# THE CONTROL OF NATURE

## LOS ANGELES AGAINST THE MOUNTAINS—I



IN Los Angeles versus the San Gabriel Mountains, it is not always clear which side is losing. For example, the Genofiles, Bob and Jackie, can claim to have lost and won. They live on an acre of ground so high that they look across their pool and past the trunks of big pines at an aerial view over Glendale and across Los Angeles to the Pacific bays. The setting, in cool dry air, is serene and Mediterranean. It has not been everlastingly serene.

On a February night some years ago, the Genofiles were awakened by a crash of thunder—lightning striking the mountain front. Ordinarily, in their quiet neighborhood, only the creek beside them was likely to make much sound, dropping steeply out of Shields Canyon on its way to the Los Angeles River. The creek, like every component of all the river systems across the city from mountains to ocean, had not been left to nature. Its banks were concrete. Its bed was concrete. When boulders were running there, they sounded like a rolling freight. On a night like this, the boulders should have been running. The creek should have been a torrent. Its unnatural sound was unnaturally absent. There was, and had been, a lot of rain.

The Genofiles had two teen-age children, whose rooms were on the uphill side of the one-story house. The window in Scott's room looked straight up Pine Cone Road, a cul-de-sac, which, with hundreds like it, defined the northern limit of the city, the confrontation of the urban and the wild. Los Angeles is overmatched on one side by the Pacific Ocean and on the other by very high mountains. With respect to these principal boundaries, Los Angeles is done sprawling. The San Gabriels, in their state of tectonic youth, are rising as rapidly as any range on earth. Their loose inimical slopes flout the tolerance of the angle of repose. Rising straight up out of the megalopolis, they stand ten thousand feet above the nearby sea, and they are not kidding with this city. Shedding, spalling, self-destructing, they are disintegrating at a rate that is also among the fastest in the world. The phalanxed communities of Los Angeles have pushed themselves hard against these mountains, an aggression that requires a deep defense budget to contend with the results. Kimberlee Genofile called to her mother, who joined her in Scott's room as they looked up the street. From its high turnaround, Pine Cone Road plunges downhill like a ski run, bending left and then right and then left and then right in steep christiania turns for half a mile above a three-hundred-foot straightaway that aims directly at the Genofiles' house. Not far below the turnaround, Shields Creek passes under the street, and there a kink in its concrete profile had been plugged by mud and a six-foot boulder. Hence the silence of the creek. The water was now spreading over the street. It descended in heavy sheets. As the young Genofiles and their mother glimpsed it in the all but total darkness, the scene was suddenly illuminated by a blue electrical flash. In the blue light they saw a massive blackness, moving. It was not a landslide, not a mudslide, not a rock avalanche; nor by any means was it the front of a conventional flood. In Jackie's words, "It was just one big black thing coming at us, rolling, rolling with a lot of water in front of it, pushing the water, this big black thing. It was just one big black hill coming toward us."

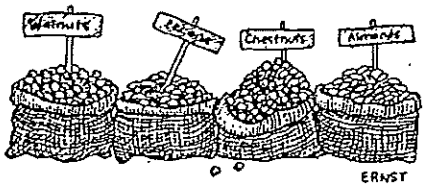
In geology, it would be known as a debris flow. Debris flows amass in stream valleys and more or less resemble fresh concrete. They consist of water mixed with a good deal of solid material, most of which is above sand size. Some of it is Chevrolet size. Boulders bigger than cars ride long distances in debris flows. Boulders grouped like fish eggs pour downhill in debris flows. The dark material coming toward the Genofiles was not only full of boulders; it was so full of automobiles it was like bread dough mixed with raisins. On its way down Pine Cone Road, it plucked up cars

from driveways and the street. When it crashed into the Genofiles' house, the shattering of safety glass made terrific explosive sounds. A door burst open. Mud and boulders poured into the hall. We're going to go, Jackie thought. Oh, my God, what a hell of a way for the four of us to die together.

