

# UNDER THE SURFACE



Tom Wilber

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Fracking, Fortunes, and the Fate  
of the Marcellus Shale

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*To my wife, Julianne Boyd, and my mother,  
Florence Leonard Wilber*



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## PROLOGUE

### *Cracks in the Rock*

From a distance, the stratified band of black shale running along the east shore of Cayuga Lake is hard to pick out from an ensemble of natural features—rocks, trees, hills, and water—that compose the landscape of the Finger Lakes region of New York. Viewed from across the lake, the rock is a thin charcoal-colored border just above the shoreline, occasionally disappearing behind cottages and boathouses. A landscape artist might incorporate it into the broader picture as a shaded accent above the beach. To geologists, shale is a defining aspect of the landscape and the Marcellus layer, well below the visible Cayuga shoreline, is a resource at the heart of our national interests.

Terry Engelder, a professor of geosciences at Pennsylvania State University, is such a person. He pointed out the rock's features to me from windows of the Glenwood Pines Restaurant on the slope above the west shore of the lake. The promontory, a few miles north of Ithaca, is one of his favorite viewing spots to study these outcroppings. He has sought out this view many times, and he still finds this perspective worth the four-hour drive from his home in central Pennsylvania.

A compact, energetic man with a tanned and deeply lined face suggesting many days in the field, Engelder has built a distinguished academic career understanding the formation and physical characteristics of rocks. His career flourished in the early 1970s when the country faced a series of major energy crises. The price of oil tripled due to an embargo by major oil

producing countries in the Middle East in 1973 and nearly doubled in 1979 during a period of political instability in Iran. At that time, Engelder was earning advanced degrees at Yale and Texas A&M Universities, after having worked as a hydrologist with the U.S. Geological Survey (USGS) and a geologist for Texaco. Policymakers and researchers began focusing—for a while, at least—on domestic energy sources to decrease dependence on unpredictable and uncontrollable supplies. That focus created opportunities for young researchers such as Engelder who had experience applying their work to both industry and government interests. The decades he has spent doing this since then have not diminished the romantic view he harbors about his vocation, which he defines as “a person who sleeps in the mud one night and the next night puts on a tux to tell people what he or she found.”

The gray band of rock above the shoreline began as mud at the bottom of an inland sea between 300 million and 400 million years ago. Sediments, including decaying organic material, were compressed over time into layers of Devonian rock, named for the geological period in which it was formed. The various outcroppings in upstate New York represent only the visible tips of this compressed sea of silt, clay, and carbon that extends south from central New York through northern Tennessee, west to the Ohio Valley, and east to the Hudson Valley. Much of this area (with the exception of Tennessee) is spanned by one stratum, the Marcellus Shale, which outcrops in Marcellus, New York.

Black shales get their name from their dark hues, reflecting a rich mix of organic material. Engelder was among the first to assign a commercial value to this characteristic—an estimated 500 trillion cubic feet of natural gas in the Marcellus alone, enough to meet U.S. needs for decades. That calculation, which Engelder announced in 2008, caught the attention of industry executives, investors, and the media at a time when U.S. dependence on foreign oil was again a political issue.

There is another thing that makes the Marcellus special in addition to its content—its position. It sits over other gas-rich geological formations and under the infrastructure of a burgeoning natural gas distribution system to major metropolitan markets in the northeast. Although the upper Devonian layers visible along Cayuga Lake are too shallow to be effectively produced, the depth and thickness of the deeper Marcellus make it ideally suited for commercial production throughout southern New York, Pennsylvania, and parts of Ohio and West Virginia. In short, the rock holds one of the largest gas fields in the world in the middle of the largest energy markets, including the metropolitan areas of New York, Philadelphia, Pittsburgh, and Boston. At the

time of Engelder's calculation of the Marcellus potential, natural gas, in addition to its traditional role in heating homes and businesses, was becoming an alternative to coal for some electricity-generation plants. It was also a proven fuel for internal combustion engines. With these facts, industry supporters began building the case that the exploitation of the Marcellus and other domestic shale gas reserves could lead the country to energy independence.

Throughout most of Engelder's career, industry lacked commercial incentives to develop technology to extract gas from shale. In the early 2000s, as the price of gas rose, prospectors began experimenting with unconventional methods in the Barnett Shale of northern Texas. Breakthroughs came when they began using two different techniques in tandem. The first was horizontal drilling, a process developed in the early 2000s using computer-generated models and steerable drilling mechanics to bore first vertical, then long horizontal wells through pancake-like strata. The second was hydraulic fracturing, developed in the late 1940s for vertical wells. Commonly known in the industry as "fracking," the process involves injecting the bore with a mix of water, sand, and chemicals under pressure great enough to split the rock and free gas embedded within. Applying the process to a horizontal well requires handling a much larger volume of solution under greater pressure compared to a vertical well and poses logistical and engineering challenges that weren't seriously pursued until the Barnett was developed.

