Nature's Atom Bomb

Before the greenish radar scans, before blurry photographs from satellites, before television or television meteorologists, and before the snappy twenty-four-hour-a-day Weather Channel, there was this: the faint flicker of lightning and the distant growl of thunder on the prairie's horizon. This was what amounted to a storm warning on the plains.

The far, open sky filled with mountainous cauliflower clouds that grew fat with rain and hail, and those dark olive-hued clouds could conceal the most powerful force known in nature—or not. No one knew for sure, no mere mortal could; after all, the tornado, or cyclone as it was called on the plains, was an act of God, an Old Testament punishment for ill deeds or a test of faith. It was capricious and deadly, leaving the living to bear witness that the great wind came straight from heaven, or so it seemed.

April 9, 1947, sometimes seems like yesterday for Ramona Kolander. Not that she dwells on the day, but it's impossible to forget a day that turns your life upside down. Not even a day really, just a few seconds, and a life's course is altered forever.

"I never would have lived the life I lived without that tornado," she explained. It served as the demarcation in her life, the before and the after.

Ramona was a senior at Shattuck High School at the time. Shattuck was a frontier town in far northwestern Oklahoma, situated at the edge of no-man's-land and the Texas border. It was flat and empty, and the emerald fields that bowed with the winds would soon turn golden as harvest time approached. The Kolanders, like most of their neighbors, grew winter wheat, a difficult, fickle, and occasionally profitable occupation.

For Ramona, most of the day was unremarkable, passing pretty much as it had for the past eighteen years of her life. She remembered the morning as a little cloudy, cool, and damp. She rose at daybreak, dressed, had breakfast, and helped her little sister, LaNita, get ready for school, a monotonous routine that was about to change with her upcoming graduation. She expected she would get a job, probably marry, raise her own kids, and live her life in Shattuck, just as her parents had.

Three Kolander children—Ramona, Floyd, and LaNita—caught the yellow school bus for Shattuck. The baby of the family, four-year-old Doug, stayed at home. The school day became lost to memory, but surely there was some excitement as the class of '47 prepared for its dances, its final tests, and its ceremonies that would send them off into a confident postwar America. The Kolander siblings returned home at 5:00 p.m. Ramona stepped off the school bus and caught a glimpse of a "strange green hue" on the western horizon. She thought little of it.

In Oklahoma in the spring, the weather could be unpredictable. The wind blustered harder than usual. A musty odor, a mixture of rain and dust, rode on the air.

The Kolanders lived a few miles outside Shattuck in a white two-story house, a patchwork of adobe and wood frame. There was no electricity. They owned a battery-powered radio but used it sparingly. A giant water tank behind the home provided the family with its drinking water. And, of course, there was a windmill, its sullen metal vanes protesting at every turn with every gust.

There was always a breeze on the prairie. The wind really did come sweeping down the plains as Rogers and Hammerstein wrote in their 1943 musical *Oklahoma!* The inland plains, a great swath of smooth lowlands, etched its way from Canada to North Texas and through much of Oklahoma. The state was a study in topographical transitions. To the east, along the border with Arkansas and the Ozarks, the terrain was hilly, green, and forested. Moving westward, the land rolled gently, and the trees, mainly oaks, grew smaller and sparser. In central Oklahoma, the ground flattened and tilted imperceptibly toward the Rocky Mountains 700 miles farther west. Around Shattuck and far western Oklahoma, the few trees that remained huddled for survival near barely trickling streams, and the tough prairie grass and planted crops took over the leveled landscape. Only windmills, grain elevators, and clouds interrupted the expansive view.

About 140 million years ago, all this land was under the shallow, salty waters of an ocean with a peaceful name—the Sundance Sea. The Rocky Mountains were being heaved upward by smashing tectonic plates, and the Sundance Sea lapped at the mountain range's edge and carried away rich sediments from the Rockies as well as Appalachia and the Ozarks. The ancient sea, which covered the interior of the continent, evenly sifted those deposits like soft flour along its ocean floor as it retreated toward the Arctic. In its wake were the inland plains. The Great Plains encompassed much of the elevated flatlands through the Texas and Oklahoma panhandles. The vast middle of Oklahoma technically was part of the Osage Plains, which, until the pioneers arrived with their plows, was an immense sea of grassland stretching westward. Here, eventually, scientists would figure out how all this strange, Jurassic geography—the arid west of New Mexico, the Rockies in Colorado, and the plains from Texas to the Dakotas—provided an ideal staging ground for the fiercest thunderstorms on the planet.

