The Oil Drum
DISCUSSIONS ABOUT ENERGY AND OUR FUTURE

Tech Talk - The East Texas Field Develops

Posted by Heading Out on May 8, 2011 - 5:21am

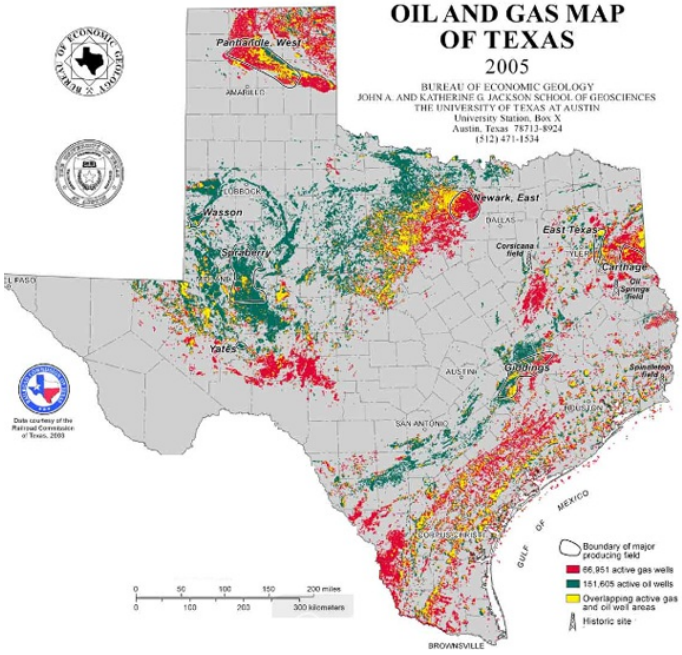
Last week I discussed the start of oil production in the United States and the evolution of the Appalachian fields, which, for a while, were the most productive in the world, but are now largely depleted. It was possible, however, to take the odd well to show that where production is largely managed, so the ultimate recovery from a reservoir can be continued for decades.

Appalachia was displaced as the production leader by the East Texas oilfield. This field, with oil held in the Woodbine sandstone, was first discovered in 1927, though there was no significant production until the end of 1930.

> The first oil leaving the field went in thirteen tank cars of 10,000 gallons each to the Sinclair refinery in Houston. Later, in December 1930, Ed Bateman, a Fort Worth promoter who ran a poor-boy operation called Bateman Oil Company, completed a well ten miles to the northwest of the Bradford No. 3 in the E. G. Sevier Survey, Rusk County. It was the Lou Della Crim No. 1, and it flowed 22,000 barrels of oil per day from 3,653 feet. With four producing wells at the end of 1930, East Texas field reported a yearly production of 27,000 barrels of oil and no gas.

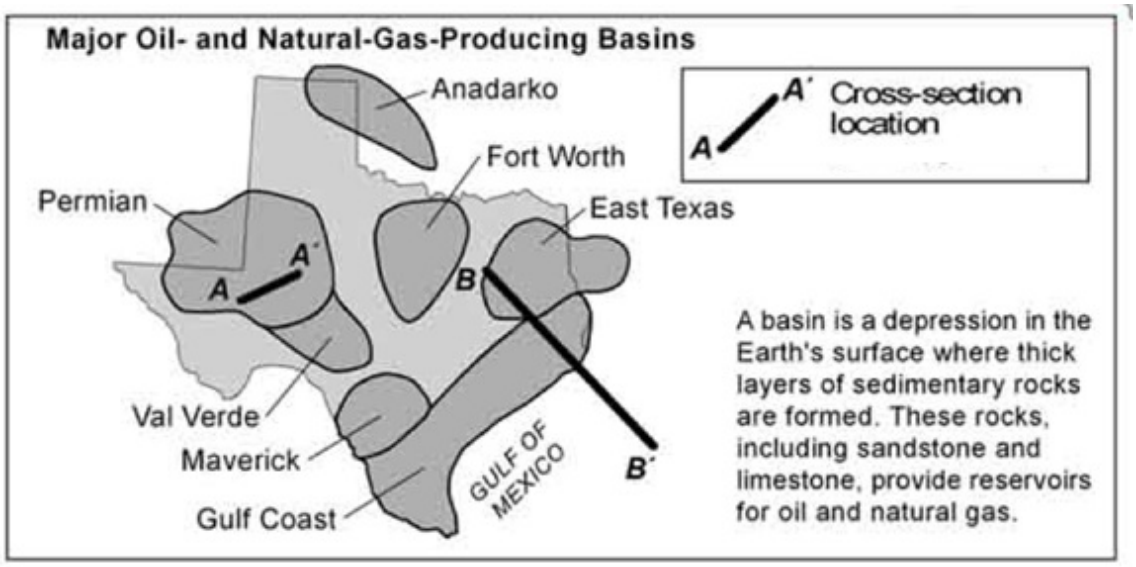
This led to an immediate frenzy of drilling, which in turn led to the first controls on well production, with the Texas Railroad Commission preceding OPEC by decades in the moves that it made to define targets for production. There are a couple of other relevant stories about the field, and so it is a useful second stop as we look at the evolution of American oil production.