By 2008, growing estimations of the Marcellus potential—lead by Engelder but also supported by early production results—triggered one of the biggest prospecting rushes in modern history. Speculators began bidding up the price of mineral leases; and the ensuing development of wells and infrastructure in Appalachia brought both a new source of capital and new concerns about the degradation of land, water, and air from which an environmental movement was born.

Engelder became an established source for reporters, including myself, covering Marcellus development. As the story progressed, he evolved from an expert within academic and industry circles to a controversial and outspoken public figure. His position as an authority and his eagerness to talk about his work made him a popular source for a growing corps of reporters who found the Marcellus story overlapping their daily beats on politics, environment, and local government. When I told him about my plans to write a book about shale gas issues, he proposed we meet for a day in the field.

Our day began at the Glenwood Pines. We roamed through the dining room, taking a moment to inform a waitress that we were not there to eat

but to look at rock. “I bring my students here all the time,” he reassured me. “They know me.” He squeezed between tables filled with patrons to lead me to the exact spot at the windows where I could get a good view of the specimen across the lake. Tuning out the distractions of colored sails trimmed against a breeze, I located the band of rock above the far shore. Engelder pointed out a subtle sine wave pattern in the rock that was apparent only by examining a long cross section from a distance. Where I saw a backdrop for boats and cottages, Engelder saw features formed by geologic compression due to the movement of tectonic plates. He explained how this compression created stress fields that resulted in a pattern of fractures—largely unseen—in this shale layer and many layers below it. His insights transformed my view of a tranquil lake shore into a complex and dynamic geological formation.

Everything central to shale gas production—and the controversy surrounding it—involves understanding rock fractures. Gas cannot flow from shale, for the purposes of production, without cracks. The more cracks, the greater the flow. Consequently, wells are more productive by orders of magnitude if drilled to intersect the greatest number of natural fractures in the shortest distance. A uniform and predictable system of fractures allows gas to be optimally controlled and captured, whereas chaotic and unpredictable cracks or faults increase the risks of gas flowing to places where it’s unwanted. The degree an operator is able to master the natural system of cracks, while systematically and effectively creating new ones through hydraulic fracturing, is the difference between boom and bust.

According to some arguments, exploiting this complicated network of stress points invites disaster as the industry pushes ahead with unproven technology and insufficient knowledge of natural systems. Publicized concerns include opening a path for highly pressurized gas, brine, heavy metals, and chemicals into water bearing zones—a risk the industry says is negligible. Engelder, too, has dismissed this risk; and this position has contributed to his reputation among some drilling opponents as a chief enabler of an exploitive and uncaring gas industry.

After leaving the Glenwood Pines, we climbed into my car and headed north. We were following a tour that Engelder, over the course of years, has led more than sixty times for students and colleagues. Noteworthy in this group is Tony Ingraffea, an engineering professor at Cornell University who shares academic interests with Engelder. The careers of both men are distinguished by their knowledge of rock fractures. Rather than focusing on how fractures were formed in nature, however, Ingraffea’s field of study involves

how those fractures can be induced through technology such as hydraulic fracturing. Engelder's geological expertise complements Ingraffea's engineering, and the two have coauthored several research papers. Ingraffea has also been the target of criticism due to his views on Marcellus development. In Ingraffea's case, however, the heat has come from industry advocates incensed by his public opposition—often stated at speaking engagements arranged by antidrilling groups—to shale gas development. Whereas Engelder is confident that extracting natural gas by means of horizontal drilling and hydrofracturing will lead to prosperity, Ingraffea believes pairing the application of these technologies for extracting shale gas poses unacceptable risks.

On our ride, Engelder was mostly interested in talking about how the tour relates to the work of another academic—Pearl Gertrude Sheldon, a structural geology student who earned her Ph.D. from Cornell in 1911. To explain Sheldon's involvement in the hands-on way he prefers to teach, Engelder directed me north a few miles on Route 89, flanking the west shore of the lake, to Taughannock State Park. We parked in the lot on the west side of the highway, near the opening of a forested gorge carved by Taughannock Creek. Terry shouldered his daypack, and we hiked away from the lake and along a stream cascading off tables of rock. Deeper in the gorge, as cliff walls eclipsed the horizon, I stopped and gazed up at roots of trees clinging to bedrock planes hundreds of feet above us. Observing these features against moving clouds gave the illusion of the ground moving, and a brief rush of vertigo.