As America neared the twentieth century, Oklahoma Territory was the last great frontier of unclaimed lands—unclaimed, that is, by white settlers. The federal government began giving away large tracts of the central and western prairie in 1889 in a series of land runs that brought thousands of people to the plains, and whole towns sprang up overnight. Those who jumped the gun, who tried to sneak on the prairie to claim their plots early, were called Sooners. In 1893, the government opened the largest parcel, the seven-million-acre Cherokee Outlet, for settlement. Campsites rose from the grassland. Homesteads, sodbusters,

cattle ranches, and railroads all followed. Woodward also sprang to life. Before the land run, Woodward served as a provisioning point for nearby Fort Supply, the U.S. Cavalry outpost that suppressed the last of the Plains Indians. With all the farmers crowding onto the prairie, Woodward began to grow as an agricultural trading post. Thirty miles to the southwest, Shattuck rose from the prairie. It was named for George Shattuck, director of the Santa Fe Railroad, a nod to the railway industry's importance. But the weather should have given the settlers pause. It was unbearably hot in the summer, bone-chillingly cold in the winter, and there was that constant wind.

The Kolanders and most of their neighbors were German. Ramona's grandfather emigrated from Germany to the Texas coast at the turn of the century, where he first tried his hand at rice farming. Soon he followed other Germans to western Oklahoma, where the soil was rich and the land cheap. Broom corn, a variety of sorghum, was the top crop, and Shattuck proclaimed itself the broom corn capital of the United States, back when brooms really were made of dried plant stalks. Her grandfather prospered enough to buy his own land, which he turned over to his son to farm. For the Kolanders, it would mean heartache.

The 1930s were the hottest, driest years on record. The buffalo grasses had held the rich sod to the earth for centuries, but over the decades, the sodbusters' plows upset a delicate balance. When the drought came, there was nothing to hold the soil. There were no crops, only spindly stalks aching for water. The topsoil left by the Sundance Sea simply became airborne. The wind swept the prairie clean, raking away the dirt until all that remained were the heavy, burnt-orange clay sediments.

Bankers, as happened in thousands of cases, seized the Kolander farm at the height of the Great Depression. The Dust Bowl affected the entire southern plains, but no other place came to symbolize the wrathful climate more than Oklahoma. The term *Okies* became the standard pejorative for all migrants who fled the dry plains in search of work and food. But the Kolanders toughed it out, moving to a smaller place and continuing to farm a reluctant land. For days on end, dust clung to the air. On April 14, 1935 -- Black Sunday—daylight turned to night in the middle of the afternoon. Visibility was zero. The dust boiled across the Texas panhandle and western Oklahoma, so blinding that people caught outdoors needed flashlights to find their way. Total darkness lasted for an hour before the dust eased ever so slightly and faint visibility returned. And those were the storms that Ramona grew up fearing—the great dust storms of the Dust Bowl.

The thunder clapped as the Kolanders finished their dinner. In the family room, Henry Kolander held his two youngest children, LaNita and Doug, on his lap and sang softly to them in German. The children played barbershop and fashioned their father's hair into odd shapes, laughing at the results. Ramona chatted with her brother Floyd, the topic now lost to memory. She remembered that her

mother, Stella, must have been doing chores because she rarely sat down after supper.

Lightning grew brighter, and thunder rattled the house. Still, no one was alarmed. “If God wants it to rain, it will,” Doug said as he kissed everyone good night. Ramona led him upstairs to bed, put him in his nightclothes, and began to read him a story.

Woodward was a straight but angled shot from Shattuck to the northeast along the Southern Kansas (Katy) Railroad. With 5,500 residents, it was one of the few towns in Oklahoma that did not lose population during the massive migration created by the Dust Bowl and the Depression. After World War II, Woodward’s niche as an agricultural trading hub grew along with postwar America’s economic boom.

In Woodward, war veteran Jim Feese prepared for a first date. That morning, he had delivered a refrigerator to a beauty shop and saw a pretty girl. He’d asked her to see a movie that night at the Woodward Theater. *Rage in Heaven* starred Ingrid Bergman and Robert Montgomery. It was a 1941 noir thriller, just making it to Oklahoma, about a psychotic husband who believes his wife is having an affair with his best friend. It was not the best first-date movie, but the only other option was *Hell on Wheels*. On Wednesday nights, the only entertainment options were prayer meetings or the movies. The theater was always packed; so were the churches. The Woodward, at 818 Main Street, was jammed with 300 people. Jim and Reva Valentine found two seats near the back.

The great wind offered no warning. Neither did the government weather bureau. The U.S. Weather Bureau had banned the word *tornado* from its forecasts and warnings a half-century earlier—no need to frighten people. They might have a heart attack and die or, perhaps worse, blame the Weather Bureau for inaccurate predictions.