There are (as with many things) rather a lot of oil and gas wells in Texas. In 2005 there were still 66,951 active gas wells and 151,605 active oil wells.



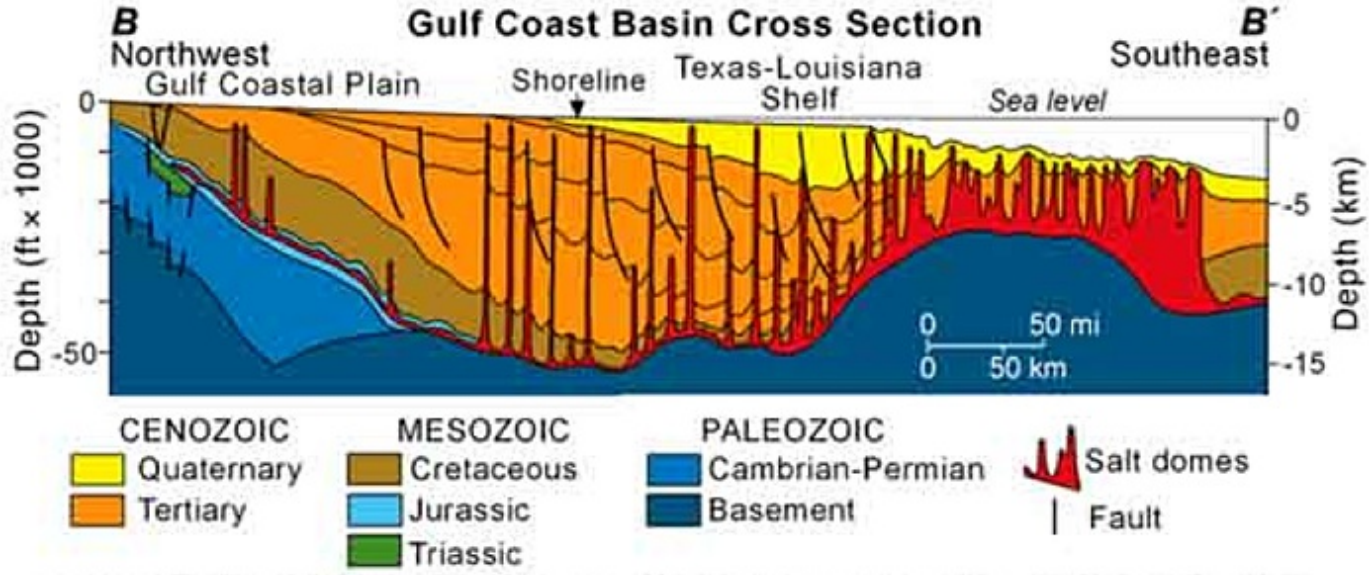
Producing wells in Texas in 2005 (Bureau of Economic Geology)

The state, and surrounding regions, have a number of different oilfields within their borders, with East Texas being where you might think.



Major Texas hydrocarbon basins (Bureau of Economic Geology)

A section along the B-B' line gives some idea of the formations, and will be a useful guide when I come to talk about reservoirs associated with salt domes later in the series, although they were the cause of the first great Texas oil rush at Spindletop.



