

# Cherry Grove Field, Warren County, Pennsylvania: The Lot 646 Mystery Well and Its Aftermath\*

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## Abstract

In the spring of 1882, an exploratory well on lot 646 in the forested wilderness of Cherry Grove Township, Warren County, Pennsylvania, was dubbed the "Mystery Well" due to operator efforts to maintain secrecy while leasing activity progressed. Rumors of another major discovery at a time when oil markets were already oversupplied by Bradford, the first giant oil field in the United States, caused widespread market speculation regarding the potential impact of this well on oil prices. Numerous operators and marketers sent personnel to watch the well on 646, leading to the development of oil scouting as a recognized profession.

On May 17, 1882, the 646 Mystery Well was drilled into the pay sand to yield a flow rate of approximately 1000 BOPD. By the end of June, 6 wells were producing 7000 BOPD, 63 development wells were drilling and another 99 rigs were being built. Two months later, in late August, field production had peaked at 40,000 BOPD from 215 producing wells, and the oil price had collapsed to the lowest price of the decade at less than \$0.50/barrel. At least 48 of these wells had flow tests > 1000 BOPD, more wells than had previously achieved that distinction for the rest of the United States combined. The newly created oil patch settlements of Garfield and Farnsworth grew explosively, and may have briefly reached a population of 10,000.

Rapid depletion of reservoir pressure coupled with mechanical issues related to sand production and paraffin precipitation led to an equally spectacular collapse of well performance. Wells generally ceased to flow during September, 1882, and field production dropped to 7930 BOPD by the end of that month. By the time the field was a year old in May, 1883, 426 wells had been drilled in a reservoir covering approximately 2000 acres, and field production had dropped to 2400 BOPD. Production continued to decline rapidly, to < 1000 BOPD by the second anniversary and < 350 BOPD by the third. As the downturn became obvious, much of the oilfield equipment and building material was salvaged in 1883 for use in field developments elsewhere. Overall, operators are thought to have lost money on Cherry Grove, possibly the highest quality oil reservoir ever found in Pennsylvania, because of a combination of excessive investment and the collapse in product prices.

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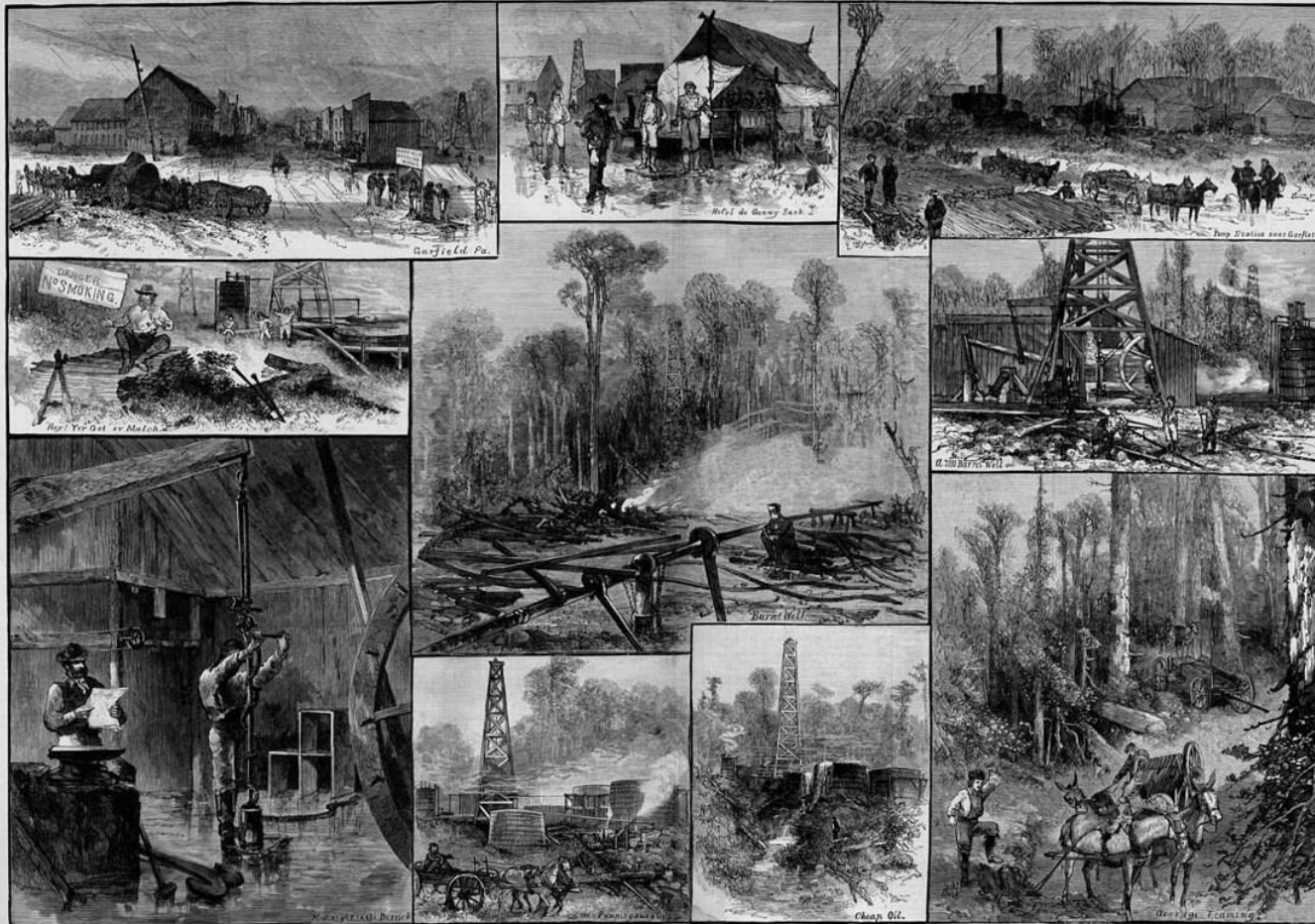
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# Cherry Grove Field, Warren County, PA

## The Lot 646 Mystery Well and Its Aftermath

Raymond P Sorenson

“The New Oil Field”



THE NEW OIL FIELD.—DRAWN BY THOS. H. DAVID.—[SEE PAGE 528.]

“The summer of 1882 must pass into history as having witnessed the most memorable doings in the annals of the petroleum trade of Pennsylvania.”

(*Scientific American*, v. 47, no. 18, p. 272, October 28, 1882)

“With this well commenced the most astonishing oil development ever witnessed in the country.”

(*Carll*, 1883, p. 367)

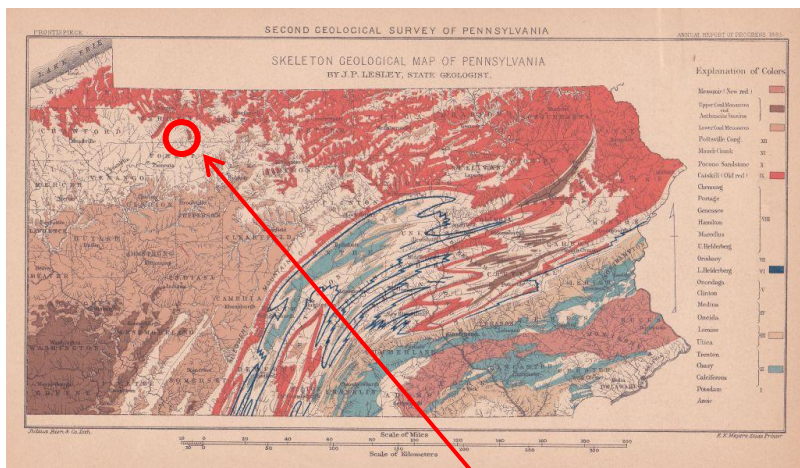
“For sudden and enormous effect upon values, the Cherry Grove excitement was without parallel in the history of the petroleum trade.”