High above the Texas Panhandle, rivers of opposing air, warm and cool, collided, and ugly gray cloud plumes soared toward the stratosphere. The storm took shape silently, without witnesses, and began to clatter and clang only as it surged upward into the atmosphere. As it took life, the storm began to inhale the prairie winds with such power that its miles-wide underbelly began to rotate, and the heavens opened. Lightning ricocheted across the clouds, and had anyone been watching, they might have seen the wrathful finger of God descending from heaven.

Concealed by heavy rain and large hail, the twister roared from the darkness. It started at White Deer, in the Texas Panhandle, at 5:52 p.m. The tornado was so powerful it blew nineteen boxcars from the Santa Fe Railroad tracks. It next hit the small Texas Panhandle town of Glazier, killing sixteen people, trapped in their homes or businesses, as it chewed the tiny downtown to pieces. A

newspaper reported Glazier was “turned to kindling” and “reduced to nothing more than a memory.”

The twister moved to Higgins, where it destroyed or damaged nearly every home in the town. Of Higgins’s 750 citizens, 51 of them died that night. Most were in a crushed movie theater that collapsed from the winds. The tornado ate the prickly sand sage to its roots, grabbed the barbed wire and telephone lines, and wrapped them into twisted strings strewn along the countryside. Glazier and Higgins became nothing but splinters that littered the barren landscape. Utility poles, railway signals, windmill towers, and trees snapped near ground level. From Higgins, the tornado, more likely one in a series of twisters, crossed the state line into Oklahoma.

The Kolanders never saw it coming, but they felt it. Ramona was reading to Doug when the house gave a sudden shudder. A second shudder shook the bed. “I think we’d better go downstairs,” Ramona told her little brother. She picked him up and headed toward the stairwell.

“The kerosene lamp was on a table by the door and I remembered thinking I should blow this out. I did and at that very moment the floor gave way under my feet and I was enveloped in blackness.” Whatever happened next, she did not recall.

The only area weather alarms were sounded by rural telephone supervisors calling each other. A nationwide telephone strike was under way, and many supervisors were filling in for the union employee positions. A telephone operator in Shattuck called a colleague in Woodward: “It’s storming out here. Are you-all all right?” Yes, they were fine, replied Grace Nix. An operator from Cestos, southeast of Woodward, called next: “There’s a black cloud over Woodward. It looks terrible.” Within minutes, the switchboard lights were ablaze with calls, and then nothing. A window in the telephone office burst, and tarpaper, shingles, broken glass, and pieces of an outdoor awning began flying into the room. Nix and assistant Bertha Wiggans took cover under a desk.

At the Woodward Theater, the sound went off midway through the movie. The theater crowd began chanting, clapping, and stomping their feet in protest. Jim took the opportunity to do the big, yawning stretch and put his arm around Reva. As he leaned in for a first kiss, the entire theater went black, and a tremendous roar from the winds outside drowned out the protests and rattled the building. There was a rush for the exits, but one man stood in the aisle and beseeched the people to stay put. They were safer inside the theater than outside on the street, he argued. The crowd settled down uneasily as the theater creaked and moaned from the wind.

At 8:42 p.m., the tornado, estimated at 1.8 miles wide, entered the western edge of Woodward and churned across its northern neighborhoods. It obliterated 100

blocks of houses, shops, power plants, a factory, a lumberyard. What the tornado didn't destroy, fire did. More than 1,000 homes were damaged or destroyed.

The Oklahoma Gas and Electric plant was located on Eighth Street, near downtown. While coworkers ran for shelter, Irwin Walker ran to the control room as the big wind tore through the city's edge. He threw the master switch into the "off" position, thereby cutting power to dangling power lines that otherwise could have sparked more fires and more deaths. Seconds later, the twister leveled the plant. Rescuers later found Walker's body under a pile of rubble.

After Ramona Kolander regained consciousness, she found herself standing in the yard. She was confused and tired, her entire body heavy with fatigue. She sat next to a mulberry tree and leaned her head against the trunk to nap. A constant "horrible moan" interrupted her. It did not stop. The lightning flashes lit her way around the yard, where she found Floyd and LaNita trying to lift an adobe wall off her father. The wall, an interior support from the home, pinned him to the ground from the chest down. It was too heavy for the children to budge.

"Have you seen your mother and little Doug?" he asked. No, she said. "They must be dead," he answered.

She and Floyd ran to the family car. The car and the water tank were still there, but everything else—the house, the barn, the garage—was gone. The splinters, nails, and glass tore at Floyd's bare feet. They fumbled for the car jack in the trunk. She put eight-year-old LaNita into the car's front seat for safekeeping. The two teens put the jack under the wall and pumped furiously on the handle. They tried to lift it themselves. It was useless. The adobe crumbled at the edges, and the wall still did not budge. Ramona's father told her to go get help. Caked in mud and blood and still in her nightclothes, she ran to the home of the closest neighbor, the Ehrlich family, a mile to the north.

