PIONEER
NATURAL RESOURCES

Finding Oil

Drop of Oil

Chapter Three:

It's August 1921, and a desperate Frank T. Pickrell is climbing to the crown block of a derrick near Big Lake clutching a handful of rose petals. The El Paso businessman reaped a fortune in copper mining before the war, yet still harbored larger ambitions.

At this point, he needed a miracle.

By now, he'd heard from plenty of folks who called the Permian Basin the place wildcatter dreams went to die. Never mind that he was also searching more than 100 miles out from the nearest oil-producing patch.

The 18-month drilling lease on a section of land he'd purchased the rights to from an Army buddy was about to expire. Desperately in need of capital, he spent a year selling "certificates of interest" in the parcels of land he intended to explore – the so-called Block No. 1 – and soon amassed $100,000 from investors. That would be roughly $1.5 million today.

His financial backers hailed from across the country. One contingent included a sisterhood of Catholic nuns from New York who agreed to invest in Pickrell's Texon Oil Co. on one condition: That he spread their specially blessed rose petals from atop the derrick.

So here he was, keeping his end of the bargain.

"I christen thee Santa Rita No. 1," Pickrell announced, borrowing the well's name from Saint Rita of Cascia, the patron saint of lost causes.

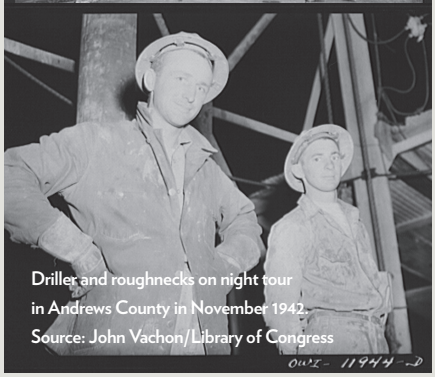
On May 28, 1923, after 21 rigorous months of drilling on a job site plagued with equipment breakdowns and labor shortages, oil finally burst from the wellhead of Santa Rita No. 1.

In dramatic fashion, Pickrell pulled off what many called a fool's errand, and the success of the first rig to strike oil in the Permian convinced oil speculators that maybe they shouldn't write off the basin's potential so quickly. Miracle accomplished.

Frank T. Pickrell with colleague in front of Santa Rita No. 1.
Source: The Permian Basin Petroleum Association Magazine, https://pboilandgasmagazine.com/the-well-that-launched-the-permian-2/

At the time

Wildcatters in West Texas



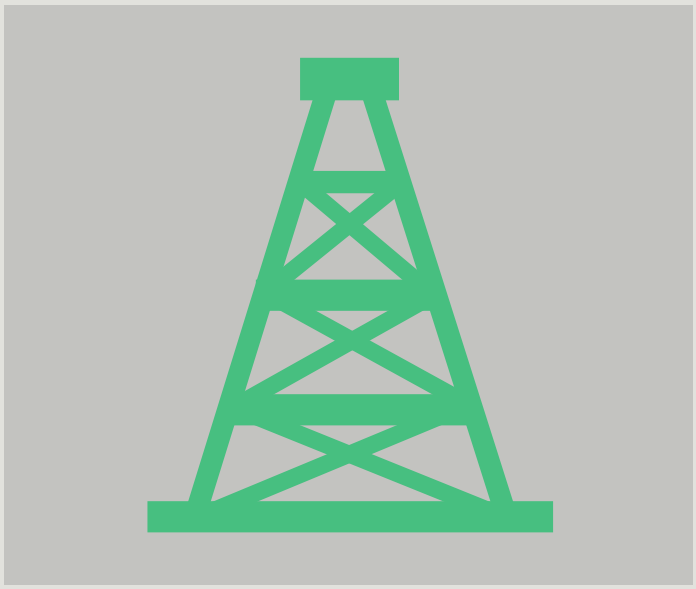
Driller and roughnecks on night tour in Andrews County in November 1942. Source: John Vachon/Library of Congress

Pickrell and other wildcatters were seeking their fortunes in West Texas, it may be shocking to learn that the emerging science of petroleum geology, even geologists on the whole, were viewed skeptically by many early American oil operators. Made no difference that European-based oil companies staffed organized geological divisions decades earlier than their American counterparts, recognizing that specialization was the future of the business.

"The American oil industry had advanced well into the second decade of the (20th) century before it conceded to geology greater efficacy in the art of oil finding than to its own pioneer hypotheses," writes noted petroleum geologist Edgar Wesley Owen in his 1975 book, Trek of the Oil Finders. "Even then, the geologist's reception was lukewarm. Experience had taught the 'practical oil man' to distrust expert oil finders. To him the geologist was suspect – another expert. Who needed experts? Certainly not the practical oil man!"