(*Smalley*, 1883, p. 327)

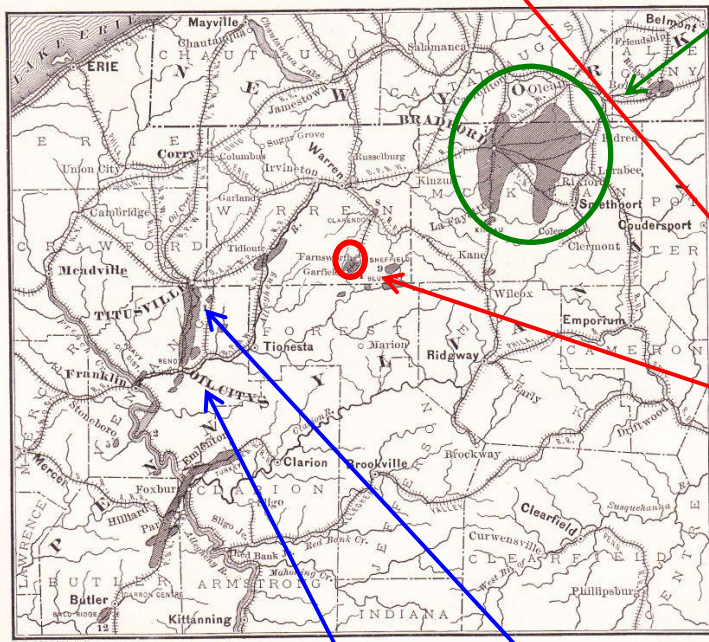
Harper's Weekly, August 26, 1882



# 1882: The Setting



Lesley, 1885



Smalley, 1883

Oil City Titusville

PA & NY accounted for 99% of U. S. oil production

**Bradford**, the 1<sup>st</sup> U. S. giant field, had swamped the market with unprecedented oil volumes but had started to decline

Crude oil in storage & awaiting transportation was greater than U. S. annual gross production

Oil markets were volatile with oil prices at **\$0.85/bbl**, but there was reason to expect rising prices

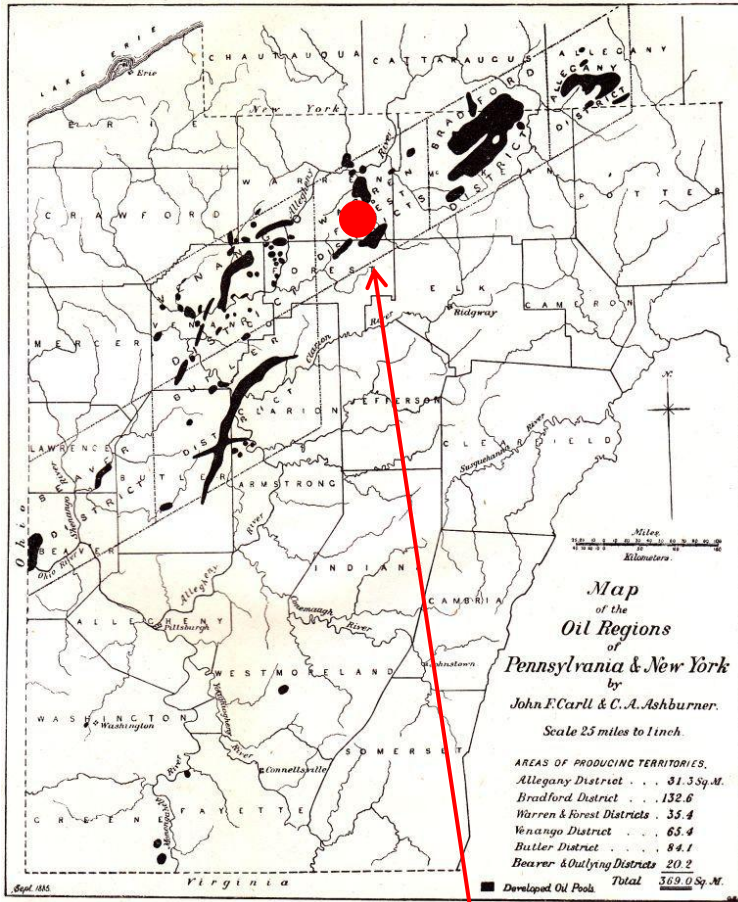
Standard Oil Trust formed in January 1882

Rumors circulated about a possible big discovery at **Cherry Grove** in Warren County, PA

# Geological Setting

Trans. of Am. Inst. of Min. Eng. Vol. XIV.

ASHBURNER.



Ashburner, 1885

Cherry Grove

For the 1<sup>st</sup> 25 years of U. S. oil production, > 95% of gross production came from Upper Devonian sandstones that had been deposited on the outer fringes of the Catskill delta.

Most of the traps were stratigraphic, in SW-NE strike-oriented sandstones.

SW-NE “trendology” was the most effective exploration method.

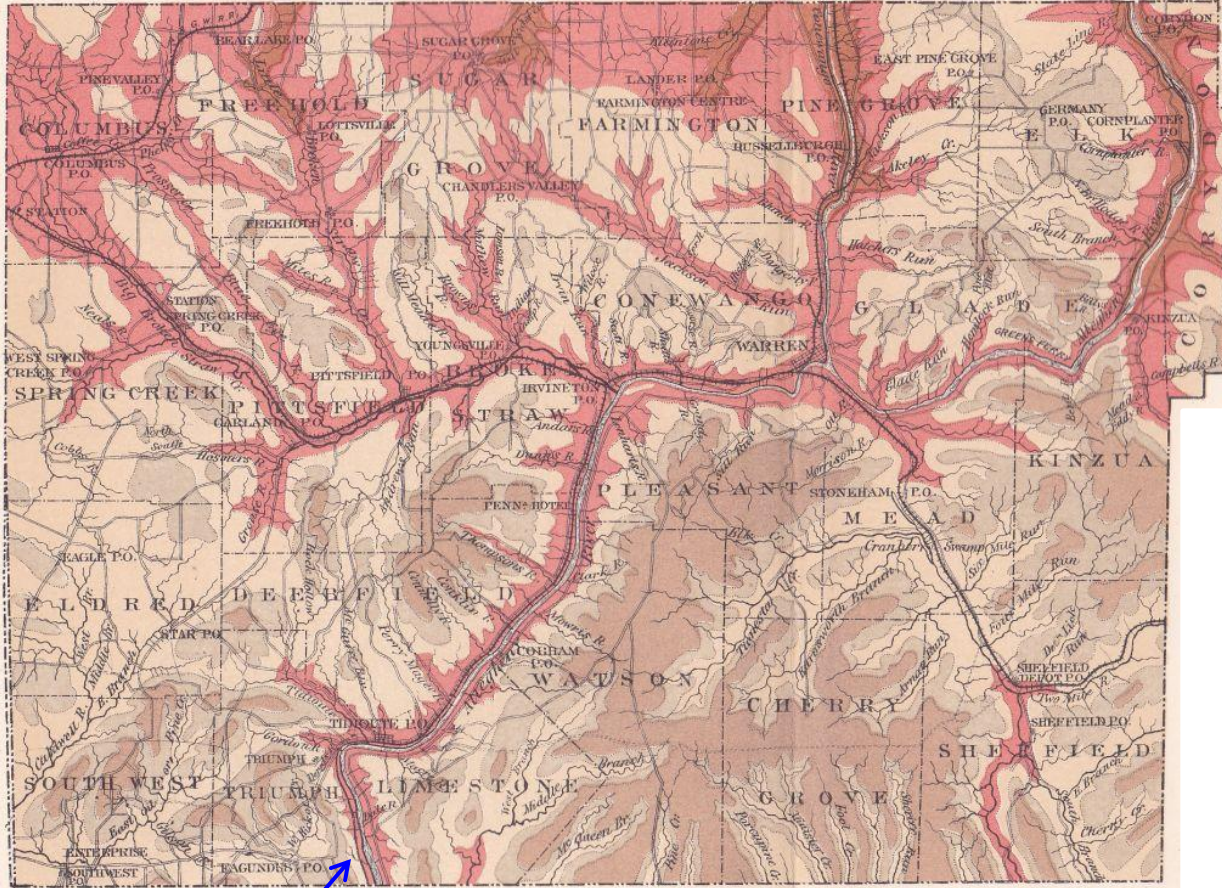
Regional dip is SSW @ 30’/mile.

The “anticlinal theory” proposed by contemporary geologists was a total failure in NW Pennsylvania due to the general lack of structural deformation.



# Warren County Surface Geology

## Geologic map of Warren County, PA



Lesley, 1885

Allegheny River

The northern limit of Pennsylvanian Coal Measures covers the low-relief hilltops.

Hillsides generally expose Mississippian outcrops.

Devonian Venango Group sandstones, which produced in the Titusville - Oil City area, crop out in stream valleys in the northern half of Warren County.

