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Oil and Gas Plays of New York State

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Here we have a map of all the active wells in New York (with a few minor exceptions). This map is a couple years old so there are some wells that aren't shown. As you can see, all the oil and gas production occurs in the central to western portion of the state. In fact, exploration of the Marcellus Shale would involve drilling in a portion of the state where the geology is still largely unknown.

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Although there are several other minor plays in the state. I'm going to be covering these 11 which are the largest producer and most commonly referred to. I'll be going through these in stratigraphic order, starting with the shallowest reservoir and working towards the deepest.

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But before I begin going over the gas plays, I thought it might be good to start with a little history of the petroleum industry in NY. The first documented occurrence of hydrocarbons in NY comes from a 1627 report by French missionaries near Cuba, NY. They reported that there was a natural oil spring seeping into the local water supply. The Seneca Indians believed the oil had healing powers and used it as a medicine.

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In 1821, almost 200 years later, William Hart dug the first natural gas well in the country in Fredonia, NY. In 1830, this lighthouse just south of Fredonia became the first to be lit by natural gas. And by the 1880's hollow logs were being used to pipe gas into towns where it was used for heating and lighting.

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Then in 1859 Edwin Drake drilled the first commercial oil well in Titusville PA, just 25 miles south of the NY boarder. This 70 foot well produced from a small lens of sandstone in the Upper Devonian shales. Its success led to increased exploration in NY.

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6 years after the drake well was completed, Job Moses drilled the first NY oil well in the town of Limestone. This well produced 7 bbl/day from the Upper Devonian Bradford Sandstone and led to further exploration in the state.

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Continued exploration and growing success led to the oil boom of the 1880's in which the Bradford and Richburg oil fields produced over 20 million barrels of oil.

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This picture shows the town of Richburg in 1882. Sadly, there are many people in NY who think that this is what their land will look like if we allow drilling in the Marcellus today.

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Following the initial boom in the mid 1880's, primary production dropped off to about 1 million barrels per year. Then the legalization of waterflooding in 1919 led to the production of over 100 million additional barrels of oil by 1961. Interestingly enough, the concept of waterflooding was first discovered in the mid-1800's when faulty casing in a nearby well caused water to flow into an oilfield. The increased pressure led to greater production, but the technique remained illegal for another 54 years.

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Moving on, below the Upper Devonian sands, the Onondaga coral reefs have been producing gas since the 1960's when they were first discovered by early seismic surveys. Producing Onondaga wells are spread out all over the state with 179 wells in 12 different counties. Cumulatively, these wells produced almost 49 mmcf of gas in 2008. Several older Onondaga fields have been converted to gas storage facilities.

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The Oriskany Sandstone play is probably the most conventional gas play in NY. It was discovered in the 1930's when drillers began to explore deeper in response to the decline in shallower wells. The gas here is trapped in anticlines and by its patchy distribution. Like the Onondaga reefs, several Oriskany fields have been converted to gas storage. Perhaps the best example of this is the Stagecoach field in Tioga County. This field was discovered in 1987 and produced almost 8 billion cubic feet of gas before being converted to what is now the easternmost underground gas storage facility in the US. This field has a withdrawal capacity of 500 million cubic feet of gas per day.

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The Bass Islands trend in Chautauqua County is northernmost extension of what is called the Silurian / Devonian Carbonate Thrust belt. It produces from the Onondaga Limestone and Bertie Dolomite. The trapping mechanism here is a linear trend of heavily fractured reverse faults and associated anticlines. This play was discovered in 1981 and was at that time NY's first flowing oil well in 40 years. In 2008, the bass islands produced over 13,000 barrels of oil and 136 million cubic feet of gas.

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The Medina play is a tight sandstone gas play located predominantly in Chautauqua and Erie Counties. With low porosities and permeabilities, most medina wells must be hydraulically fractured before they will produce at economic rates. The Medina is the second largest gas producer in the state, it is characterized as a continuous-type accumulation because the formation seems to produced almost everywhere in the target area. It has been estimated that there may still be up to 4 trillion cubic feet of undiscovered gas in this play.