“No matter how many times you return, you see something new,” Engelder remarked, pointing out the geometric patterns in the cliff walls, many of which ran perpendicular to the stream bed and nearly at right angles to each other. He explained how his academic frame of reference was largely shaped by Sheldon's observations. After two summers charting the geology manifested in outcroppings along the lake and the gorge, Sheldon was the first person of record to see that upper Devonian shales were uniformly bisected by a grid of vertical planes corresponding to the dips and rises in the sine wave—the tectonic-induced stress field—that Engelder had shown me along the lake shore. She called them symmetrical joint sets, and Engelder now pointed them out in the blocky rock faces all around the gorge, exposed where complementing halves of the joints had fallen away. The pattern that Sheldon documented was the genesis of Engelder's belief that the joints are not products of the chaotic process of uplift and erosion that might have affected only the upper shale layers exposed during the glacier age. Rather, they are as old as the rock itself, a result of gas generated from organically

rich sediment aging under high pressure and heat. The joints formed along the stress fields created throughout the entire Devonian layer by the action of tectonic collisions; and they reflect both the high organic content of the rock and an efficient means for it to escape—aspects that make it a more desirable target for commercial production.

Sheldon, according to Engelder, provided “the seminal observation that has turned the Marcellus into a supergiant gas field.” In 1912, the *Journal of Geology* published Sheldon’s twenty-seven-page paper, “Some Observations and Experiments on Joint Planes,” detailing her observations about joints in the shale along the lake and gorge. In Engelder’s estimation, this paper charted the direction of the petroleum industry into the twenty-first century and the era of shale gas development.

If this is true, there is irresistible irony that a field so dominated by men was influenced by the groundbreaking work of a woman prior to suffrage. Engelder speculates that Sheldon must have spent days on end wading up creek beds and hiking and camping along undeveloped shorelines as she took 3,000 readings over the course of a fall and two summers. Public transportation outside of cities was not well developed, and Engelder imagines she would have made the 15-mile trip from Ithaca to the gorge mostly or entirely on foot or perhaps riding a bicycle—a vision that fits his view of geologists as pioneers. At the time, the primary market for petroleum was producing kerosene for lamps, and the demand was falling in proportion to the rising popularity of electric light. The explosion of petroleum demand related to mass-produced motor vehicles and paved roads had yet to develop. Drawing from scant records of Sheldon’s life, Engelder concludes that she was driven by a calling to advance knowledge about natural history rather than aiming for any particular commercial application. To promote Sheldon’s as-yet-unrecognized influence on the multibillion-dollar hydraulic fracturing industry, Engelder proposed an award in her name from the American Association of Petroleum Geologists to honor women who have contributed to petroleum and natural gas development. Engelder, who is not reluctant to promote his role as an advisor to industry and investors, said he would welcome a personal role in giving the Sheldon award, the status of which was unresolved at the time of our field trip.

As we hiked along the gorge, retracing Sheldon’s steps, Engelder found the spot he had been looking for. Here he left the path and stepped out onto a shelf of dry streambed—smooth dark rock dimpled by the wear of water over eons. He took chalk from the pocket of his daypack and knelt down. With his face close enough to feel the sun radiating from its surface,



he began drawing diagrams on the streambed to illustrate the broad concept he was pointing out in the landscape all around us: the orientation of stress fields created by the collision of the African plate with the North American plate nearly 380 million years ago and the resulting pattern of cracks from escaping gas. He then dug in his pack for a geology hammer and chipped off a piece of shale overhanging the creek. He brought it to his nose and sniffed. He chipped off another piece and held it to my nose, an exercise he had repeated with countless students over the years. I noted the musty, bituminous odor of the rock, and Engelder smiled approvingly.

This rock wasn't the Marcellus but one of the numerous shale layers above it that, based on Sheldon's field work and Engelder's deductions, serve as analogs to what lies beneath. "A good black shale like the Marcellus will knock your socks off," he said.

The gorge is a place where what's under the surface comes together with the land above, and the past merges with the future. Rock layers visible here extend out of view for thousands of miles. Above them, the waterways that created the gorge and exposed the rock flow past vineyards, orchards, bed and breakfasts, farms, businesses, and homes. A few miles to the south of Taughannock Gorge is Ithaca, a city of about 30,000 people that is home to Ithaca College and Cornell University. Further south are the industrial cities of Corning and Binghamton in the Susquehanna River watershed, and beyond that there are vast rural tracts of northern Pennsylvania. To the east is the Delaware River basin, encompassing a network of streams, reservoirs, and rivers that are the primary water source for New York City and Philadelphia. This is but a fraction of the Marcellus footprint, which encompasses 95,000 square miles of metropolitan, urban, suburban, rural, and wilderness land.