Coal Measures and Conglomerate XII

Sub-Olean Shales and Conglomerate

Crawford Shales

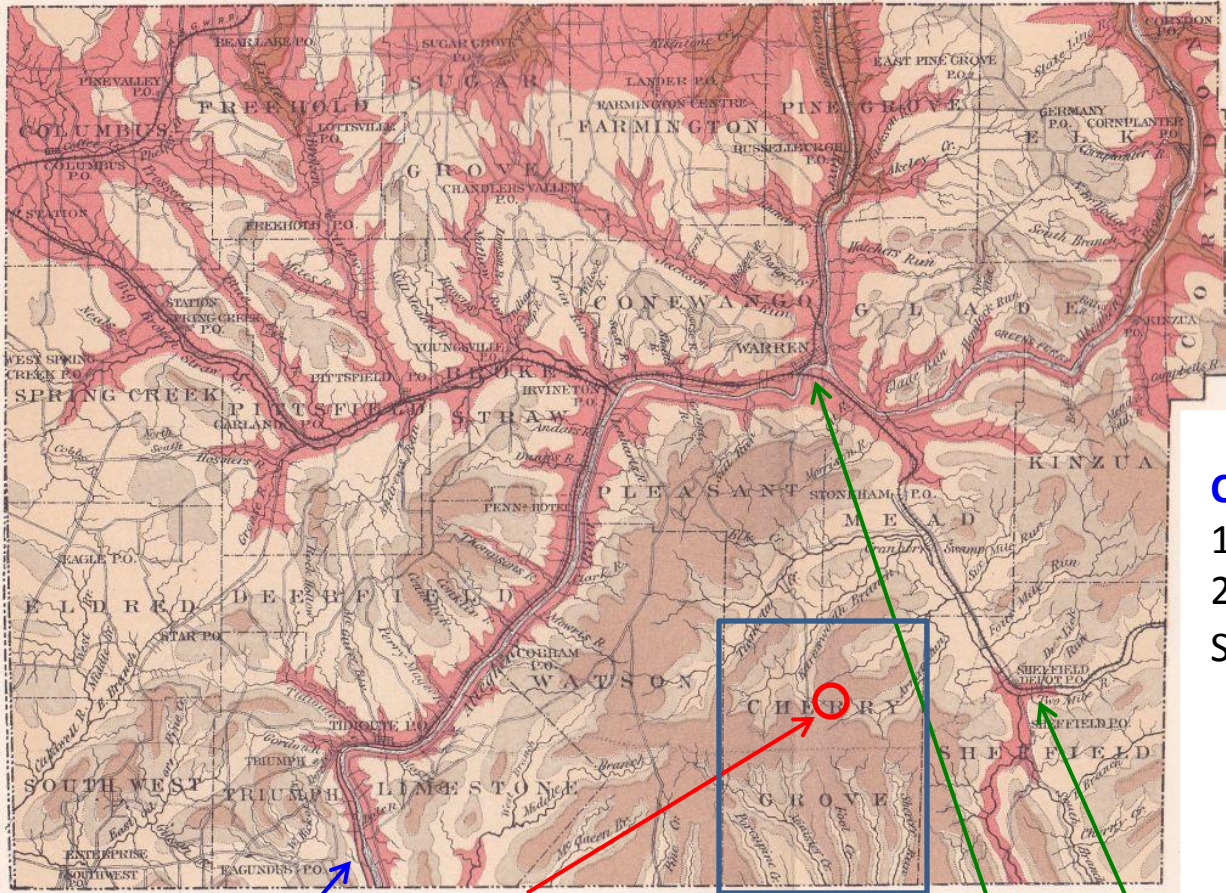
Venango Oil Sands (of J.F. Carll)

Chemung Flags (of I.C. White)



# Cherry Grove Township, PA

## Geologic map of Warren County, PA



Lesley, 1885

**646 Mystery Well**

**Cherry Grove Township**  
**46.9 sq. mi.**

**Allegheny River**

**Warren Sheffield**

**1882**

Virgin timber covered much of the area, with only a few isolated farms.

Industry was largely limited to lumber & tanning (using hemlock bark).

## Cherry Grove Township population

1880 census :	145 (3.1/sq mi)
2000 census:	228 (4.9/sq mi)
Summer of 1882:	<b>&gt;10,000</b>

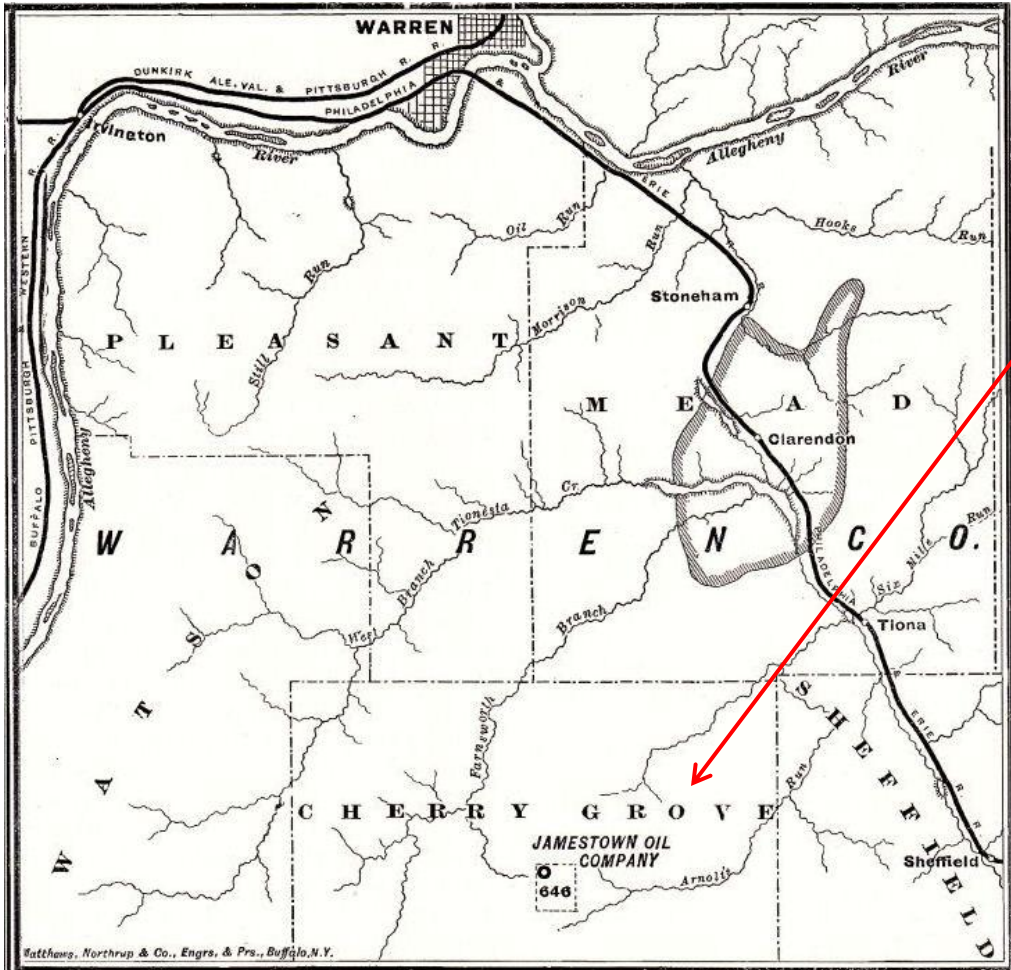
**Today**

Rural , heavily forested

Majority of area is within the Allegheny National Forest.