That did not age well. Of course, it's laughable to read that paragraph in 2022 because the energy industry is underpinned by the expert analysis and specialized skillset geologists contribute to oil and gas exploration.

Simply put, without advanced geoscience, we wouldn't have a modern energy industry.



Oil companies would also certainly lack the depth of knowledge they have today about the intricate relationships that exist between the resources we're looking for and the underground conditions drillers will likely encounter as they do. Things like how a subsurface rock formation's folds or faults affect how a well is drilled, or at what angle. Or, how fluid and core samples and other environmental studies are precisely calculated into where to place a wellsite.

Without solid science, people don't have the tools to make informed decisions. And in this highly competitive business, making a mistake at the front end of a major drilling project can cost a company millions of dollars. That's why, if you're a leading American energy company like Pioneer, you recruit the best talent in the business. Let's meet a few of them as they walk us through this critical stage in the life of a drop of oil.

“I think most people,

when they picture a geologist, they think I’m either working on a volcano or running from a dinosaur, or that I generally walk around in cargo shorts and boots,” jokes **Nate Ball,** Pioneer’s regional geoscience supervisor on the company’s Strategic Planning & Field Development team. “But while there are geologists who do lots of field work like that and study volcanos, that’s not typically what happens in the oil and gas profession.”

His most important task, **Nate** says, is interpreting geologic conditions below the earth’s surface to identify the rock formations likely to yield the greatest amounts of oil and natural gas. Many times, captured layers of hydrocarbons are trapped along folds and fault lines, and these formations are the targets geologists aim to hit.

Our geologists collect and analyze a wealth of information, such as rock core well samples, well logs and 3D seismic images to create subsurface models indicating where petroleum resources are distributed. From those interpretations, they can estimate how much oil and gas has accumulated underground.

About 40 geologists currently work for Pioneer, but not all of them do the same thing. They’re arranged in groups based on the life cycle of a well.

Geologists are involved in every stage of exploration, planning and drilling our wells. Some are actively involved in the drilling process, known as geosteering, to interpret downhole measurements and ensure a well is placed as precisely as possible in the strata.

"There's a variety of data sets at our disposal, and our job is to be able to reliably interpret any of those data," **Nate** says. "A geologist's job is to reconcile all of those data types into something coherent – a reasonable interpretation based not on just one type but based on all of the data sets while the well is being drilled."

The more refined the analysis of those vast datasets, the more precisely we're able to place a well. In fact, if subsurface conditions are determined to be ideal, individual wellbores can be targeted within 20 - to 30-foot windows, factoring in a five-foot "zone" in which to place a drillbit, even at depths of 10,000 feet, two or three miles out.

"We're kind of glorified cartoon artists," **Nate** deadpans. "If we've done our job, we can show you a picture or a diagram of how the subsurface works. The most successful geologists can use pictures or diagrams, even, yes, cartoons at times, to help people relate to the data that's being presented."

Of course, there are always curveballs, as there are at every step of this elaborate process.

“Some of the most challenging parts of subsurface work deal directly with our ability to deliver a deterministic value,”

explains **Beth McDonald**, Pioneer’s senior vice president for strategic planning, field development and marketing. “When we deal with Mother Nature, there are distributions of outcomes due to the heterogeneity of the rock – meaning rock quality changes significantly over the lateral.”

The 17-year Pioneer veteran puts it another way.

“Just think about your drive to work,” **Beth** says. “When you see the exit sign from the highway that says it’s two miles to your exit, how much does the terrain change across that distance? My guess is that it is certainly changing – likely more than we can easily quantify.

“There are many changes within the rock across the Midland Basin, and our team does its best to interpret the data we have to reduce our risk and increase our certainty on well performance,” she says.

Beth McDonald at the Q1 Employee Meeting

Now comes the handoff – and the potential payoff.

It's up to **Nikki Burnett**, Pioneer's senior strategic planning and field development director, and her four teams to work with the data **Nate** and his colleagues have collected to estimate how much oil and gas can be recovered from each well in the most economical way possible. She'll compare notes with our drilling, completions and facilities engineers, geologists and other analysts to assemble a field development plan.

What's created is known as a "**drilling fairway**" plotting how many wells we want to drill in a certain area and the distance and spacing between each wellsite.

Her 42-employee unit's main charge is to provide the company with an estimate of what oil and gas rates are going to be from the beginning to the end of a well's lifecycle. That forecast helps calculate how much value each well has, and how much it will produce throughout its operating life.

Nikki's teams repeat this process every quarter for each of Pioneer's 3,300-plus horizontal wells, and work with our budget and planning teams to develop an accurate production outlook for future quarters.