She ran and ran and paused at a bridge over a small stream until a flash of lightning showed her the bridge was still there. The Ehrlichs' home had not been touched. Breathless and feeling faint, she pounded on their door begging for help. And then she collapsed. The Ehrlichs' telephone still worked, and they put out a call to neighbors. The rescue team quickly rallied to the Kolander farm, and the men lifted the wall pinning her father to the ground.

At her father's feet, under the same wall, was her mother. Except for a bruised lip, there were no marks on her body. Her neck had been broken. The men began tossing aside the remains of the Kolander home that were scattered about the yard. They lifted a door and found little Doug crushed to death.

Shattuck Hospital's first indication of catastrophe came from a Higgins farmer who wheeled his pickup to the emergency room door. The back of the truck was filled with wounded Texans. The Shattuck Fire Department and scores of

volunteers headed west toward Texas to aid Higgins, unaware of what was happening to the east, unaware that, like a locomotive, the tornado had followed the old Katy railway tracks from Shattuck to Woodward.

When Jim and Reva emerged from the dark theater, downtown was lit brightly by the flames destroying Sharp Lumber Yard and Big 7 Electric Co. He took her home, which had been spared by the twister, checked on his parents, and picked up his brother to join the rescue efforts.

The Stewart family lived on Eleventh Street in Woodward. They were lucky enough to have a basement, and that's where they hid as the twister marched through their neighborhood. Chuck Stewart was five years old at the time. After the tornado destroyed the house above them, his mother and sister boosted him out of a basement window. For a moment he was all alone, just him and the howls in the distance. "There were screams everywhere. We could hear people who had been injured screaming; it was dark and the street was covered with debris," Stewart recalled.

Immediate rescue efforts were ad hoc, neighbor helping neighbor. As the night wore on, Woodward residents formed five-man teams to walk through the hardest-hit neighborhoods calling out for survivors and digging by hand for the injured. The tornado had stripped the trees of their limbs and bark, snapping the trunks about six feet high. Rescuers left the dead in the streets; they couldn't take the time to move them. The people trapped under debris required their immediate attention.

The phone lines were down. The electricity was off. For a while, no one outside of the town knew of their tragedy.

An enterprising telephone lineman, L. L. Avrell, followed the downed telephone wires until he came to lines that were still intact. Avrell shimmied up the telephone pole with his tester phone and managed to reach an Oklahoma City telephone operator with a call for help. The Oklahoma Highway Patrol also radioed for assistance, and ambulances throughout western and central Oklahoma were on their way.

The Daily Oklahoman carried an early-edition front-page bulletin: "The Oklahoma Highway Patrol reported that Woodward, northwest of Oklahoma City with a population of 5,500, was hard hit by a tornado Wednesday night. Jim Holland, Highway Patrol trooper, called his headquarters here from Woodward to say that 'half the town has been blown away and that all possible aid—doctors, nurses and troopers—is needed.' Communications in this northwest section went out after his call, and other details still were lacking at 10:30 p.m."

As word spread, volunteers from nearby towns hopped in their trucks and headed to Woodward to help. Tinker Air Force Base, just outside Oklahoma City,

arranged a predawn flight of medical personnel and equipment to Woodward and Shattuck. The Katy Railroad dispatched a train to evacuate the injured from Woodward to hospitals in nearby towns.

The Woodward hospital was overwhelmed. Rescuers left the injured sprawled across the hospital lawn where the doctors and nurses triaged the most critical. When the hospital filled its beds, it moved the injured to the sanctuary at a Baptist church and finally ousted guests at a nearby hotel.

For many World War II vets, the scenes brought to mind the battlefields they had only recently left: the body-crushing, dismembering deaths; the screams of pain; and the pleas for help. The site of the hospital triage was as horrific as anything they had seen in battle. A transport from Tinker Air Force Base ferried some of the injured to Oklahoma City. General Fred Borum, the Tinker commander, surveyed the victims after they landed. During the war, Borum flew wounded Allied soldiers out of France. “I never saw anything worse overseas,” he told reporters.

A tornado batters and shreds the human body—not the twister actually, but all the things inside the wind funnel: gravel from the roads, utility poles, furniture, lumber from torn houses, and road signs all become swirling missiles bombarding the body.

Still covered with dirt and blood, Ramona awoke in a bright corridor of Shattuck Hospital, lying on the bare floor. Neighbors had driven her to the hospital, as they had her father. Scores of other bleeding, moaning tornado victims lay beside her, filling the hallway.