# January - April, 1882



**January 1882:** Grace & Dimick (Jamestown Oil Co.) spudded an exploratory well on Lot 646 in Cherry Grove Township.

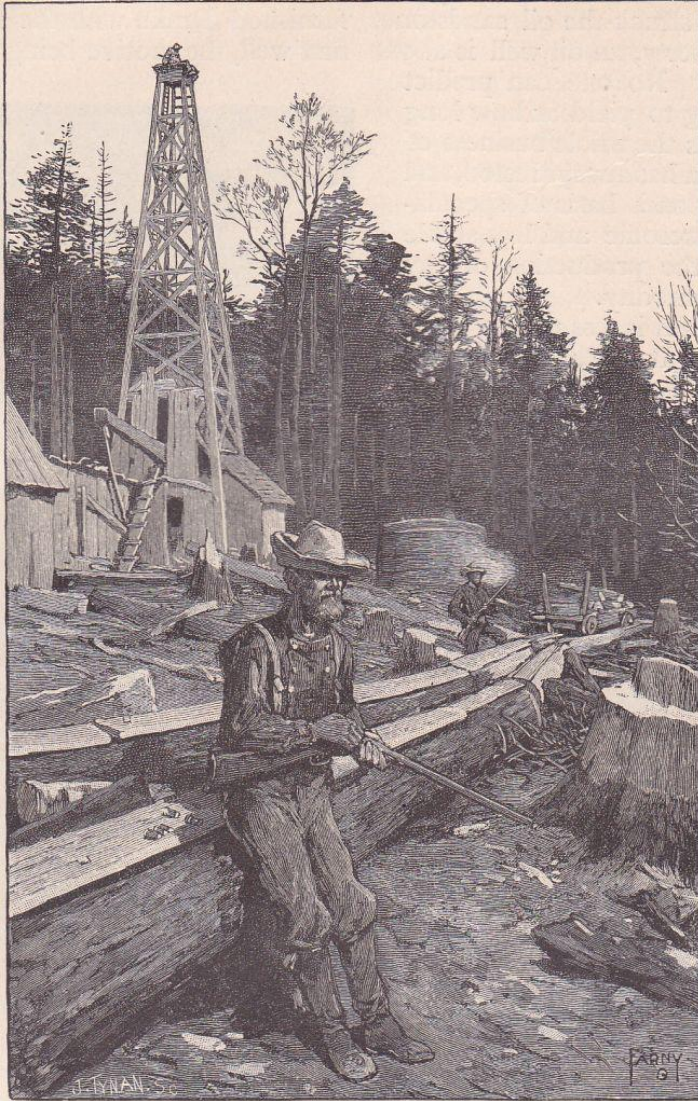
**March 10:** Top of sand was penetrated @ 1610' with 300' oil entry.

The Lot 646 Mystery Well was shut down, boarded up, and guards posted while leasing activity proceeded.

Oil markets became unstable due to rumors of a possible large discovery.

# The “Mystery Well”

## “Guarding a wildcat well”



Smalley, 1883

**March 29, April 3, April 26:** The Lot 646 Mystery Well experienced short duration flows of oil.

**April 14:** Other rigs were under construction, including one by Grace & Dimick. Leases were reported at \$100-150/acre and 1/8 royalty.

**April 29:** Oil prices dropped to **\$0.75.**

**April:** Union Oil Co. bought the Lot 646 Mystery Well. Construction began on a new town of Garfield, named after President James Garfield, who was assassinated in 1881.



# Oil Scouts

“Pennsylvania – scene in the oil regions – an oil scout under fire”



Numerous companies sent personnel to try to learn the status of the Lot 646 Mystery Well, where the term “**Oil Scout**” was first used. The Lot 646 Mystery Well and others that followed were guarded to keep out intruders.

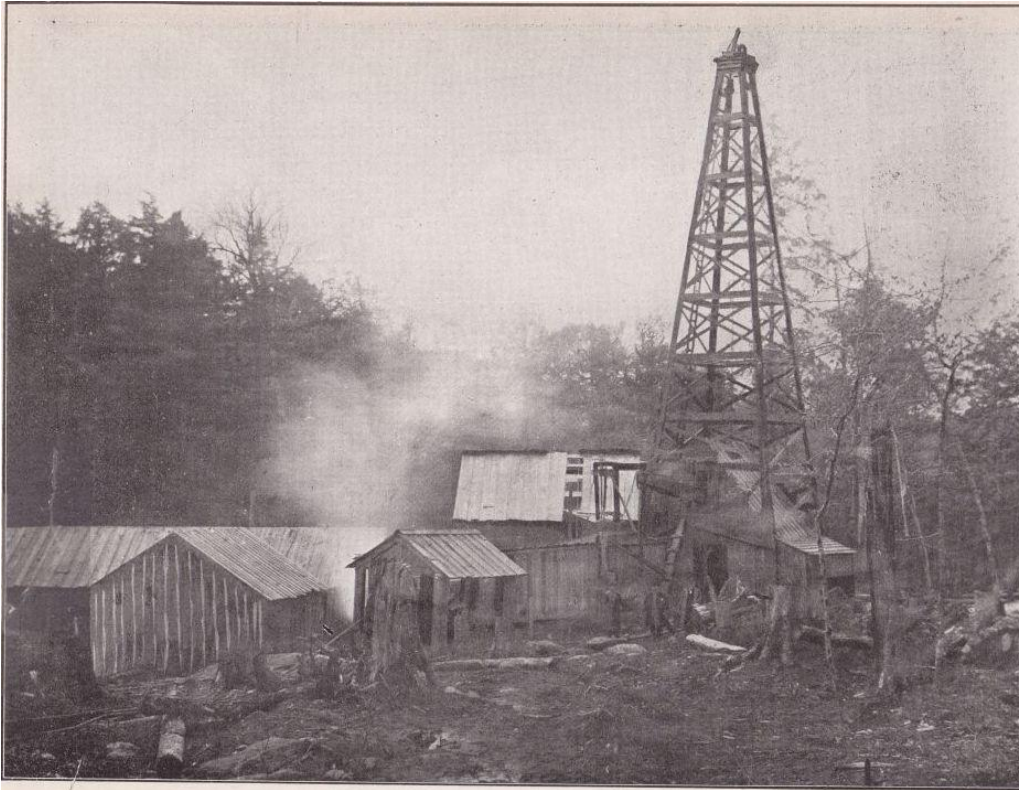
A fake nitroglycerine shot was used on the Lot 646 Mystery Well as a diversion: the subsequent failure to flow convinced many spectators that the well would be a dry hole.

Gunfire was known to have occurred on at least two occasions.

*Frank Leslie's Illustrated Newspaper*  
April 4, 1885, p. 115-116

# May, 1882

## “The famous wildcat mystery”



*Whiteshot, 1905*

**May 1:** 13 rigs were drilling or under construction in vicinity of the Lot 646 Mystery Well. Construction began on 1<sup>st</sup> of 2 narrow gauge railroads to Cherry Grove.

**May 9-10:** The Murphy offset well on Lot 619 hit gas and burned while the Lot 646 Mystery Well was still shut in. Union Oil began laying an 8 mile pipeline to Lot 646.

**May 17-19:** Plugs were drilled out on the Lot 646 Mystery Well, with an initial flow of 200 BOPD. Flow increased to 1000 BOPD as the sand was penetrated. Oil price dropped to **\$0.65**/bbl.

**May 25:** Leases topped \$1000/acre with  $\frac{1}{4}$  royalty. A 2<sup>nd</sup> pipeline was under construction.



# June, 1882



*Smalley, 1883*

**June 2:** Cadwallader Lot 635 well flowed 2000 BOPD, Murphy Lot 619 well flowed 1500 BOPD.

**June 12:** United Pipe Lines (Standard Oil Trust) was building 2 pipelines and storage facilities designed to take 40,000 BOPD.

**June 13:** Lot 646 Mystery Well flowed 2500 BOPD.

**June 14:** Oil price dropped to **\$0.52**.

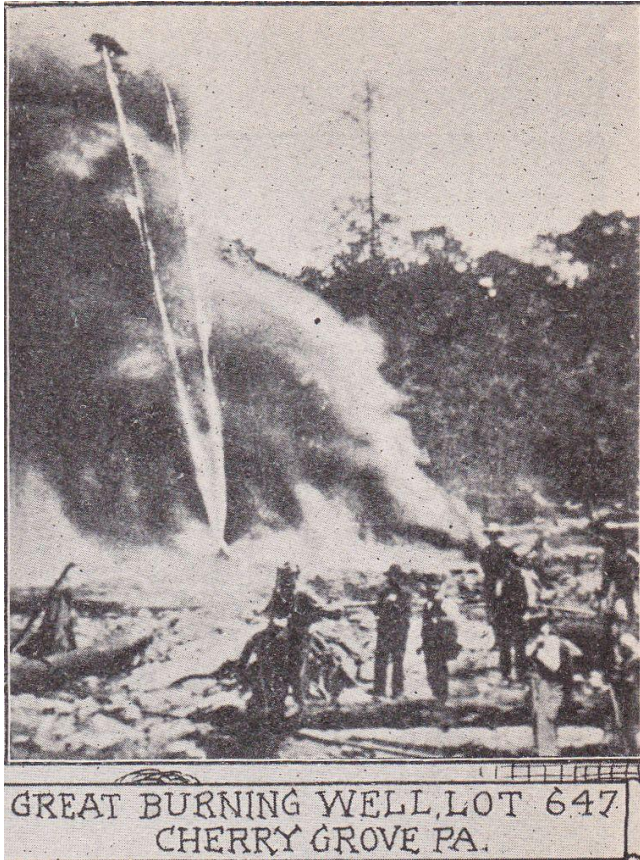
**June 17:** Garfield population reached 1500; wells at Bradford were scavenged for equipment to send to Cherry Grove.