To her, that's not even the hard part, if you can believe that.

"It's a very time-consuming task," explains **Nikki,** "but the most challenging aspect of it is estimating production for the wells we haven't drilled yet and creating forecasts for every single stick." "***Sticks***" are the markers representing the thousands of wells in Pioneer's complete drilling inventory that haven't yet been put into production.

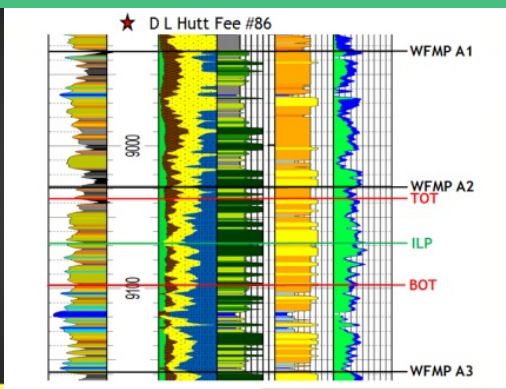
The markers are snapshots in time – even several years out from being drilled – yet the numbers still must be run for each stick to calculate the company's economic forecast and develop a hedged estimate of what the price of oil is likely to be over a period of time. Pioneer reviews those reserves forecasts twice a year to update its net resources potential. Other factors, like acquisitions and divestitures, must also be factored in. It's a delicate dance.

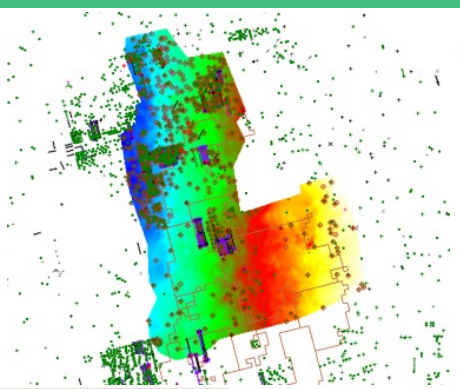
"It helps us understand what the value of the company really is," **Nikki** says. "And our responsibility is to develop accurate forecasts for every location, updated twice a year."

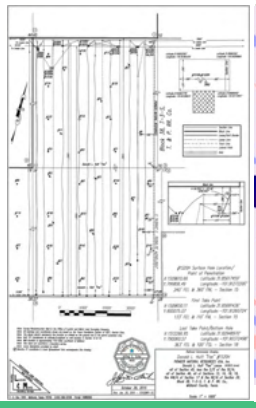
Like all of the Pioneer people you'll meet in the coming weeks, **Nikki** is passionate about her work, and it began at an early age.

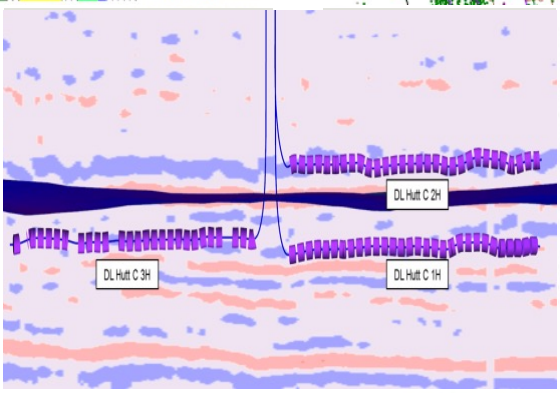
Born in energy-rich Baku, Azerbaijan, near the beaches of the Caspian Sea, she became immersed in the industry. Her dad was in the business, too, so she grew up around derricks and tank batteries and can describe the look, feel and smell of oil like it was second nature.

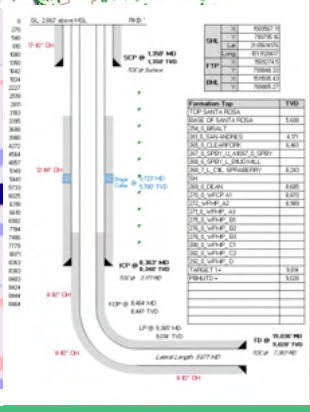
"It's in my blood," she says.