“I was in pain; I had several deep cuts and numerous hard blows to my head and body but no broken bones,” Ramona recalled. The eldest Kolander sister, Betty, married and living in Texas, was contacted by neighbors and rushed to the hospital trying to find her family. Betty overheard nurses discussing the injured in Ramona’s ward. They should be treated last, one nurse told another, because they were unlikely to live.

“When I did not die, they finally cleaned my cuts, stitched them up, and put me on a cot on the floor of the clinic with the other less seriously injured. The next day one of my classmates saw me but did not recognize me because of all the black and blue bruises on my swollen face.”

The Daily Oklahoman surveyed the Woodward destruction—the lots scraped clean, the trees turned to stumps, homes turned to scrap, the number of dead—and in the postwar hyperbole of the time called it the “Sooner Hiroshima.” The tornado, it said, was “nature’s atom bomb.”

The bomb as metaphor was still new. Yet the Oklahoma newspaper was not alone in noting a similarity.

The man destined to become the twentieth century's greatest meteorological detective knew the power of the bomb. It would teach Tetsuya Fujita many things about the nature of winds and the nature of luck. On August 9, 1945, the twenty-four-year-old college professor hurried calmly, along with Meiji College students and colleagues, toward an underground bunker next to the physics building. The air raid siren screamed an alert. A B-29 bomber dubbed *Bockscar* flew overhead, hidden by the clouds, one bomb clutched in its belly.

War defined Fujita's earliest years—not the sounds of air raid sirens that pierced the silence around Meiji College on August 9, 1945, but the government secrecy that blacked out area maps, banned weather statistics, and withheld all manner of scientific data that piqued Fujita's vivid imagination as a child and his quest to know the unknown, to see the invisible. He made his own observations, his own maps, and his own experiments, first with the ocean, then with the sky, and eventually with the weather.

Fujita grew up in Nakasone, a small village of 1,000 people on the island of Kyushu, the most southwestern link in the chain of large islands that makes up Japan. Green, soggy fields of rice surrounded the city, as did two active volcanoes. His father, Tomojiro, was an elementary school teacher, and the family lived comfortably in a home originally built by his grandfather. In kanji, the character "Tetsu" means philosophy and "ya" denotes a boy's name. His father gave him his name, Tetsuya, the philosopher. He took the name seriously. Nakasone was like any other small town. Visitors entered unlocked homes uninvited, with merely a "Mr. Fujita, I am here, where are you?" Customers charged their purchases at Nakasone stores and paid all debts by December 31 each year. On New Year's Day, people celebrated their birthdays. There was, at least in Fujita's memory, no sense of hardship in this small town so far from Tokyo.

Even as a child, Fujita had a precocious intellect. He was immensely curious, observant, and imaginative. He watched the rising and falling tide near his home, so he could run along an exposed sandbar to catch clams and shako fish. "At that time, I was interested in astronomy because the variation of the sea surface was closely related to the relative position of the sun and the moon." He was no ordinary elementary school student. Confident in his ideas, Fujita was unafraid to offer contrary opinions even when it brought him trouble.

On a school field trip as a teenager, he visited the Yabakei Rapid, where a Buddhist monk, Zenkai, spent thirty years digging, with only a hammer and chisel, a tunnel through a cliff over the rapids. Asked to express his admiration, Fujita suggested the monk should have spent fifteen years building a digging machine so that the tunnel could be completed in another fifteen years, thereby

leaving behind both a tunnel and a digging machine that could be used to build even more tunnels. “Unfortunately, I did not receive a passing grade because I failed to appreciate the monk’s spiritual accomplishment.”

Exploring and cartography were his hobbies. As a teenager, he mapped the contour lines of his school yard. He fashioned a telescope to track the spots on the sun. He and a teenage buddy discovered a limestone cave while climbing a hillside near his home. Carrying only survey chains and a flashlight, he mapped the entire cavern.

He wanted to attend Hiroshima College of High School Teachers, but his ailing father asked him to stay closer to home, to attend Meiji College of Technology. Meiji College specialized in mining, metallurgy, and mechanical engineering. Fujita opted for the last. His engineering emphasis was on the measurement of impact forces.

He also worked part time for a geology professor and was assigned the task of drafting topographic maps of four volcano craters on the island. “After working on his project for several months, my eyes began seeing contour maps as if they were three-dimensional mountains.” He considered changing his major to geology, but his father died in 1939 and his mother was ill. He didn’t want to be away from her for extended research trips. He also was not one for strenuous hiking or lugging interesting rocks.

His ability to envision three-dimensional forms led to a Japanese Navy contract on ways to detect U.S. aircraft. The mission involved the effect of the curvature of the Earth and weather on multiple searchlights and three-dimensional triangulations. The idea was to determine how the results could be used to locate U.S. warplanes through a new Japanese tool called a radio-locator, Japan’s term for radar. The U.S. radar was far more sophisticated and advanced.
Fujita would not have time to finish his project.