**June 20:** Anchor Oil Co. well on Lot 647 burned while flowing 3300 BOPD.

**June 25:** Oil tanks on 646 overflowed and burned.

# The Lot 647 Burning Well

**“The Burning Well at  
Cherry Grove, Lot 647”**



*Whiteshot, 1905*

The Lot 647 well was the first oil well fire to be extinguished by shooting off the well head with a cannon shot.

Production from the Lot 647 well was reestablished at > 1000 BOPD.



*Detlor & Waddell, 1882*



# July, 1882

## “Shooting a well”



SHOOTING A WELL.

Smalley, 1883

**July 1:** 6 wells flowing 7000 BOPD, 63 wells drilling, 99 wells under construction.

**July 23:** 32 wells producing 13-18,000 BOPD

**July 28:** Use of nitroglycerine began in Cherry Grove.



Sorenson, personal collection

# Garfield & Farnsworth

**“End of plank road near 646 at Cherry Grove”**



*Clark Variety Store, 1882*

The oil boom towns of Garfield, Farnsworth and Vandergrift formed along lumber company plank roads.

The population grew from zero to 10,000 during the summer of 1882.

**“Garfield, Pa”**

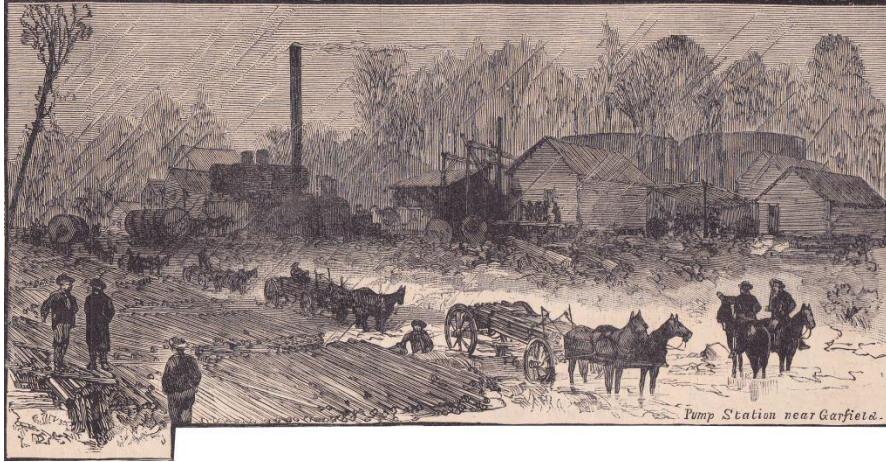


*Harper's Weekly, August 26, 1882*



# Cherry Grove Infrastructure

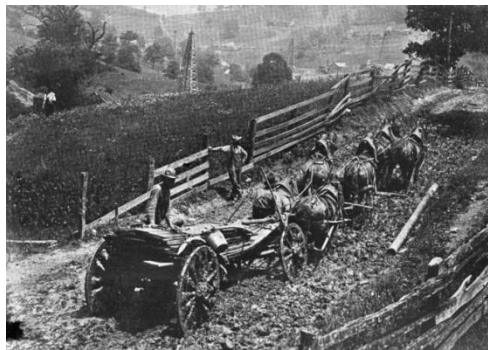
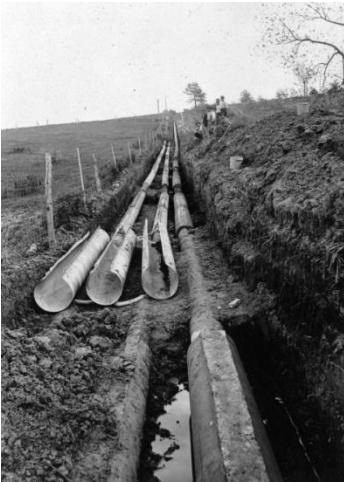
## “Pump station near Garfield”



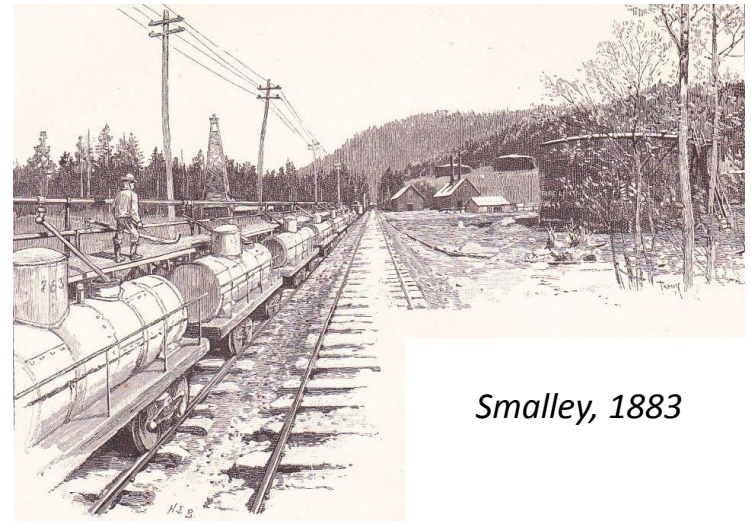
*Harper's Weekly, 08/26/1882, p. 537*

Two railroads and three pipelines reached the Cherry Grove field within 3 months of the discovery.

United Pipe Lines (Standard Oil Trust) built pipelines and storage to handle 40,000 BOPD, the largest such facility in the world to date.



*Sorenson, personal collection*

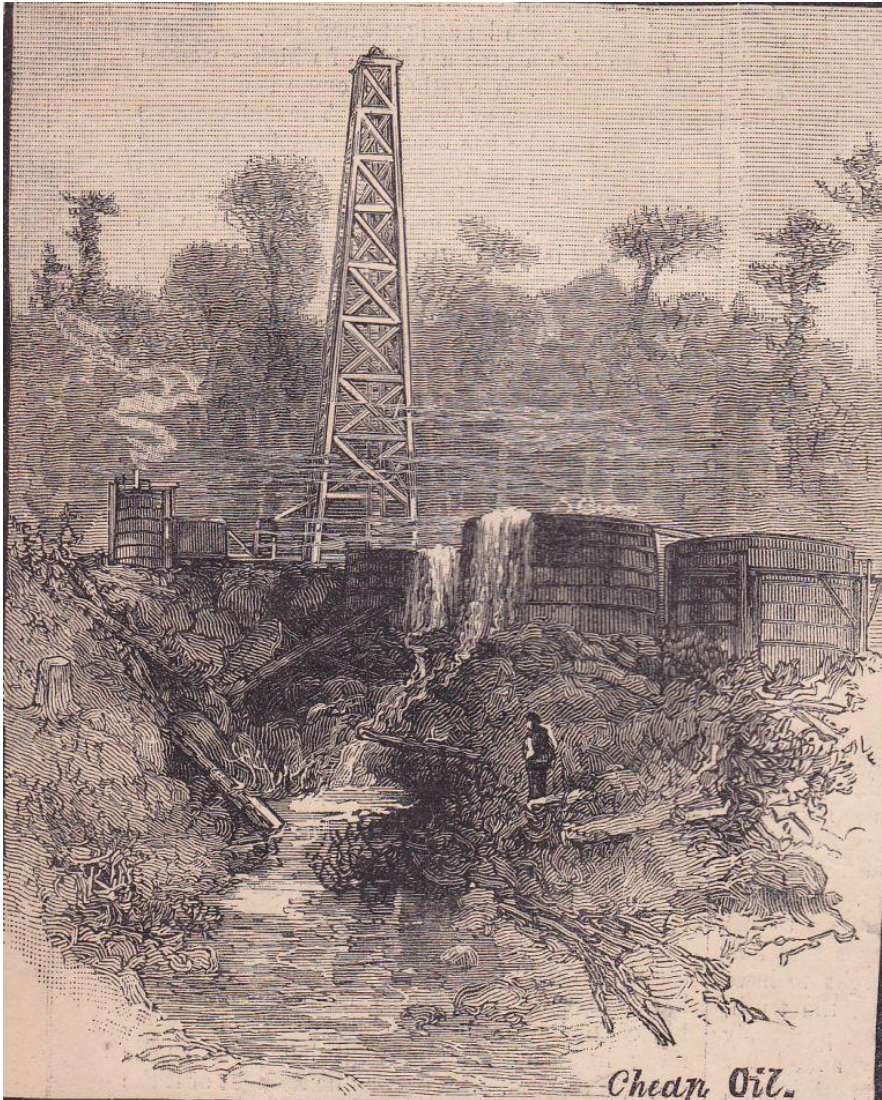


*Smalley, 1883*



# August, 1882

## “Cheap Oil”



**August 1:** 54 producers and 2 dry holes were completed during July. 160 wells were drilling with 116 rigs being built.