The destinies of communities over similar shale gas reserves—in Alabama, Louisiana, Wyoming, Arkansas, Texas, Colorado, and other places—are linked to the Marcellus region by local geology and global energy concerns. In all these shale gas regions, the relationships people have with the land, and with their neighbors, are as complicated and multidimensional as the topographical and geological terrain. Here, too, there are cracks. They are created by forces that sometimes pull in opposite directions, at other times collide with great force, and often are buried from view. The social parallels to the natural features of the Marcellus are the focus of this story, and they begin with a series of events unfolding in rural communities along the border of New York and Pennsylvania between 1999 and 2011.

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## 1. AN AGENT OF DREAMS

**R**on and Jeannie Carter were in their late sixties and on a fixed income when the landman parked his luxury sedan in front of their trailer home. He wore a cowboy hat, boots, and an oversized buckle on his belt. He was not a big man but, striding confidently up to the drive, he cut a striking figure; and he brought uncommon news: Cabot Oil and Gas—a company from Houston, Texas—was interested in leasing the Carters' land for natural gas exploration.

The year was 2006. In the Endless Mountains of northern Pennsylvania, where the Carters lived, visits from landmen were rare but not unheard of. Some property owners from previous generations had signed over mineral rights to land speculators for between \$1 and \$5 per acre, with little ever coming of it but a modest check and a little paperwork. The proposal this landman brought might also amount to nothing—or the 75-acre ancestral homestead could be sitting right on top of a source of income for Ron and future generations. Cabot was not a speculator but a fully capitalized drilling company, the landman explained. His name was James Underwood, and he quickly impressed Ron as experienced in these matters. The \$25 per acre that Mr. Underwood was offering was far better than offers Ron's father had once entertained. It would be almost enough to cover the Carters' tax bill, even if nothing more came of it. If Cabot struck gas, the Carters would be guaranteed a piece of the action: 12.5 percent. That was in black and white

on the lease Mr. Underwood brought. The way gas prices just kept on rising, that could amount to something.

Jeannie Carter, Ron's wife of fifty years, was decidedly against the idea. If the landman didn't immediately know this, he would soon learn that she required some convincing. Forty-five minutes into his introductory visit, when it was clear the Carters were not going to sign anything that afternoon, the landman announced he had taken enough of their time. He knew they would want to think about it, and he surely understood that. But they had better not wait too long, he added—and here Ron sensed genuine indifference in his voice. The neighbors were signing up, the landman told them; and with due respect, Cabot didn't need the Carters to move forward with its plans.

Drilling companies based in the south, like Cabot, were among the first to sense opportunity in Marcellus Shale formation underlying Appalachia in the first decade of the twenty-first century. These companies sent agents to acquire rights to the land, and they started with promising territories that could be leased cheaply. That brought them to Susquehanna County in the heart of the Endless Mountains.

When viewed heading north on Interstate 81 toward the New York State border, the Endless Mountains live up to their name. With each crest in the road, the northern Appalachian terrain appears and reappears, flowing in waves and channels to the horizon. The New Milford exit—one of the last before New York—drops into a place that could also be called the Timeless Mountains. Away from the traffic and commerce of the interstate, the northeastern Pennsylvania landscape appears essentially as it did a generation ago—farms and fields, agricultural supply and general stores, lunch counters and gas marts, and the occasional horse-drawn buggy venturing from one of the Amish settlements tucked away in the Susquehanna River Valley. Heading west, County Route 706 wanders over hill and dale before settling down in Montrose, a village of 1,660 residents and the seat of Susquehanna County. Here, roads merge into the village center, with a public green and a Greek revival courthouse facing a boulevard with broad sidewalks, period streetlamps, and tidy storefronts.

From this hub, Route 29 runs out of the village to the south, passing through Dimock Township and connecting with town roads meandering through forested hollows. Homesteads and trailers of generations of farmhands, quarry workers, and lumberjacks are mixed with nineteenth-century

farmhouses and contemporary homes of artisans and organic farmers—newcomers pursuing ambitions of gentrified country living. Dry-laid stone-walls from settlement times mark boundaries. Some have buckled with time and exposure to the elements, swallowed by wild rose and elderberry bushes. Others, perhaps built by better craftsmen or restored by capable hands, remain plumb and square, at least for another generation. A section of this kind of sturdy wall ends in front of Ron and Jeannie Carter's home.