The war came to Japan’s home front in 1945. That spring, Fujita visited an old school friend in Tokyo. His visit coincided with a new American plan to force Japan’s surrender. More than 300 bombers ravaged the capital city for two days in March with a new type of bomb. The bombs carried napalm, an incendiary jelly that set sixteen square miles of the city ablaze. Within three hours, nearly 100,000 Tokyo residents died, the stench of their burned flesh settling over the island.

Fujita and his friend ran from the house as they heard the air raid sirens. They glimpsed fiery red skies to their southeast and heard the explosions growing ever closer as the B-29s dropped their bombs at will. “Early the next morning we walked around the neighborhood and found unexploded cylinders of incendiary bombs stuck deep into the gravel road near his house.”

He kept his emotions to himself and his mind on science. In his memoirs, he simply noted, “Several days later, while on the train from Tokyo back to Kyushu, I began to think about a mechanical/electrical analog computer operated by converting mechanical quantities into electrical signals.” He focused on his radar project. Surely the deaths weighed on Fujita as they did other Japanese. A U.S. invasion was obviously imminent, and Japan’s defeat at Okinawa provided the Americans with a staging area. But in its 2,000 years as a military force, Japan had never surrendered. Indeed, there was no word for *surrender* in its language. Until August 1945.

On August 6, the *Enola Gay* dropped the first atomic bomb on Hiroshima as the United States sought Japan’s unconditional surrender. An estimated 70,000 to 80,000 people died instantly from the fireball and blast wave. “We have spent two billion dollars on the greatest scientific gamble in history—and won,” President Truman told Americans. He again called for Japan to surrender: “If they do not now accept our terms they may expect a rain of ruin from the air, the likes of which has never been seen on this Earth.”

Three days later, Fujita, an assistant professor of physics at Meiji College, was hurrying toward a bunker on a cloudy morning. *Bockscar*, carrying a 10,000-pound atomic bomb, could not be seen or heard from the ground. The air raid sirens howled as the bomber passed repeatedly over the city, looking and waiting for a small break in the clouds.

“I clearly remember hearing a series of air raid sirens on the day of the bombing, but the aircraft was not visible due to a thick layer of stratus clouds.”
The B-29’s initial target was Kokura Arsenal, three miles from Meiji College. The bomb ferried by *Bockscar* was even bigger than the one dropped on Hiroshima. But the stratus clouds, those thick, heavy blankets of icy particles that block the sunlight and make for a dull, gray day, kept *Bockscar* from locating its primary target. The clouds spared Fujita. The bomber turned toward its secondary target, the port city of Nagasaki 135 miles away. An estimated 35,000 to 40,000 people died as the equivalent of 21,000 tons of TNT dropped onto the city. Japan surrendered unconditionally.

The unexploded Tokyo firebombs, obeying his father’s wishes to attend Meiji instead of Hiroshima College, the thick stratus clouds: luck provided Fujita the only shelter he needed.

A month later, he stood amid the devastation that had been Nagasaki and Hiroshima. The Japanese government sent teams of Meiji College engineers and students to study the bomb sites. Charred bodies still littered the hillsides. Radiation dusted the cities, and people were developing mysterious illnesses. Radiation sickness was a surprising by-product of an atomic explosion. “Do not sit on or touch anything in the bomb area,” Fujita advised his students. Some of them nevertheless became ill.

At Nagasaki, Fujita used his expertise on impact forces to help determine the exact location of the explosion. He intended to use the same principle for triangulating radar beams to determine the flash point of the explosion, but the massive devastation left him with few objects from which to plot the angles of the shock wave. Walking around a cemetery, Fujita found a bamboo flower pot with a crescent-shaped burn mark on the inside lip. He scurried to other cemeteries surrounding the city. The flower pots all had the same burn marks. He used these flower pot shadows to angle back to ground zero. His theory was that the bomb had exploded 520 meters above Nagasaki. Using the same technique, he estimated Hiroshima's explosion at 530 meters. Both estimates were close. The bombs detonated in the air, not on contact with the ground. He surmised the United States knew the air pressure at each city, which it did, triggering the explosions above the surface.

At both bomb sites, Fujita noticed a giant starburst pattern directly beneath the explosions. The trees at Nagasaki were burned but still standing directly beneath the explosion. Likewise, a bridge that had been *Enola Gay*'s target still stood. The outburst from the bombs flattened bamboo, pine trees, and steel poles in a circular pattern away from ground zero. He envisioned the explosion, the great white blinding ball of fire and an incredible whoosh of winds that fell to the Earth and spread outward in all directions.