Production: 18,750 BOPD

**August 11:** 109 active producers, production > 30,000 BOPD, with considerable oil going to waste

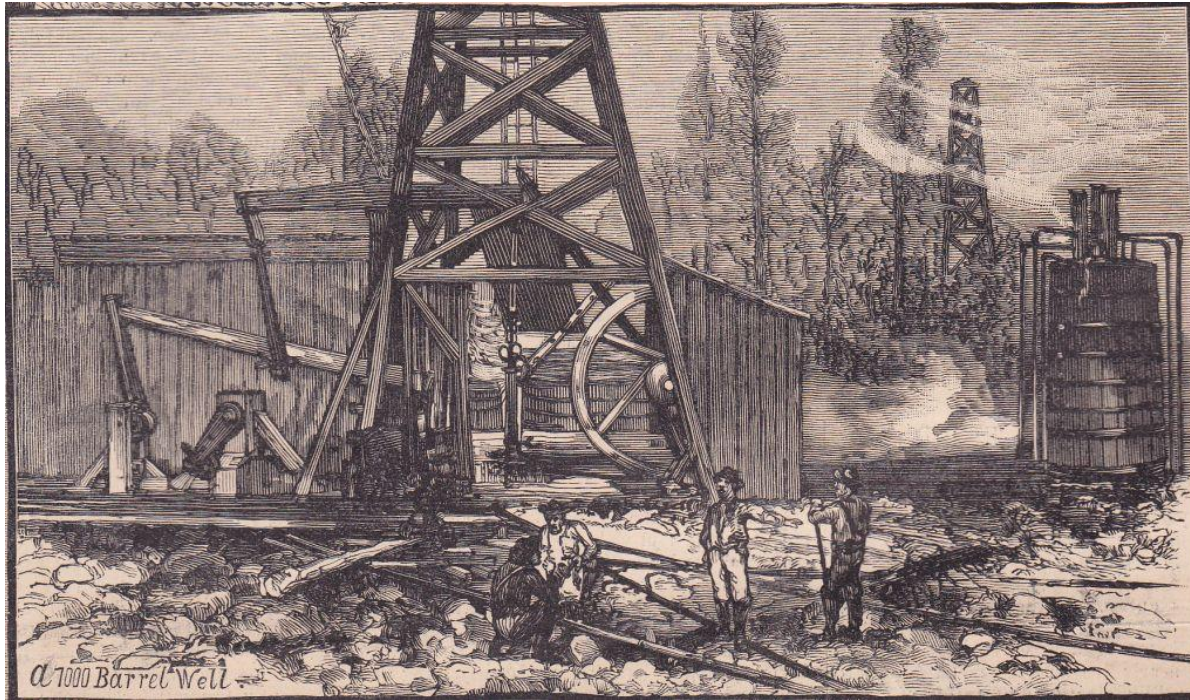
**August:** Cherry Grove production peaked at an estimated **40,000 BOPD**, nearly 1/3 of United States gross production.

Oil prices dropped to **\$0.49**/bbl.



# 1000 BOPD Flow Rates

**“A 1000 Barrel Well”**



*Harper's Weekly, August 26, 1882*

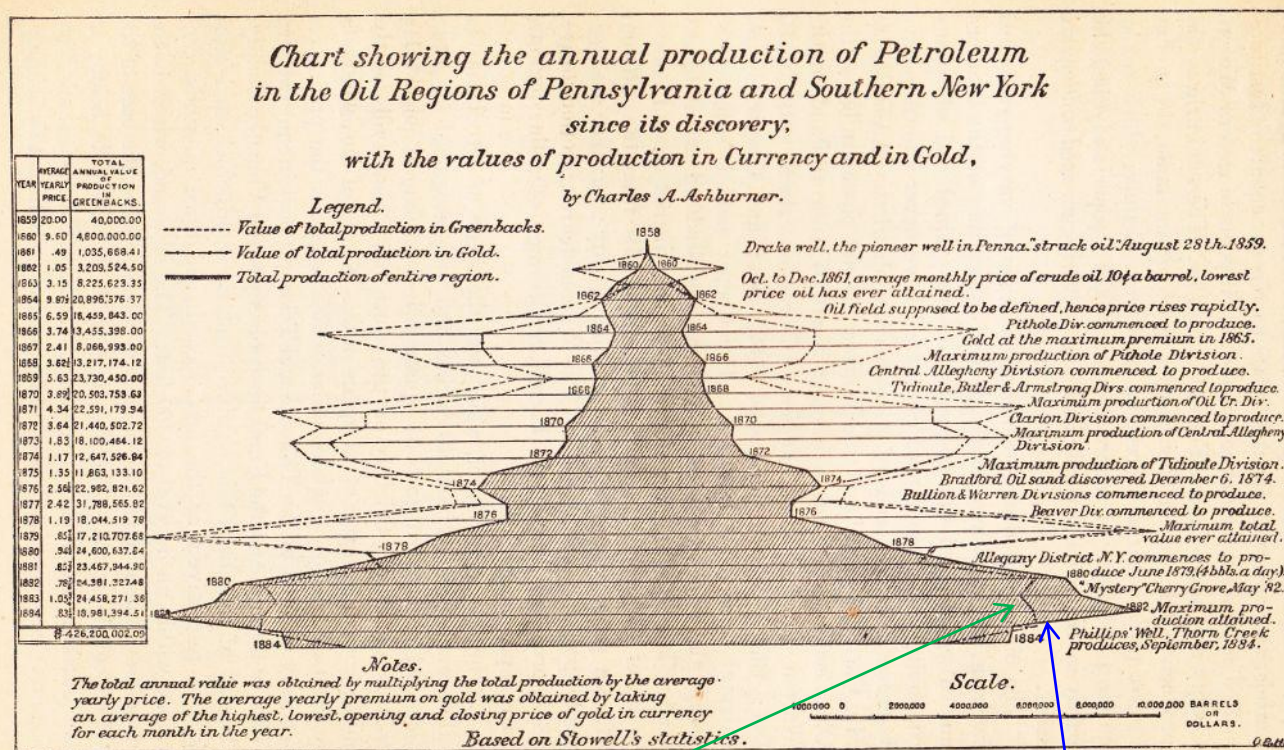
In the first **22** years of the U. S. oil industry there were **30** wells that reported flow rates **>1000 BOPD**.

Between May 17 and August 1, 1882, Cherry Grove had **48** wells that flowed **>1000 BOPD**.

*(Carll, 1883, p. 368-369)*

Almost all of these were natural flow rates, as the first use of nitroglycerine at Cherry Grove did not occur until July 28.

# PA-NY Production Statistics



The Cherry Grove discovery was followed by the maximum PA-NY annual oil production volumes and a dramatic decline in oil prices.

"Mystery" Cherry Grove, May, 1882"

"Maximum production attained"

PA-NY oil production peaked in 1882, but the value of production was greater in 1881 & 1883.