Modified from Worrall, D. M., and Snelson, S., 1989, Evolution of the northern Gulf of Mexico with an emphasis on Cenozoic growth faulting and the role of salt tectonics, *in* Bally, A. W., and Palmer, A. R., eds., The geology of North America—an overview: Geology of North America, v. A, p. 97–138.

Section showing the rock structure in East Texas (Bureau of Economic Geology)

East Texas was not the first oil field in Texas to be brought into production, nor the most famous. That resides with Spindletop down near Beaumont in Southeast Texas which is remembered as the most dramatic, when it blew back in 1901.

> On January 10, at around 10:30 a.m. the Lucas Gusher at Spindletop blew. The oil spray, which could be seen for ten miles, was fully six inches across and rose to over 200 ft above the derrick. . . . . .
>
> Nine days and 800,000 barrels later, they cut the gusher off.

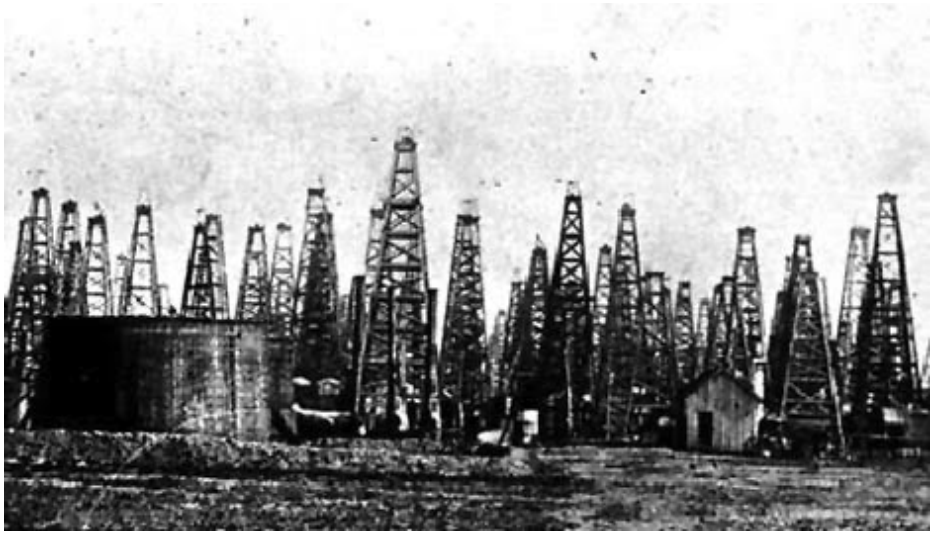
Over 285 active wells were drilled into the formation under Spindletop Hill. But the field rapidly declined in production over the next five years, although it was a major contributor to America being able to reach a production of 1 mbd in 1919.

> The overabundance of wells at Spindletop led to a rapid decline in production. After yielding 17,500,000 barrels of oil in 1902, the Spindletop wells were down to 10,000 barrels a day in February 1904.

In 1926 there was a second surge in production, which was more controlled and gave the field peak at 21 million barrels in 1927 (out of a total field production of around 153 million barrels), but this had petered out by 1931, just as East Texas was surging. Spindletop is credited with being the first well to use drilling mud, rather than water, as the cooling and transportation fluid to get the cuttings out of the hole, while keeping the hole itself stable.

The production potential of the Woodbine sandstone in East Texas, in contrast, was greatly helped because the oil lay over water, and this underlying water helped to sustain the driving pressure that helped keep the wells in production over longer time intervals. Of course that only

holds true to a degree. And back in 1931 there was little constraint on how close wells could be.



Wells at Spindletop in 1902 (Spindletop- Gladys City Boomtown Museum)

This led to a great rush to bring wells into production, given that the this production was governed by what is known as "the rule of capture."This, in essence said that if the well came into your well by flowing out from under your neighbors yard, then that was just tough for him/her, providing that your well remained on your land all the way. That ruling came about ultimately through an 1889 Pennsylvania Supreme Court decision. However it should be noted that the well has to remain on your property. There was a considerable scandal in East Texas in 1962 when it was discovered that some wells had "bent" so that instead or remaining on the owners property they ended on someone else's lease, and took that oil. That is not allowed, and became a scandal when the scale of the mischief was discovered.