This Nagasaki starburst pattern intrigued him, even more so when he saw the pattern repeated years later in the middle of the United States after a thunderstorm.

For Fujita, the worst days were after the war. Inflation soared by more than 200 percent. Rice became so expensive that the college professor could barely afford it. Meiji College even offered "resting days" so that famished staff members could conserve their energy.

"My daily life under the postwar inflation was miserable." He turned to weather not out of a great love of the science, although it became that, but as a secondary income source. In 1946, he received a grant to reeducate grade school teachers in any science topic. He chose weather science because it could be studied cheaply. All he needed was a pencil and paper and his immense powers of observation.

He collected daily weather data—wind speed, temperature, air pressure, and humidity—to prepare a monthly booklet for schoolteachers. In the spring of 1947, Fujita learned silk-screening in order to meet the teachers' demands for color weather maps. His cartography skills dazzled the teachers.

While collecting weather statistics, Fujita became interested in thunderstorms—their power, their lightning, and their mystifying mechanics.

The mere clap of thunder sent him scurrying to the rooftop of his boyhood home, armed with his notebook and pencil. One evening, Fujita recorded the direction of lightning and the time between the flash and the thunder for the next ninety minutes. He charted the location of thirty-three lightning strikes on a map of the island as the storm moved northeasterly toward the seashore, determined their grouping, and suggested that each of three identifiable groups represented the heart of the thunderstorm.

Money was scarce in postwar Japan, and there certainly was none to spare for scientific research. Yet there was plenty of *kagakusuru kokoro*—a spirit of pursuing science. No one had that spirit more than Fujita. He cajoled, recruited, and enticed an army of volunteers from his students, their friends, and their relatives. A solar eclipse over the island presented an opportunity to study the effect of the eclipse on wind and temperature. And Fujita the organizer amassed his first armada of observers, a plan he would use repeatedly in the years to come.

As the solar eclipse approached, Fujita deployed his volunteers to forty-six observation stations and assigned them the task of recording weather observations in fifteen-minute intervals for eight hours. Their only tools were thermometers, barometers, and handmade wind socks. Three eager students volunteered to scale the Japanese Broadcasting Association transmission tower at one-, thirty-, and fifty-meter intervals to track the vertical winds.
The volunteers' observations allowed Fujita to illustrate numerous charts and graphics on the wind and temperature changes. For the volunteers, it was all for fun, perhaps a nice diversion from postwar miseries. Regardless, the scientific recruits donated their own time and effort. It made for a nice scientific project, but Fujita wanted more.

He wanted to feel the winds.

A hot August day in 1947 appeared promising for a storm. He trekked up a steep slope to Seburiyama Mountain's 3,400-foot peak, where Japan had a weather station and the U.S. Air Force had recently installed a radar center. He initially planned to observe the storm in its elements, but lightning persuaded him to seek the safety of the weather office. From the rickety, leaky weather hut, Fujita recorded as many data as possible: wind speed and direction, temperatures, dew points, and air pressure. He later gathered similar information from thirty other weather stations. His only tools were pencil and paper and his own senses. Fujita sketched a series of time-lapse drawings of the thunderstorm—its height, its winds, the rain and lightning.

What Fujita learned from this one trip to the mountaintop was that thunderstorms spewed cool downdrafts off their backsides while sucking in warm updrafts. The years have dimmed the origin of this "cool downdraft" discovery, but a half-century later, this cool downdraft would prove critical to tornado formation.

Fujita's first research paper, "Raiu-no-hana" (Thunder-Nose), elicited little response from Japanese scientists. Months later, Fujita made a presentation to the Fukuoka Weather Service District, from which he had observed the Seburiyama thunderstorm. He received a warmer reception from the field forecasters—and he received a gift that changed his life.

After the session, a weather service employee told him of fishing a copy of "Nonfrontal Thunderstorms" from the garbage dumped by the nearby U.S. Air Force radar base. The research paper was written by a University of Chicago professor named Horace Byers. Would he like to have it? the employee asked. Fujita—the scientist, the theoretician, the engineer—had only one explanation for the discovery of Byers's report: pure luck.

Fujita borrowed cash from the mother of one of his college students and bought an English-language typewriter. He translated his own "Thunder-Nose" research paper, pecking with one finger at a time, and mailed the paper to Byers, seeking his opinion and comment. In Byers, he sensed a kindred soul, a scientist as interested in the powers and mystery of the thunderstorm. He waited anxiously for a response from the Chicago scientist.

His father always said nothing in this world remains unchanged. "Look up at the full moon in the sky," his father told him. "It will have to turn into a new moon." For the world of meteorology, a new moon was at hand. One nearsighted Japanese immigrant with a preternatural ability to imagine the invisible was about to turn his formidable skills toward nature's most powerful storms.