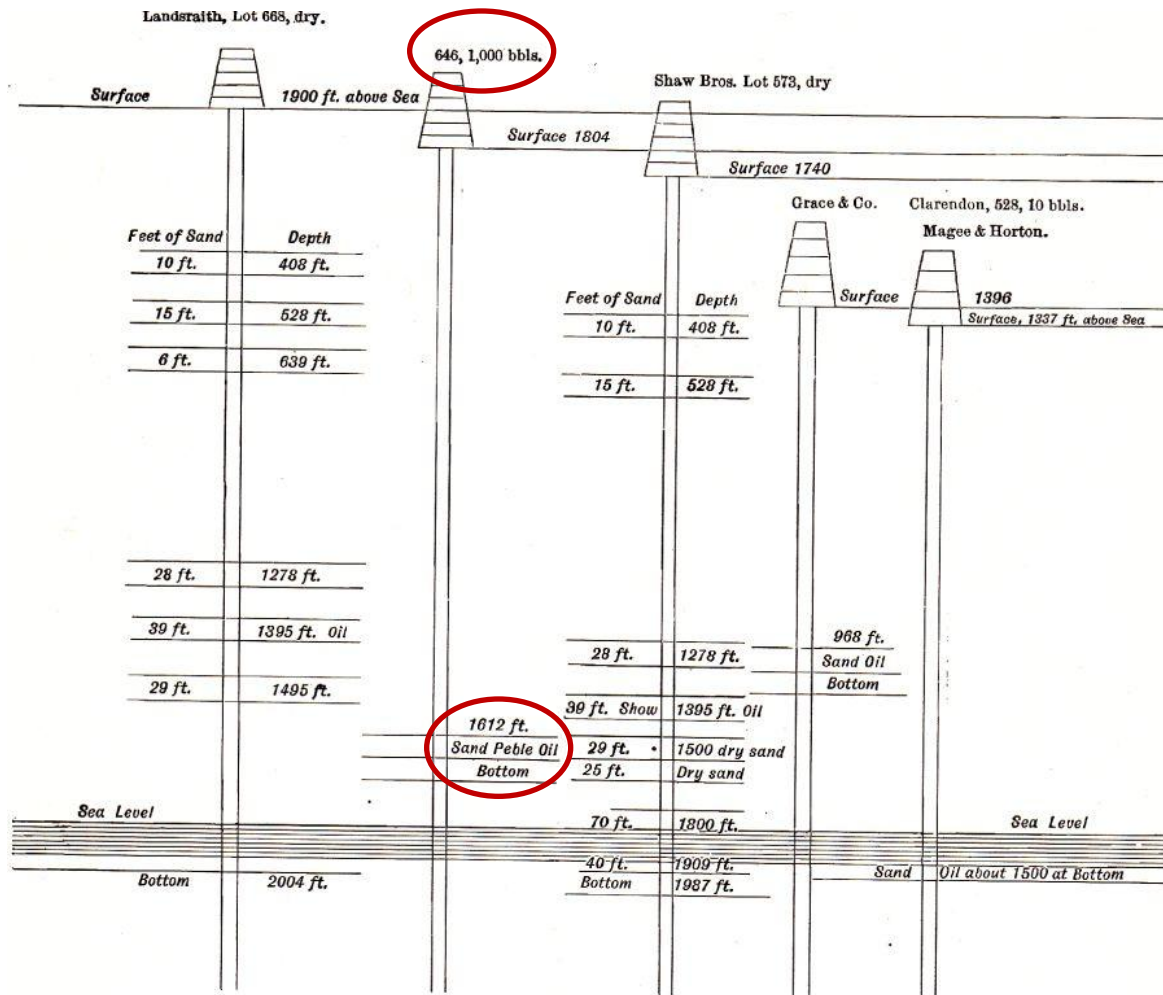
Ashburner, 1885

Annual production value

Annual production volume



# Why The High Production Rates?



High porosity (sand control problems suggest limited cementation.)

Very coarse grain size (“pebbles”)

Coarsening upward sandstone  
(Most wells did not completely penetrate the sand body.)

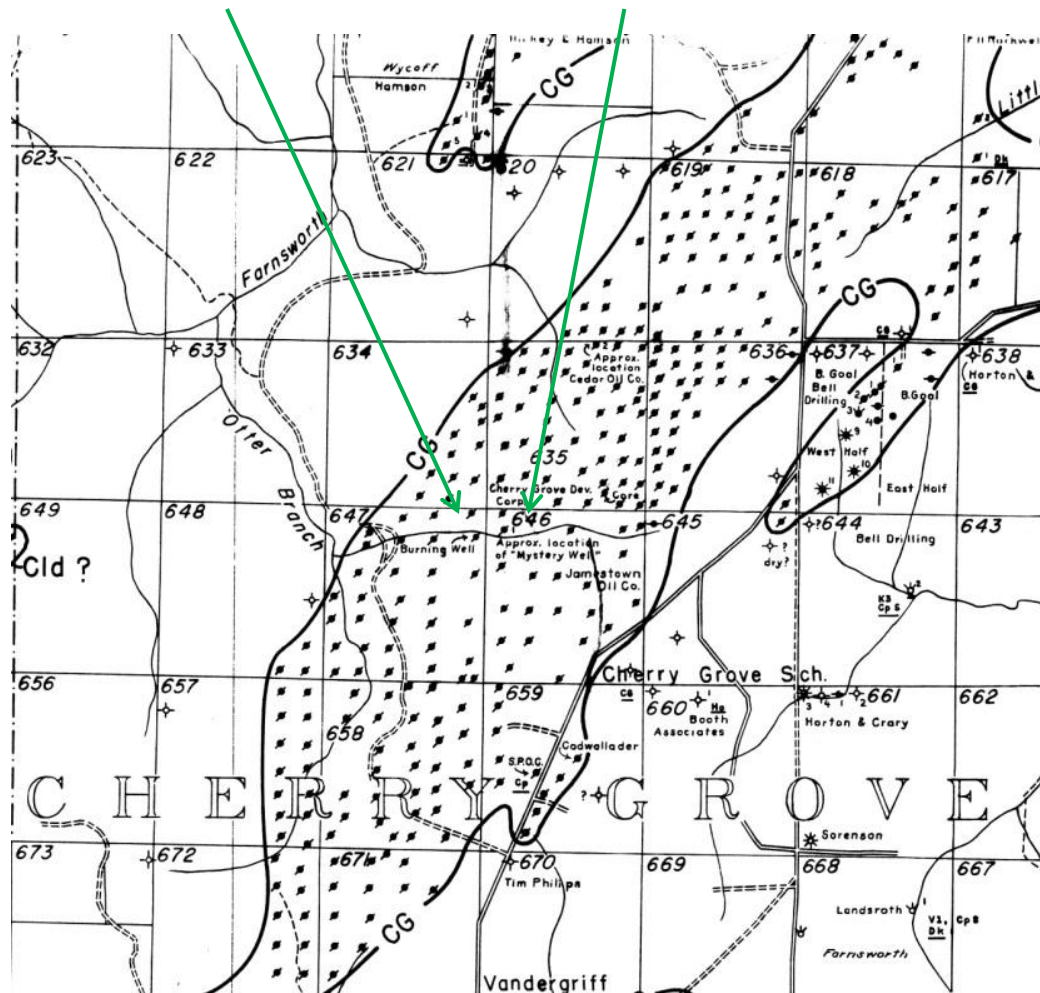
Light, low viscosity oil (50.6° API)

High gas saturation

Rapid development prior to reservoir pressure depletion

# September, 1882

## Lot 647 Burning Well Lot 646 Mystery Well



Ingham et al, 1956

**September 1:** 215 producing wells, 27 dry holes. Field limits defined at approximately 2000 acres.  
Oil price **\$0.56**/bbl.

**September 5-7:** Several wells ceased to flow.

**September 7:** The author's grandfather, Henry Nels Sorenson, celebrated his 1<sup>st</sup> birthday on Lot 661, approximately 1.5 miles SE of the Lot 646 Mystery Well.