The parents' bedroom was on the far side of the house. Bob Genofile was in there kicking through white satin draperies at the panelled glass, smashing it to provide an outlet for water, when the three others ran in to join him. The walls of the house neither moved nor shook. As a general contractor, Bob had built dams, department stores, hospitals, six schools, seven churches, and this house. It was made of concrete block with steel reinforcement, sixteen inches on center. His wife had said it was stronger than any dam in California. His crew had called it "the fort." In those days, twenty years before, the Genofiles' acre was close by the edge of the mountain brush, but a developer had come along since then and knocked down thousands of trees and put Pine Cone Road up the slope. Now Bob Genofile was thinking, I hope the roof holds. I hope the roof is strong enough to hold. Debris was flowing over it. He told Scott to shut the bedroom door. No sooner was the door closed than it was battered down and fell into the room. Mud, rock, water poured in. It pushed everybody against the far wall. "Jump on the bed," Bob said. The bed began to rise. Kneeling on it—on a gold velvet spread—they could soon press their palms against the ceiling. The bed also moved toward the glass wall. The two teen-agers got off, to try to control the motion, and were pinned between the bed's brass railing and the wall. Boulders went up against the railing, pressed it into their legs, and held them fast. Bob dived into the muck to try to move the boulders, but he failed. The debris flow, entering through windows as well as doors, continued to rise. Escape was still possible for the parents but not for the children. The parents looked at each other and did not stir. Each reached for and held one of the children. Their mother felt suddenly resigned, sure that her son and daughter would die and she and her husband would quickly follow. The house became buried to the eaves. Boulders sat on the roof. Thirteen automobiles were packed around the building, including five in the pool. A din of rocks kept banging against them. The stuck horn of a buried car was blaring. The family in the darkness in their fixed tableau watched one another by the light of a directional signal, endlessly blinking. The house had filled up in six minutes, and the mud stopped rising near the children's chins.

STORIES like that do not always have such happy endings. A man went outside to pick up his newspaper one morning, heard a sound, turned, and died of a heart attack as he saw his house crushed to pieces with his wife and two children inside. People have been buried alive in their beds. But such cases are infrequent. Debris flows generally are much less destructive of life than of property. People get out of the way.

If they try to escape by automobile, they have made an obvious but imperfect choice. Norman Reid backed his Pontiac into the street one January morning and was caught from behind by rock porridge. It embedded the car to the chrome strips. Fifty years of archival news photographs show cars of every vintage standing like hippos in chunky muck. The upper halves of their headlights peep above the surface. The late Roland Case Ross, an emeritus professor at California State University, told me of a day in the early thirties when he watched a couple rushing to escape by car. She got in first. While her husband was going around to get in his side, she got out and ran into the house for more silverware. When the car at last putt-putted downhill, a wall of debris was nudging the bumper. The debris stayed on the vehicle's heels all the way to Foothill Boulevard, where the car turned left.




Foothill Boulevard was U.S. Route 66—the western end of the rainbow. Through Glendora, Azusa, Pasadena, it paralleled the mountain front. It strung the metropolitan border towns. And it brought in emigrants to fill them up. The real-estate line of maximum advance now averages more than a mile above Foothill, but Foothill receives its share of rocks. A debris

## CHINA JOURNAL

North wind like a fine drill
sky Ming porcelain for a thousand miles
The danger of what's-to-come is not in its distance
Two inches can break the heart
(*Great Wall*)

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Halfway to Chengdu; past noon.
Against the brown riprap and scree grass
Two peach trees in blossom,
speechless from daybreak till now.
(*Jialing River*)

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Sky color of old steam
the power that moves what moves
Moves as the Buddha moves unmoving
great river goes eastward
(*Leshan*)

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The emperor's men are dust-red from eternity,
Quince tree pale cinnabar in the field.
Invisible as dewdrops in the afterlife, time thumbs us,
Not lightly here, but not lightly there.
(*Xi'an*)
—CHARLES WRIGHT