It's a neat white trailer with brown shutters, sitting on the edge of a woodlot. Facing away from the woods, a canopied front porch, furnished with deck chairs, wind chimes, and hanging flower baskets overlooks an expanse of fallow field. This is where Ron reads Tom Clancy and Clive Cussler on summer days as hummingbirds and finches flit about feeders. He wears a cap tipped back on his head, exposing a face with earnest features, a small mustache, and sturdy metal glasses. Jeannie often sits with him doing crossword puzzles. It had always been a quiet place, but that changed after 2007. Following the landman's visits, the unpaved and seldom-traveled road visible from the porch became a primary route for caravans of heavy equipment. Subsequent events drew people from far and wide: reporters from network television, national magazines, and newspapers; filmmakers; environmental advocates; politicians; and celebrity elites such as Robert F. Kennedy Jr.

I met the Carters while covering natural gas development in New York and Pennsylvania for Gannett's Central New York Newspaper Group. Their homestead was at the center of a rush to develop the Marcellus Shale—soon to be touted as the mother lode of domestic energy reserves and emblematic of a conflict over shale gas development that was taking shape across the county. On the surface, this was a story about ecology versus the economy, land use conflicts and policy, and the heady prospects of unheard of sums of money changing hands. These themes were compelling enough and easy for the mainstream media to grasp. But people soon sensed that the significance of events ran deeper. The energy future of the nation, global warming, energy independence, and ecological sustainability—these were the larger issues of the day, and they were integral to the Marcellus story unfolding in out-of-the-way places such as Dimock.

The Marcellus, a mile underground and stretching from southern New York through Pennsylvania and parts of West Virginia and Ohio, is a black shale formation long known to hold an abundance of natural gas. That gas was essentially worthless, trapped in rock with no effective way to extract it using conventional drilling methods. The formation was a vault with no key;

and prior to the time I met the Carters, it was noteworthy only because of the technical challenges it posed to those drilling through it to reach proven gas-bearing formations deeper in the earth. The best known of these were the Oriskany Sandstone and the Trenton Black River Limestone. For years, drilling companies able to pinpoint porous, geographically sporadic pockets in these formations—mostly in parts of western New York, Pennsylvania and West Virginia—were rewarded with prolific and free-flowing production.

When landmen came calling to secure rights to property in Dimock in 2006, few people outside the industry had heard of the Marcellus. Residents had no way of knowing its worth to energy companies, which, with a series of breakthroughs pioneered in Texas, had found a key not only to the Marcellus vault but to black shale reserves worldwide. The discovery—involving a process that uses hydraulically applied force to shatter rock and free gas deep in the earth—held the potential to dramatically alter the lives of Dimock residents and change the global dynamics of energy production and consumption. By spring 2008, people living over the Marcellus from the Finger Lakes to the Ohio River Valley began catching on as Underwood and his colleagues made their rounds.

Newspaper reporting offered a front row seat from which to track daily developments in both states. I drove from upstate New York south through the Endless Mountains, where I met the Carters and other residents of Dimock, including Victoria Switzer, Norma Fiorentino, and Don Lockhart. The story of the Marcellus begins here, in the rural reaches of northeastern Pennsylvania, long before most people knew anything of shale gas or of hydraulic fracturing.

## **A HISTORY OF EXTRACTION**

Carter Road is named after the Carters because they were the oldest family living there when the 911 emergency system was installed late in the last century. It's where beauty and utility have coexisted, not without tension, for generations. Primeval forests of hemlock, pine, maple, and beech were logged to exhaustion throughout northern Pennsylvania well before the Carter family arrived. By the early 1900s, a rush on resources had advanced with little technical or scientific experience, government oversight, or planning. Timber was a versatile and seemingly limitless resource for heating, building, burning, and tanning. Hillsides were stripped bare as industry took hold during the nineteenth century.

The trees provided timber for a vast network of mineshafts for a booming anthracite coal mining industry concentrated in five counties of northeastern Pennsylvania, including Susquehanna County. Just prior to World War I, the industry—extending south from the northern border of Lackawanna County through Dauphin County—employed 181,000 mine workers and led the growth, capitalization, and vitality of the region. The coal extracted in abundance from this region provided cheap, efficient fuel for factories, forging works, and homes. Railroads were built, canals dug, and an entire economic infrastructure was built on the back of the northeastern Pennsylvanian coal industry.

Economic success was accompanied by historic measures of calamity. Between 1869 and 1999, more than 31,100 miners died on the job in the anthracite region. Workplace safety improved over time, yet injury and fatality in the coal industry remain hazards to both workers and residents. Waste from mine shafts still fouls rivers and tributaries. The earth beneath entire communities spews fumes from inextinguishable fires. One of the most famous examples is found in the town of Centralia, once a vibrant borough with more than 2,000 residents in the southern part of the anthracite region. It was abandoned and condemned after an underground coal fire began spreading in 1962. The fire still burns today, and only a handful of people stubbornly hold on to their homes in what has become a ghost town.

