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Permania - 100 Years In The Permian Oil Fields Of New Mexico And Texas

The Permian Basin oil field in southeast New Mexico and west Texas first started producing shortly after World War I. But almost 100 years later, it seems to keep getting better, and may become the world's biggest oil field. A combination of new technologies and global price wars has kept the basin amazingly productive.

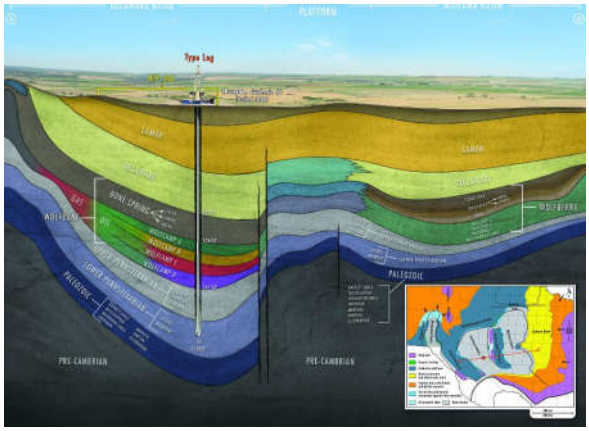
There's actually a word for this – it's called *Permania*. And it's on the lips of everyone in the Oil&Gas industry.

Many huge oil fields are famous throughout the world. The Ghawar field in Saudi Arabia, discovered in 1948, is considered the biggest and the best known, producing about 5 million barrels per day, with estimated reserves exceeding 70 billion barrels. And this is above the 70 billion or so already extracted. Ghawar is why Saudi Arabia leads OPEC.

But the Permian Basin, a 300-mile expanse from west Texas to southeastern New Mexico, is headed to becoming the biggest in the world. It is now the largest producing basin in the United States, having yielded almost 30 billion barrels of oil and 75 trillion cubic feet of natural gas. Currently, the Permian is pumping about 2 million barrels of oil a day.

It's gotten so busy that the town of Carlsbad, New Mexico has nary a vacant room given the many oil and gas people coming through. And they've been building new hotels as fast as they can.

The Permian Basin is almost unique in that it has so many oil and gas producing rock formations stacked one on top of each other, called multiple stacked plays, each of which is more than a thousand feet thick, ranging in depths from a few hundred feet to five miles below the surface (see figure from Tarka).



Map of the Permian Basin in southeast New Mexico and west Texas showing the multiple stacked producing zones in cross-section. Even after a 100 years of production, the Permian Basin is producing more oil and gas than ever, thanks to new technologies and strategies.

Eighty percent of the reserves are located at less than 10,000-feet in a dozen or so stacked zones including the Yates, San Andres, Clear Fork, Spraberry, Wolfcamp, Yeso, Bone Spring, Avalon, Canyon, Morrow, Devonian, and Ellenberger formations.

In contrast, the Eagle Ford field in east Texas, another big field, has producing zones only two to three hundred feet thick.

According to Scott Sheffield, Executive Chairman and CEO of Pioneer Natural Resources, the Permian will end up being bigger than the Ghawar field, with more than 75 billion barrels in the Spraberry and Wolfcamp plays alone, 40 billion barrels in the Delaware, and more in new zones being discovered, like the Wolfcamp C. Sheffield thinks the totals will exceed 160 billion barrels.

The primary producing rock types are limestone, dolomite and sandstone that have high porosities. But advances in horizontal drilling and hydraulic fracturing have expanded production into unconventional, tight oil shales such as those found in the Wolfcamp formation.

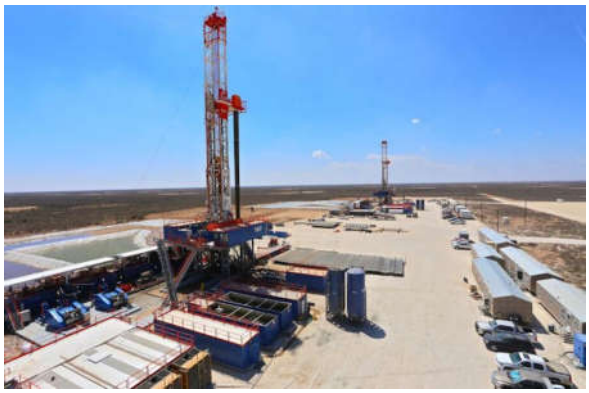
In fact, it is precisely the technological advances that have opened up the Permian so much, innovations that have increased oil recovery from 5-7% only last year to 15-20% in 2017.

'The reason productivity is dramatically increasing in the Permian Basin,' says David Zusman, Managing Partner of Talara Capital Management, 'is that there is directional drilling with longer laterals (horizontal drill lengths away from the vertical shaft), rising proppant intensity in wells (the particles that keep fracked wells open), tightening frac cluster spacing, and a shift

to multi-well pad drilling – everything that allows operators to better stay in the producing zones and get more out of them. It has made the Permian the lowest cost basin in the United States, and likely the all-important marginal barrel globally.'

Surprisingly, the rig count isn't as much of an indicator as it used to be, because each of those rigs are producing more. Rig count in the U.S. went from over 1,600 in 2014 to 350 at its lowest, and is now back up to 700 or so. But those 700 are producing more than ever before.

Some of these drill rigs can even walk around on their own from well to well (see figure).



A Patterson-UTI APEX WALKING drilling rig, operating in the Permian Basin, uses hydraulic feet to walk from one drill site to another, able to move forward, sideways or in a circle with pipe racked back, without the need to move other primary equipment. These new technologies have not only reduced cost and increased efficiency, but have played an important role in the evolution of the industry in response to external forces like the recent Saudi-U.S. oil war.

According to SeakingAlpha, there were 285 horizontal/directional drill rigs operating in the Permian Basin at the end of March 2017, with 43 new rigs added in just the last two months.

The amazing productivity of the Permian Basin comes from its geologic history. From about 850 to 310 million years ago (from the Precambrian to the Mississippian), the ancestral Permian Basin was a shallow marine margin on the edge of a vast western sea, slowly accumulating marine carbonates, sediments and shales.

Then during the Permian, beginning about 300 million years ago, the North American continent collided with Gondwana Land (a supercontinent that later split apart into South America and Africa). This violent compression created two deep sub-basins, the Delaware and the Midland Basins. These filled with clastics (sediments like sands and gravels), and were surrounded by shallow shelves that precipitated carbonate rocks from reefs and shelled organisms of the shallow

sea.

After that, the basins became slowly shut off from the ocean, intermittently flooding and evaporating for millions of years, precipitating thousands of feet of salt, some very pure and tight. The effect was a deep basin filled with marine sediments, capped by tight formations, in which the dead marine organisms were eventually pressed and cooked into oil and gas.

Since these formations include both porous and tight rocks, the oil was able to be extracted with increasingly innovative technologies, from traditional to advanced, over the last century.

As the Permian Field approaches 100 years in age, and as our ability for technological innovation shows no sign of slowing down, production from this basin will show no sign of slowing down either.

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