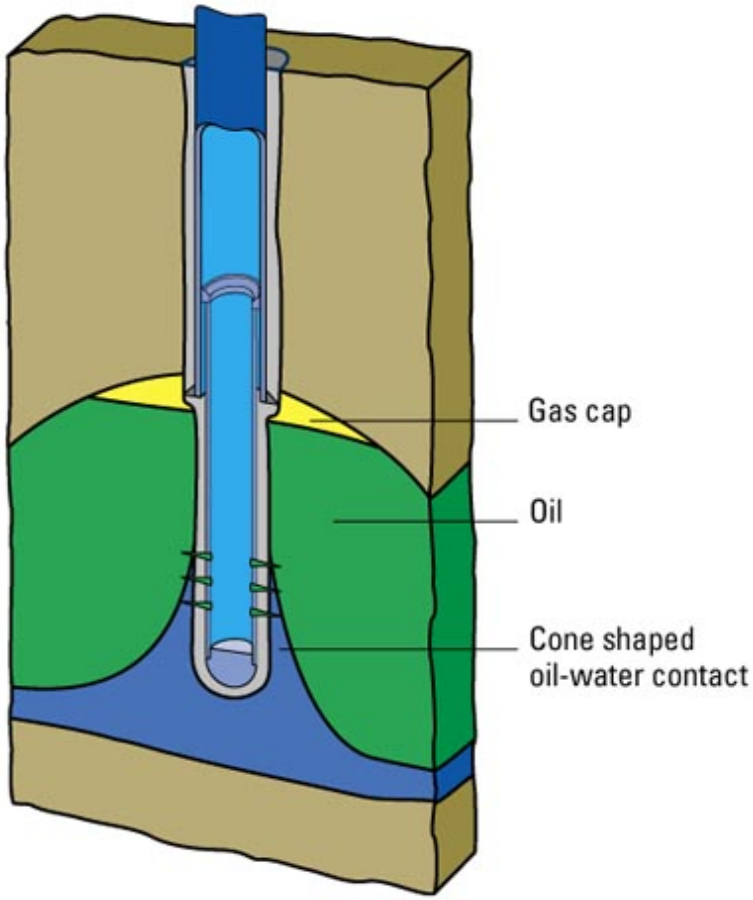
> It was learned that operators had drilled slanted holes from barren acreage beyond the limits of the field back into the Woodbine formation, tapping into productive leases owned by major companies. During a series of investigations, inspectors found 380 deviated wells in East Texas field and shut them down. An estimated $100 million worth of oil was stolen over several decades from legal owners. Many of the oil pirates were leading citizens of East Texas communities.

Yet this wasn't the greatest problem with the field. So productive did the wells become that the amount of oil available saturated the market available, and within months the price of oil had plummeted. It began the year at $0.99 a barrel, but by July was down to $0.13 a barrel, and something had to be done. The industry answer had been to increase production at individual wells as the price fell, but the problem with increasing production can perhaps be illustrated by example.

If you take a cup of black coffee and very carefully pour cream into the cup over the back of a spoon at the level of the coffee, you can "float" the cream on top of the coffee. (And if you are of that frame of mind you can do this with various types of alcohol in a bar). If you put a straw into the cream and suck gently you can pull most of the cream into the straw, and thence into your mouth (production) without getting any coffee. But if you suck too hard then the coffee comes up through the cream into the straw and you can't reverse the situation.

So it is with an oil well. If there is water under the oil (as there is in East Texas) then sucking too

hard (relatively) will pull the underlying water up into the well rather than the surrounding oil. The process is called "coning" and can be illustrated.