Another disaster, less than 40 miles south of Dimock, accelerated the demise of the anthracite coal industry and highlighted the costs of resource extraction. The Knox Mining Company disregarded orders by the state Department of Mines to shut down an anthracite mine carving out a vein under the Susquehanna River in Port Griffith. Work continued even after an inspector found that the company was violating rules that prohibited mining within 35 feet of the bottom of a riverbed. On January 22, 1959, the river fell through the roof of the mine. A massive vortex formed over the hole as 10 billion gallons of water drained from the river and filled the interconnecting network of shafts below the Wyoming Valley. Twelve miners died, and mine operations were halted in the valley.

A few hundred miles to the west, in the Allegheny region of Pennsylvania, oil and gas drilling witnessed a similar pattern of prosperity followed by neglect and decay. It began in 1859 with the pioneering venture of Edward L. Drake, a retired railway man hired by investors of the Pennsylvania Rock Oil Company to explore ways to extract oil, which had limited but growing value at the time. Drake was the first to employ drilling machinery to produce

petroleum from wells rather than experimenting with other methods then in vogue (and proven ineffective) to collect it from surface seeps common in the area. His success in developing the first U.S. wells in the Titusville region sparked a rush of capital and workers to the region that marked the birth of the modern petroleum industry. For the next three decades, tens of thousands of wells—some clustered a dozen feet from one another—would be the hallmark of these boom towns. Coupled with advances in production and refinement as well as growth in applications for light, heat, manufacturing, and transportation, these Allegheny wells laid the foundation for a fossil-fuel-based economy in a country then largely dependent on whale oil.

The petroleum boom in the Allegheny region brought untold wealth to some investors and speculators, and gainful employment to teamsters, rough-necks, and laborers. When it was over, it left abandoned towns and memories of environmental degradation and human loss. A series of spectacular oil fires devastated entire communities in the Allegheny region before the boom ended in the last part of the nineteenth century. The worst was on June 5, 1892, when petroleum tanks overturned in a flood, causing an inferno along Oil Creek. According to an account in the *New York Times*, “an explosion was heard up the stream, which was rapidly followed by two others, and quick as a flash of lightning the creek for a distance of two miles was filled with an awful mass of roaring flames and billows of smoke that rolled high above the creek and river hills.” The fire raged for days from Titusville to Oil City and killed scores of men, women, and children.

Petroleum speculators began leaving western Pennsylvania to seek oil first in Ohio, and then after the turn of the century in Texas and Oklahoma, where oil fields were proving more productive than those of Pennsylvania. Electricity had begun displacing oil and kerosene as a preferred source of light, and automobile production had yet to begin driving the demand for oil exploration. It was about that time that Ron Carter’s family legacy began in Dimock, just north of the still-bustling anthracite coal mines. By the 1920s, the virgin landscape once occupied by the Delaware and, later, Iroquois Indians was long gone, but the land was beginning to heal from decades of logging and was developing a rustic beauty that is at the base of its character today. From their porch, Jeannie can see three massive hickory trees that, like the stonewalls flanking the property, offer a tangible link to an earlier time. She vividly remembers being fifteen years old and picnicking with Ron under those trees the year they met during an outing organized by Ron’s parents and other members of the Dimock Baptist Church.

At that time, Ron's family owned close to 200 acres. Ron was born and raised in a gabled, four-bedroom farmhouse perched beyond the hickory trees and across the field from Ron and Jeannie's current home. In the 1940s, Ron was a young boy, and his parents and grandparents were able to coax enough of a living from the land to comfortably support an extended family. His father, Ray Carter, tended the animals—cows, pigs, and chickens—and his grandfather, George Brown, logged and sold timber that provided infrastructure for coal-mine shafts being dug to the south of Dimock. In the house where Ron grew up, trips to the grocery store were infrequent. The family occasionally slaughtered a pig and a cow in the barn, and slabs of smoked and salted pork hung on the porch through the winter. The cellar was full of potatoes, canned fruit, produce, and bulk provisions for baking and cooking. The family made enough profit to buy the things they needed, and by today's standards, they didn't need much.

One thing they could not do without, however, was water. Crops and livestock need plenty, and in Dimock wells and streams are fed by one of the greatest freshwater circulatory systems in the country. Burdick Creek, where Ron fished as a boy, runs through the hollow to the west of Carter Road before connecting with Meshoppen Creek, which feeds the Susquehanna River. The Susquehanna River watershed and the overlapping Delaware River watershed to the east are the heart of a network of streams, ponds, lakes, wetlands, and rivers encompassing 41,000 square miles in parts of New York, Pennsylvania, New Jersey, and Maryland. In addition to sustaining a thriving ecosystem, the watersheds provide drinking water to millions of people (including residents in New York City) and support industries and commerce throughout the Northeast and mid-Atlantic.