Saturday, three days after the tornado, Woodward began burying the victims. The weather again tormented the dead and the living. The skies grew dark gray, and the rain poured steadily all day, occasionally turning to sleet and snow just to add to the misery. At the cemetery, volunteers clawed through the mud with shovels, working from dusk to dawn in freezing rain to dig enough holes for all the dead.

The two Woodward funeral homes each held a funeral every hour on the hour for the entire day. The schedule repeated daily, until a few of the least damaged churches were repaired and hosted funerals for their parishioners. A constant parade of hearses and ambulances ferried the dead to their final resting place. Tractors had to pull some of the hearses through the muck. The first to be buried were two boys, the only children of Mr. and Mrs. H. C. Harper. Roy Lee was four and his brother H. C., Jr., just two months old. The Salvation Army's state commander presided over the graveside ceremony. One body, a baby girl, was never identified and was buried beneath a headstone that merely listed her as "unknown victim." One four-year-old girl simply disappeared, never to be found or buried.

Officially the toll stood at 181 in three states, with 107 from Woodward. It took weeks to find and count them all. Thirty horsemen rode up and down the banks of the North Canadian River outside Woodward in search of missing people. The Salvation Army and Red Cross kept a casualty list. Much of Woodward was in shambles. Artillery units from Fort Sill, outside Lawton in southwestern Oklahoma, pitched tents for the homeless and set up a field kitchen for the hungry. H. E. Bailey, the state transportation director, brought in equipment to help clear the roads and clean up the tons of trash.

For the state disaster organizations, it was a familiar drill. Tornadoes were a fact of life, though never as devastating as the Woodward tragedy. Two years earlier, a twister had killed sixty-nine people in the small town of Antlers. In '42, two massive tornadoes, occurring two months apart, claimed fifty-two people in the small eastern Oklahoma town of Pryor and thirty-five in Oklahoma City. There were ninety-seven killed in Snyder in 1905 and seventy-one in Peggs in 1920, both tiny communities that lost a substantial percentage of their populations.

But Woodward was the state's worst. A generation of Oklahomans grew up recalling the Woodward twister. People gathered on front porches on humid spring days and told stories about the horror, the deaths, and the survivors. As a boy, Gary England, who would become Oklahoma's premier television weatherman, would be spellbound by these tales: A large truck never found. Clothes ripped off victims by the wind. A naked body wrapped around a utility pole.

He and his family were living near Woodward at the time. He remembers the setting sun tinting the sky on April 9, 1947. The sky appeared so unusual that England's family and neighbors gathered at a nearby school yard to stare in wonder at the clouds on the western horizon. Gary recalled that the skies, from his vantage point, "looked like fuzzy, pink egg cartons floating gently across a darkening sky." To meteorologists, as Gary later learned, these clouds were called mammutus clouds, and they indicated a large thunderstorm nearby. His father made the first weather forecast Gary remembers hearing: "Somewhere tonight, there's going to be a bad tornado." He was right.

The 1947 tornado ranked sixth among the nation's top ten deadliest twisters. From 1900 through 1940, these explosive by-products of thunderstorms claimed more than 8,700 American lives. Still, the U.S. Weather Bureau officially remained silent. There would be no tornado forecasts; the bureau wasn't even sure if forecasts were possible.

But 1947 was an unusually deadly year for tornadoes nationwide. According to the U.S. Weather Bureau, forerunner to the National Weather Service, 161 tornadoes across the country killed 306 people, one-third of them from Woodward's lone funnel.

The Woodward twister would be the first of a series of deadly postwar tornadoes to kill 100 or more people. Still, Weather Bureau forecasters, on orders from Washington, would not issue tornado forecasts or warnings. The United States had just won a global war, unlocked the secrets of the atom, and was the major military power in the world—but it would not utter the word *tornado*.

At most, local officials might warn of “severe local storms.” No field forecasters dared use the word *tornado* for fear of inciting not just panic but their supervisors. For the most part, the residents of the Great Plains had to rely on their own common sense, their own eyes, and their own luck.

They buried Ramona’s mother and brother in the same casket. Her father told her that as the storm grew stronger, he and her mother had leaped from their chairs. “Those kids are upstairs,” were her last words. She was ahead of him, rushing toward the staircase, when a wall collapsed on them. The door that crushed Doug broke “nearly every bone in his tiny body.”

The Kolanders, like many other rural families, had an underground cellar where they kept canned vegetables and supplies, and they had the radio, though no weather bulletin was issued. The cellar also served as storm shelter. They could have made it to safety; her mother and brother could have been saved, and her life would have been so different.

If only, said Ramona, they had been warned.