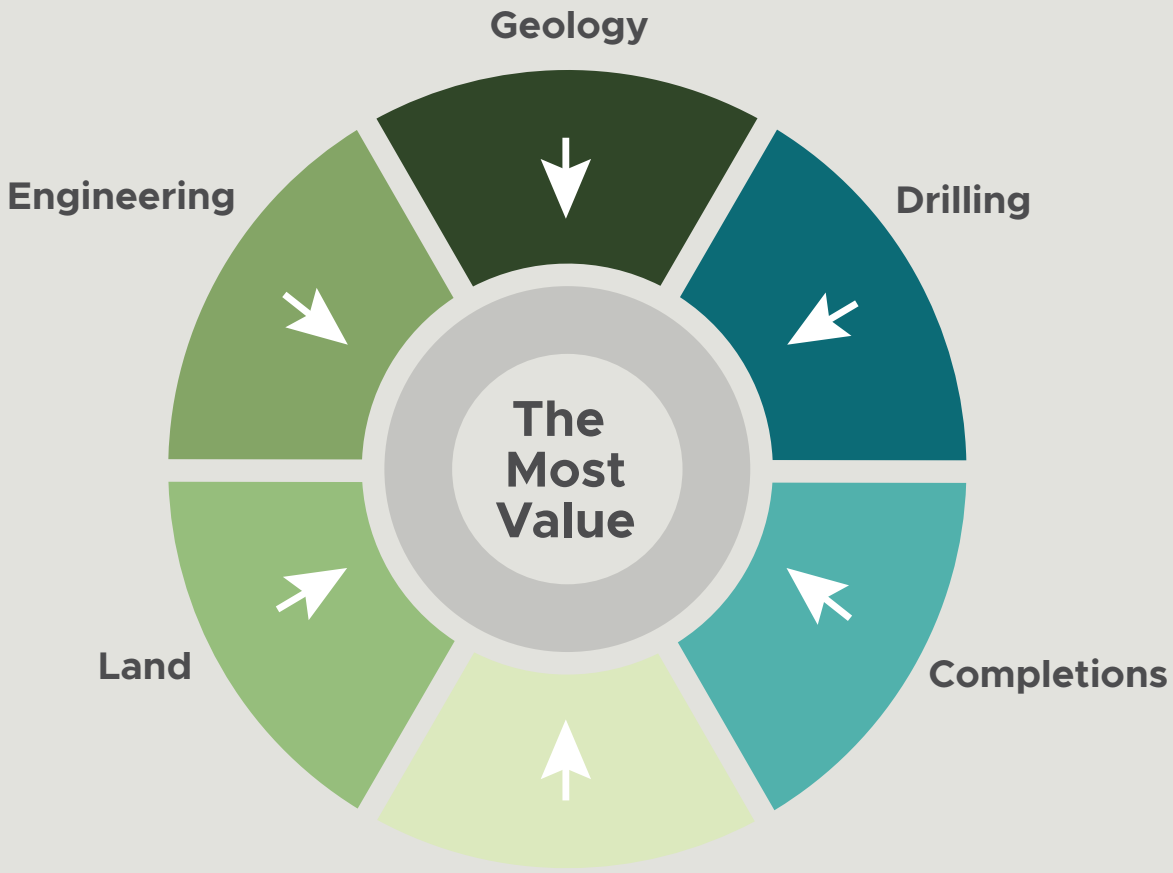








Major Players in Development Planning



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Drop of Oil

COMING NEXT WEEK:

Find out how Pioneer's Land department secures the acreage we want to drill on. We'll learn that accomplishing this critical step in the life of a drop of oil relies on a mix of shoe-leather research, mastery of digital records management and deft negotiation skills.

MISSED A CHAPTER?

Catch up on our Life of a Drop of Oil series here

Chapter 1: *A story unlike any other*
Chapter 2: *Where does oil come from?*

Geology glossary:

Petroleum geoscientists: These include geophysicists, geologists, geochemists and petrophysicists. They work in multidisciplinary teams to decide where to collect and analyze a variety of subsurface data, including well logs, cores and seismic tests. They also examine **drillhole databases** to develop 2D and 3D interpretations of potentially oil and gas-rich rock formations.

Drillhole database: Also known as a **borehole database,** this is a central repository that stores the measurements, seismic test results, recordings of physical features and potential deviations in samples extracted from test sites. It lets geologists develop enhanced subsurface profiles.

Seismic imaging: Uses sound waves to form 3D images of geologic formations.

Structural geology: The study of how rocks deform.

Folding: Rocks that are bent or curved during deformation.

Faulting: When rocks on either side of a subsurface displacement slip past one another on a mappable scale.

Fractures: Cracks in the Earth's crust with minor displacement relative to their length.

Strata: A layer or series of layers of rock. **Stratigraphy,** simply, is the branch of geology that studies the origin, composition and distribution of those layers.

Petroleum geochemistry: The study of rocks and fluids to identify the types, potential sources and history of the oil, gas and water present in rock formations.

Hydrogeologists: Analyze the risk of ground and surface water contamination during the drilling and operation of a well, informing decisions about where to position a well and how to reduce the risk from surface and drilling operations.

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