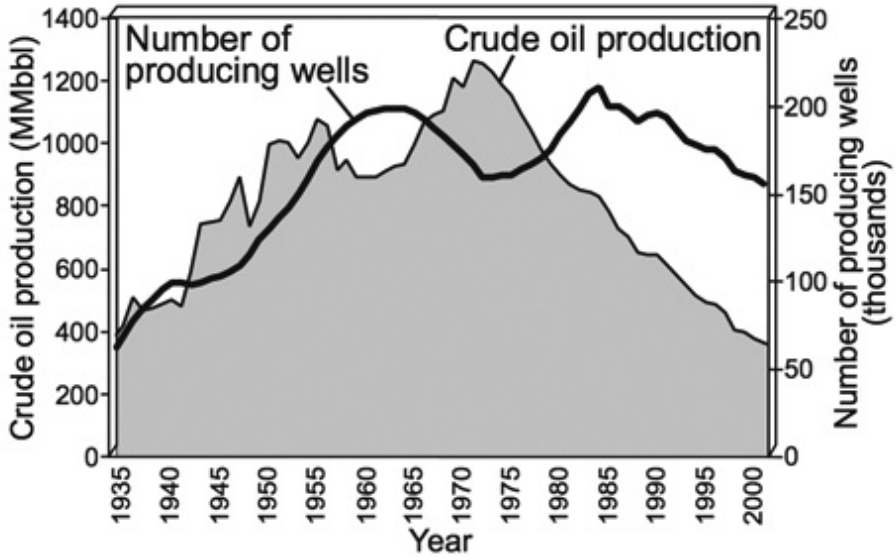
Water coning (Schlumberger)

Obviously this is not desirable, but if the alternate to pumping like crazy to get all the oil out from under your derrick before it all flowed to your neighbors was to lose the production to them, folk just hoped coning wouldn't happen to them. The combination of damage to the field, and the glut of oil that this produced had an immediate effect on price. Something had to be done, and it was.

> On August 17, 1931, the governor ordered the Texas National Guard and Texas Rangers into the ten-month-old field to shut in all of its 1,644 wells and to maintain order. The field resumed production on September 5, 1931, under a new proration order that limited its production to 400,000 barrels of oil per day, permitting each well 225 barrels and giving no consideration to its potential or to the characteristics of the lease. New wells came on line, and by October allowables were reduced for each one to 165 barrels per day.

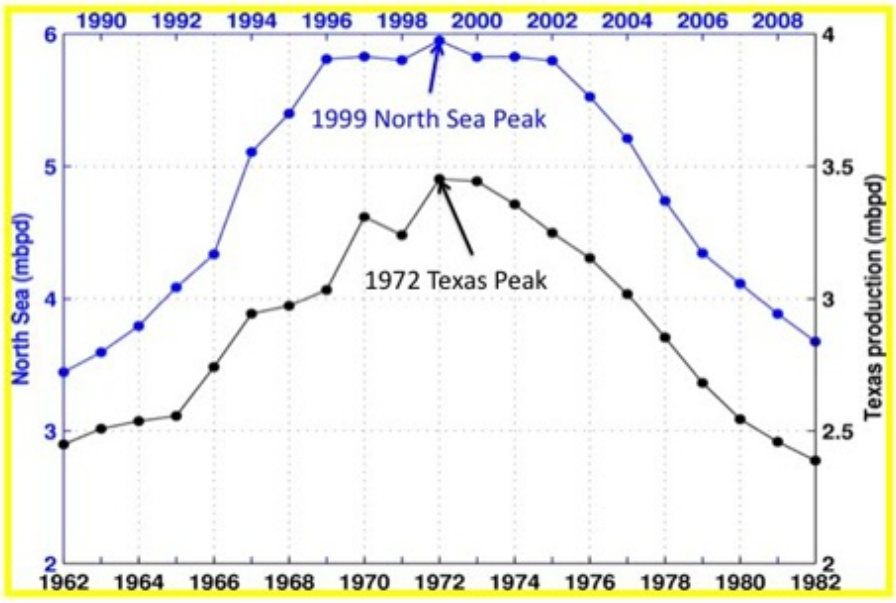
And it was from those days that the Railroad Commission of Texas acquired its power. But that is a sufficiently interesting story that I will go into it more next time.

In the interim, let me leave you with this thought. The production of oil in Texas peaked in 1972, and in March of that year the Railroad Commission lifted restrictions on produced volumes for individual wells.



The peak in Texas oil production (U of Texas)

However the profile of that peak, and the resulting decline (in which period there were no longer regulatory restrictions) has, as Westexas has noted, been similar to the decline of other fields. It thus allows modeling and a prediction of future oilfield production post peak. But that too is a topic best left for another day.



A similarity in peak profiles (Westexas)