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The Herkimer-Oneida-Oswego is a relatively new play with the majority of its wells having been drilled in the last 13 years. It consists of fractured sandstone which lies between the Upper Silurian shales and the Upper Ordovician Queenston formation. Nornew has drilled several successful horizontal wells into this unit and one well drilled by Gastem earlier this year tested 2 mmcf/day from this horizon. There is good potential for future Marcellus wells to be deepened to include this play.

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Moving on, the Queenston is an upper Ordovician sandstone that is productive in the central part of NY, mostly Seneca and Cayuga Counties. It is a fluvial sandstone with frequent cross-beds, likely deposited in a braided stream type of environment. This gas play incorporates a facies change trap as the queenston grades from a sandstone into a shale as you move away from this area. Natural fractures are thought to be the key between a productive and dry well. The queenston produced almost 2.5 million cubic feet of gas in 2008.

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The Utica is an Upper Ordovician organic-rich shale that was deposited during the taconic orogeny which makes correlation difficult. With TOC's as high as 3.5% this formation is believed to be the source rock for many of the plays we've covered so far. Although production data is not yet available, Gastem has had recent success drilling vertical wells in Otsego County and stimulation of these wells will likely increase production. Like the Herkimer-Oneida play, the Utica offers a 2-for-1 oppornity when paired with Marcellus as they appear to share the same fairway.

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The Trenton Limestone play was discovered in 1888. It is an upper Ordovician limestone with interbedded shales. The typical well has several high pressure gas shows during drilling that usually drop to about 10 mcf/day. These high pressure shows have been known to blow casing right out of the hole and mud weights as high as 19 pounds have been used to hold back the pressure. We believe the gas is contained in bedding planes, shale partings, and horizontal fractures where the pressure actually holds open the space between beds until punctured by a well. All the productive Trenton wells are less than 3000' deep which corresponds to the threshold between horizontal and vertical fracture development. There are currently 13 active wells that produced almost 42 million cubic feet of gas in 2008

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The Trenton-Black River Hydrothermal Dolomite Gas Play occurs as an alteration of the Trenton and Black River Limestones. We believe that faulting during the Taconic Orogeny allowed high pressure / high temperature fluids to travel upward along basement rooted faults where it leached and in turn dolomitized the surround rock. These reservoirs occur as long linear seismic lows and have been known to have permeabilities greater than 10 darcies. The Trenton-Black River dolomites are by far the largest gas producer in the state and made 34 billion cubic feet of gas in 2008.

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What has been called the Theresa Sandstone play for the last 20 years is actually the upper sandy member of the Galway Formation. It correlates best with the Rose Run Sandstone in Ohio which is a large gas producer. Here in NY, this is a sub-crop play occurring where the Rose Run directly underlies the Knox Unconformity. The porosity in this reservoir is secondary in nature and consists of mostly leached feldspar, dolomite, and quartz. Traps appear to be 4-way closures that are detectable on seismic. This play produced 534 million cubic feet of gas in 2008 and has great potential for further exploration. We are also studying this formation for its carbon sequestration potential.

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If we look at a graph of natural gas production over the last 125 years there are several noticeable peaks and troughs that correspond to some of the plays I've talked about today.

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This table from the DEC's annual report shows the production information for NY in 2008. As you can see, most of the oil here comes from the same Canadaway Group which is actually the Upper Devonian sands such as the Richburg and Bradford. As I stated earlier, the Black River Hydrothermal Dolomite is the largest gas producer in the state. Drilling in the Medina continues increase production and although there isn't much information about the Herkimer-Oneida-Oswego Gas play, there appears to be good potential for more production there.

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Now for a little shameless plug. The Empire State Oil and Gas Information System, otherwise known as ESOGIS, is a great place to find information about fields and individual wells. We have cataloged various pieces of information including drilling permits, completion reports, wireline logs, digital logs, core photos, and various reports. Some of this information is free, but most of it is by subscription only. We are not funded by the state, so the subscription fees enable us to keep the site running.

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References