf dropped at least 650 feet, leaving an exposed area that refilled less than a million years later - the blink of an eye in geologic time.

"Proving the existence of the Paleocene-Eocene drawdown would profoundly alter the interpretation of the Gulf's geologic history with academic and economic ramifications," the researchers wrote. "The theory, if further validated, would provide a revised context and would enhance predictability for petroleum exploration. ... We can add another line of evidence that the (Gulf of Mexico) drawdown occurred and that it likely happened near the Paleocene-Eocene boundary," or in the era between the Paleocene and Eocene epochs.

Several members of the team had previously worked near the village of Chicontepec, in Veracruz. Cossey, in fact, has written a book about the region, "Chicontepec: A Mexican National Treasure."

He returned in February 2015 to an outcrop previously documented as a coal bed, convinced that the existence of turbidites, a type of sedimentary rock associated with deep ocean currents, next to the coal deserved more investigation.

Analysis of samples from the outcrop convinced the researchers that the

"coal" was in fact a fossilized oil seep dating to the late Paleocene/early Eocene. Samples from above and below the oil contained fossilized sea life, additional evidence that the area was once submerged.

The researchers report that the oil seep developed after a dramatic drop in water levels in the Gulf, triggered by evaporation and coinciding with the PETM, the previously reported surge in temperatures. They conclude the dropping sea levels reduced pressure on hydrate-rich sediments, resulting in a massive methane release. Although there is not yet proof the warming was triggered by the methane release, Cossey said the timing fits.

"We know there was an increase in temperatures about 56 million years ago," he said. "If we know the drawdown in the Gulf of Mexico caused that, we can better understand how natural events on earth can affect the climate."

Van Nieuwenhuise noted that today's warming oceans could also cause hydrates on the ocean floor to release methane, which may exacerbate climate change.

The region where the outcroppings were found was re-submerged as the Gulf waters rose but are now above sea level and about 100 miles from the Gulf coast, due to later geologic movement known as Tectonic activity, which would have reopened the passage between the Gulf and the world's oceans.

Provided by University of Houston