**September 25:** >100 wells had nitroglycerine shots in the previous two weeks in an effort to maintain production.

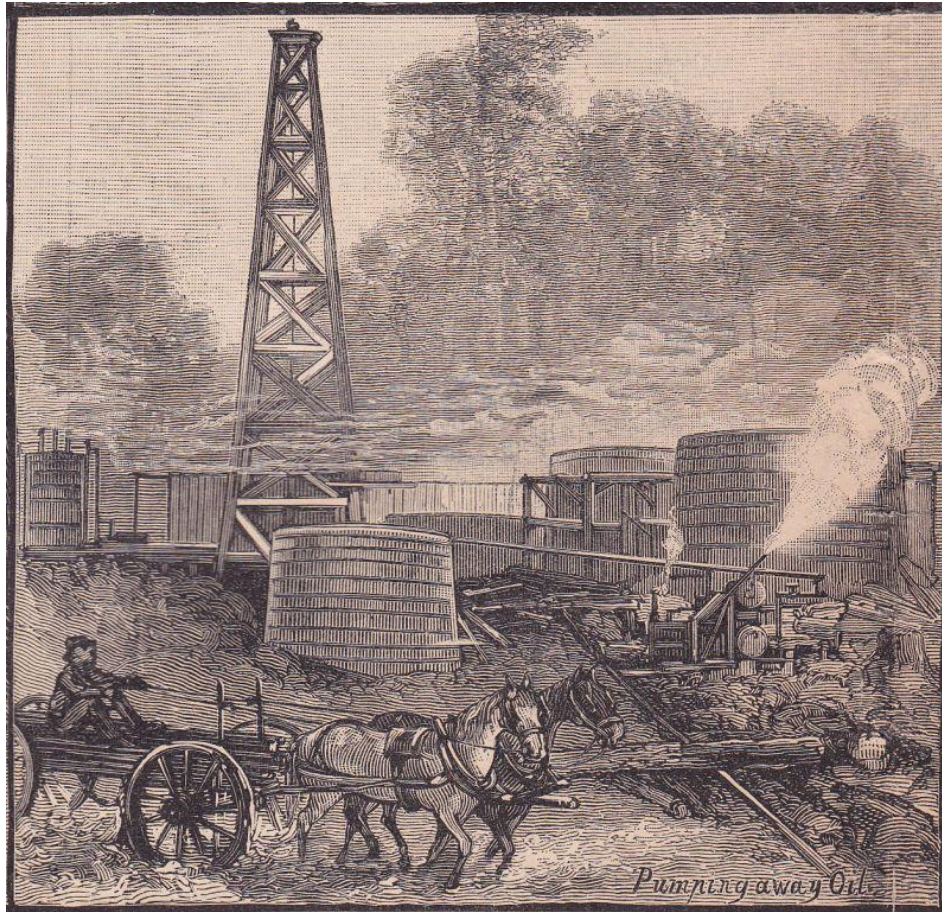
**September 28:** 114 wells have ceased to flow.

**September 30:** Production declined to 7930 BOPD; oil price rose to **\$0.95**/bbl.



# September, 1882

## “Pumping away Oil”



Harper's Weekly, August 26, 1882

### Why the production collapse?

Rapid drop in reservoir pressure

Dump flooding from shallow aquifers

Sand control problems (Cherry Grove was the 1<sup>st</sup> U. S. oil reservoir to exhibit sand control problems, with no industry experience on how to deal with it. Problems intensified after nitroglycerine shots.)

Paraffin precipitation (The oil was observed to “freeze” in the pipelines, and similar problems occurred in wellbores.)

Premature well abandonment due to price collapse (Well equipment was often recovered as soon as the wells ceased to flow.)

# Cherry Grove Activity & Decline

<i>Summary.</i>				<i>Productive. Dry.</i>		
Wells completed in May, . . . . .	2			2	0	
“ “ June, . . . . .	4			4	0	
“ “ July, . . . . .	63			58	5	
“ “ August, . . . . .	161			150	11	
“ “ September, . . . . .	108			106	2	
“ “ October, . . . . .	39			38	1	
“ “ November, . . . . .	28			25	3	
Total, . . . . .	405			383	22	

*Carll, 1883*

## Production Timeline

May, 1882:	Discovery
August, 1882:	40,000 BOPD
September, 1882:	7,930 BOPD
May, 1883:	2,401 BOPD
May, 1884:	<1000 BOPD
May, 1885:	<350 BOPD

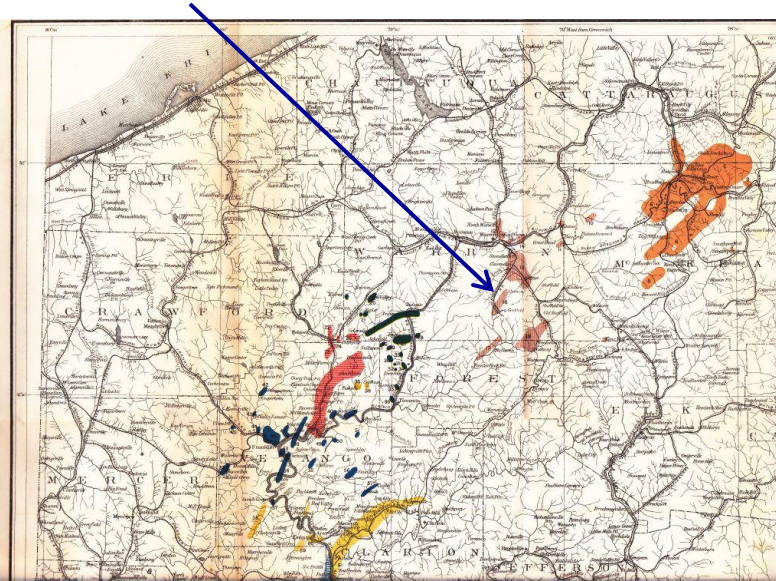
*Crum & Dungan, 1911, p. 106*





# Cherry Grove Field

## Cherry Grove



Ashburner, 1886

Recovery of casing and equipment from numerous Cherry Grove wells for use in new field developments elsewhere began in the 4<sup>th</sup> quarter of 1882.

Buildings in Garfield & Farnsworth were demolished and the materials transported for reassembly in new boom towns.

The Lot 646 Mystery Well was the most heavily publicized well in Pennsylvania history.

The Cherry Grove field had an impact on the oil industry out of all proportion to its size.

Cherry Grove may have had the highest quality oil reservoir ever discovered in Pennsylvania.

Total Cost (\$):	<b>3,143,525</b>
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Gross Revenue (\$):	2,069,218
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Royalty (\$):	-258,652
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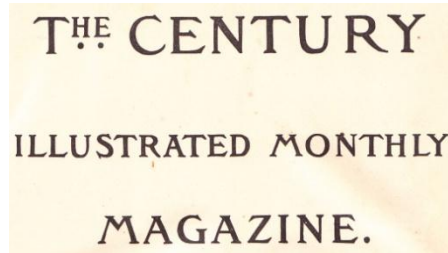
Net Revenue (\$):	<b>1,810,566</b>
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Net Loss (\$):	<b>1,332,959</b>
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**Most operators at Cherry Grove lost money**

*The Derrick's Handbook of Petroleum, 1898, p. 360-361  
(May 26, 1883)*

# Cherry Grove Media Coverage



## Industry Journals

- The Petroleum Age

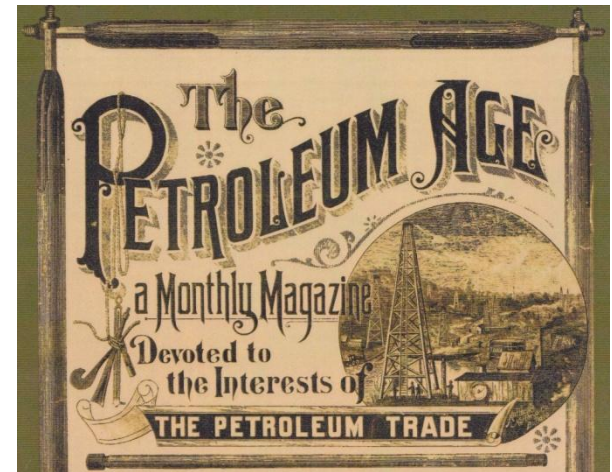
## National Media

- Harper's Weekly
- Century Magazine
- Frank Leslie's Illustrated Newspaper
- Harper's New Monthly Magazine
- Scientific American
- The New York Times

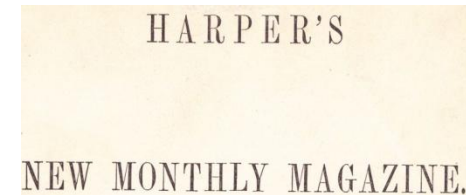
## Regional newspapers

- Oil City Derrick
- Warren, Titusville, Bradford, etc.

## THE OIL CITY DERRICK.



## The New York Times





# Cherry Grove- Today



A replica rig and a small community center—museum, built in 1982 as part of the centennial celebration, are located behind the Cherry Grove fire hall near the southeastern margin of the Cherry Grove Field.

Only a handful of stripper wells are active.

Secondary recovery has not been feasible due to inadequate plugging of old wells and communication with shallow aquifers.

*Photo courtesy of Walt Atwood, 2011*