The life that Ron knew as a young boy had begun to change by the time he was a teenager. The post-World War II economy grew with unprecedented levels of production and consumption. America's ever-growing demand for inexpensive commodities and processed food could be met more efficiently and profitably by production from other parts of the country and the world. New industry rose based on economies of scale, capital interests, mechanization, and cheap labor. Across the United States, agricultural practices changed accordingly, and those changes did not favor Appalachian family farms.

Lacking a single iconic attraction such as the Adirondack High Peaks, the clear and deep waters of the Finger Lakes, or the resorts of the Poconos, the Endless Mountains of the northern Appalachian countryside was largely

forsaken by the tourism that came to the aid of other communities after World War II. Dreams here, from settlement times, were made from raw beauty difficult to measure yet easy to squander—timber, agricultural product, minerals, and stone valued in board feet, BTUs, and raw tonnage. This and hard labor fueled the industrial revolution and wartime economic booms. By the early 2000s, such dreams had largely played out, leaving a poverty rate greater than 12 percent and an economic void waiting to be filled.

Long before the arrival of the twenty-first century, it was common for those of Ron's generation to leave the farm after high school to pursue new dreams elsewhere. In 1957, Ron moved to Johnson City in the Southern Tier of New York, about 30 miles northwest of the family farm. Although technically a village then, it was growing into a bustling manufacturing hub, with the Endicott Johnson shoe empire still thriving and a promising information technology company called IBM expanding quickly. That same year, he married Jeannie, who had left her family farm in neighboring Brooklyn Township to work as a secretary in Endicott. Like the family farm, the Endicott Johnson operation soon fell amid shifting economic pressures involving free-market demand for more with less. In this case, shoes could be produced far more cheaply overseas. Ron and Jeannie and their three sons then moved back to the Carter homestead, and Ron found sporadic work at Bendix in South Montrose and, later, a steady job at Procter and Gamble near Scranton. He worked at Procter and Gamble for twenty years making disposable diapers until a heart attack forced him from the job before he became eligible for retirement benefits.

Ron tells me his family story matter-of-factly in a deep, slow voice, pausing to gather his thoughts now and then, and conveying his feelings through quick, forceful hand gestures. Jeannie mostly listens, but chimes in with details Ron may have forgotten. The heart attack, she offers, "made other things seem not so important."

Her husband calls her Jeannie or, sometimes, when not addressing her directly, "The Wife." She's a slight woman, with a sweet voice belying a formidable strength and a farmer's firmness with animals. She snags Brandee, the family's excitable terrier that likes to jump on visitors. The dog struggles unsuccessfully in her arms as she settles back into her chair.

Jeannie worked at various jobs over the years ranging from factory work at Allied Signal (formerly Bendix) to a greeter at Walmart in Tunkhannock after Allied Signal closed. She and Ron supplemented their income, eventually paying off the mortgage of their upgraded trailer home, by selling off

pieces of the homestead (including the farmhouse where Ron grew up). The real estate market in northeastern Pennsylvania was generally too remote to attract developers of subdivisions, which tend to drive up prices of rural land situated near urban areas. In Dimock, the relatively low demand, low prices, and low cost of living attracted other kinds of buyers: those seeking acreage for wood lots, a country home, or perhaps a cheap alternative or supplement to long-term market investments.

In addition to using the real estate money to pay off debts, the Carters invested in machinery for a small quarry on the remaining land. Two of the Carter boys lived separately on the homestead, and both of them were in the stone business. Even as making a livelihood from coal, petroleum, and farming became a thing of the past, stone remained a significant industry in northeastern Pennsylvania. An abundant endowment of bluestone, coveted for upscale building projects, lies just under the surface of many fields and wood lots in this area, and it commands a good price when the building market is on. The old fieldstone walls also fetch a price on suburban markets; and it's not uncommon for farmers to sell their stone walls to out-of-town buyers, who have them trucked off and reassembled in affluent neighborhoods in New York and New Jersey.

But the bluestone market was flat, and Ron and Jeannie were down to 75 acres when the landman arrived.

## THE LANDMEN

While gas reserves were found and produced to the west in New York and Pennsylvania throughout the twentieth century, prospecting to the east remained sporadic, low-key, and highly speculative. Breakthroughs in shale gas development changed that—by 2007, thousands of landmen were competing for rights to land over the Marcellus on both sides of the Pennsylvania–New York border. Many of them worked for national and multinational gas companies based in Texas and Oklahoma, including Cabot, Chief Oil and Gas, Range Resources, and Chesapeake Energy.

One of them was James Underwood, the landman who had approached the Carters. While I was researching developments in Dimock, I phoned him to arrange an interview. I wanted to ask him about his travels throughout the country, and his encounters with people in northeastern Pennsylvania. I was especially interested in what he told residents about the newly exploitable resource to which gas companies were seeking title. He had been living out of

a hotel room at the Holiday Inn Express near Interstate 81, he told me. Ron and Jeannie Carter remembered that, in addition to his sedan, Underwood had a large pickup and a camper from which he sometimes worked. As I tried to arrange a place and time to meet, he became chronically unavailable.

The other name that often came up in my interviews with landowners was Frank Fletcher. Like Underwood, Fletcher dressed and talked like a cowboy, and he left a distinct impression on those he met. “He looked like a big Texan. He dressed real nice, real flashy, and wore gold,” said Julie Sautner, one of the Carters’ neighbors. She and her husband, Craig, signed their mineral rights over immediately after hearing Fletcher’s pitch. In my phone interview with him, Fletcher fit their description. He was charming and polite, with an engaging southern drawl and a cowboyish manner. He was born in Massachusetts and had lived in Los Angeles, although, as he told me, he may have picked up his accent from having worked for decades in Texas and Oklahoma. We arranged to meet at the Flying J truck stop in New Milford. I was to look for the man in the cowboy hat, headgear that was increasingly in vogue throughout Susquehanna County. On the day we were to meet, I called Frank to tell him I was finishing an interview in Dimock and I was on my way. He informed me that he regretfully had to pass, “at least for now,” after Cabot officials told him not to do the interview if he wanted to continue to work for them. “Sorry for having to back off, but I guess you understand,” he said. “I hope you’re at least sympathetic to our side of the story.”

I was certainly curious. The business of Fletcher and his colleagues was integral to events unfolding in Susquehanna County.

Fletcher and Underwood are part of a brotherhood of peddlers better known in oil-rich communities in the Midwest and South than in the Northeast. But their approach and style fit well into the farm culture of any rural U.S. community. They’re throwbacks to the day when door-to-door was a common way for men to do business and deals were made at the kitchen table rather than in law offices. They are versed in land-use and farming matters, and the types of things that landowners worry about: taxes, weather, crop yields, animal stock, and the art of extracting wealth from the land. They are charismatic enough to show up on people’s doorsteps and gain access to their homes. Often they are invited in. If they aren’t, they are persistent enough to prevail, sooner or later.

Understanding the risks and rewards inherent in a deal is essential to any negotiation. Here the gas companies had the clear advantage. They were privy to data collected from beneath residents’ land: seismic studies and

geological surveys supporting the growing body of industry knowledge suggesting the Marcellus was the richest domestic energy source in the country. Northeastern Pennsylvania and southern New York straddled one of the most promising sections. Few residents of Dimock had any idea of that, and none of them had access to detailed scientific data.

Gas prospecting brought another interested party to the region in spring 2006—Jackie Root, a farmer and self-taught lease negotiator from Tioga County, Pennsylvania. After having some success organizing residents to deal collectively with companies in Jackson, about 70 miles west of Dimock, she was recruited by the Penn State Cooperative Extension to help advise people dealing with offers from landmen. She likened dealing with landmen to “a poker game where they get to see your cards but you don’t get to see theirs.” Mostly, people trusted landmen because they had high hopes and little experience in such matters, she told me. It’s natural to believe somebody “with a charming southern accent that looks like your grandfather,” she said, especially when that person conveys enticing information about your land and “looks like he knows what he is talking about.” It’s hard to know what to believe, she added, because along with good, honest landmen there are some known to tell “untruths.”

There was a way around the risks of this game, and it involved establishing solidarity with neighbors. Large tracts of contiguous land owned by multiple individuals were made even more attractive if their mineral leases could be dealt all together, eliminating patchwork acquisitions. Both owners and lessees could benefit from this, Root thought. This was especially effective when landowners were knowledgeable about the resources they possessed and united in their commitment to hold out to command the best price. During a gas rush spurred by a proven resource, it was an especially good way to deal with big companies with deep pockets. On the other hand, when speculation was high and interest was low—as it had been for years in Susquehanna County—there was little incentive for prospectors to play a game in which the rules were established by a collection of holdouts.

In 2006, before things had developed very far in Dimock, Root was one of the featured speakers at a meeting coordinated by the Penn State Cooperative Extension in Montrose. Not wishing to alienate the industry, she invited Frank Fletcher to participate in the spirit of public education. “He told them ‘we’ll pay \$25 an acre and never a nickel more,’” Root later recalled about that meeting. “I think Frank was very threatened by what we offered.” Perhaps he was, but for various reasons Root’s organizational efforts never