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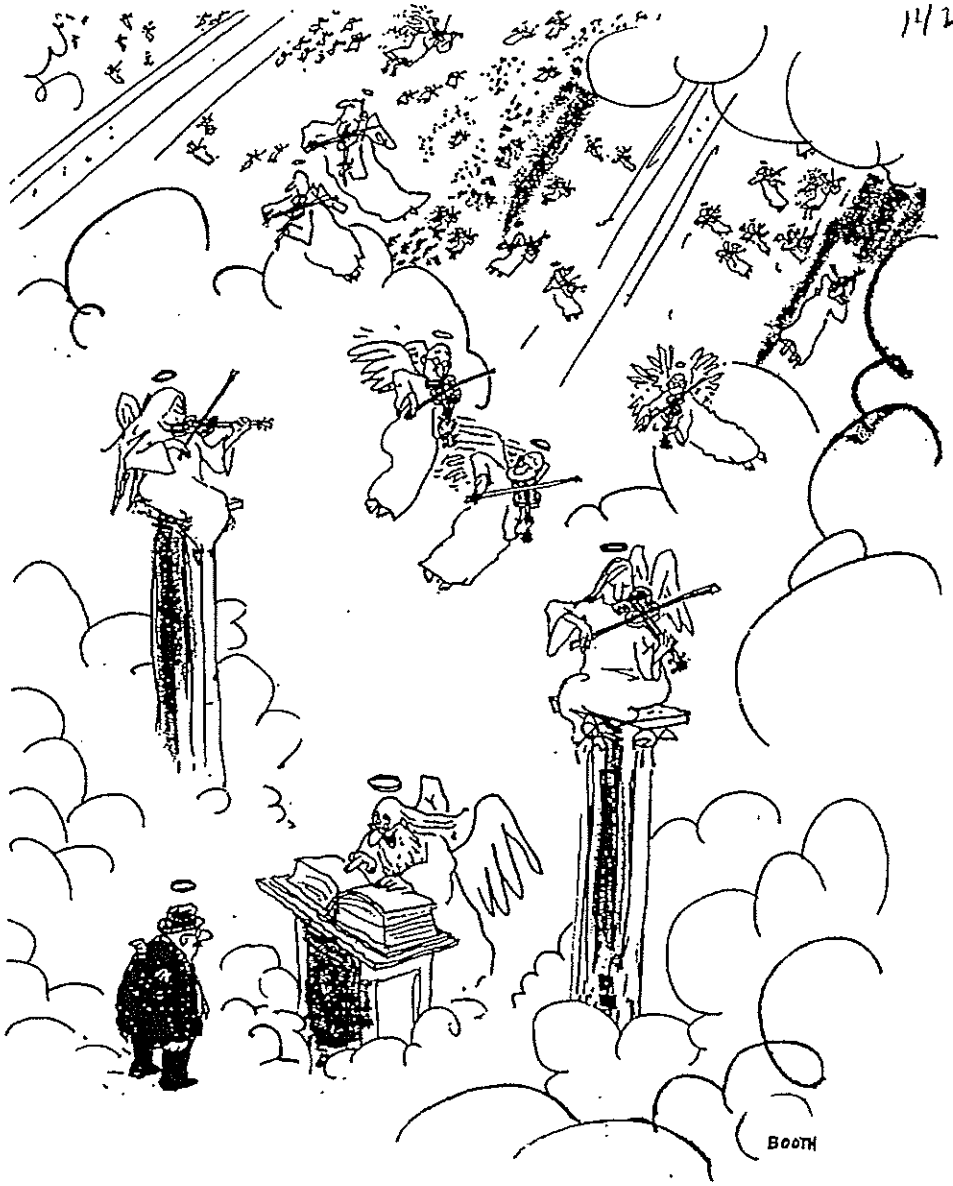
flow that passed through the Monrovia Nursery went on to Foothill and beyond. With its twenty million plants in twelve hundred varieties, Monrovia was the foremost container nursery in the world, and in its recovery has remained so. The debris flow went through the place picking up pots and cans. It got into a greenhouse two hundred feet long and smashed out the southern wall, taking bougainvillea and hibiscus with it. Arby's, below Foothill, blamed the nursery for damages, citing the hibiscus that had come with the rocks. Arby's sought compensation, but no one was buying beef that thin.

In the same storm, large tree trunks rode in the debris like javelins and broke through the sides of houses. Automobiles went in through picture windows. A debris flow hit the gym at Azusa Pacific College and knocked a large hole in the upslope wall. In the words of Cliff Hamlow, the basketball coach, "If we'd had students in there, it would have killed them. Someone said it sounded like the roar of a jet engine. It filled the gym up with mud, and with boulders two and three feet in diameter. It went out through the south doors and spread all over the football field and track. Chain-link fencing was sheared off—like it had been cut with a welder. The place looked like a war zone." Azusa Pacific College wins national championships in track, but Coach Hamlow's basketball team (12–18) can't get the boulders out of its game.

When a debris flow went through the Verdugo Hills Cemetery, which is up a couple of switchbacks on the mountain front, two of the central figures there, resting under impressive stones, were "Hiram F. Hatch, 1st Lieut. 6th Mich. Inf., December 24, 1843–October 12, 1922," and "Henry J. Hatch, Brigadier General, United States Army, April 28, 1869–December 31, 1931." The two Hatches held the hill while many of their comrades slid below. In all, thirty-five coffins came out of the cemetery and took off for lower ground. They went down Hillrose Street and were scattered over half a mile. One came to rest in the parking lot of a supermarket. Many were reburied by debris and, in various people's yards, were not immediately found. Three turned up in one yard. Don Sulots, who had moved into the fallout path two months before, said,




*"Malcolm W. Dunlap, violin repairs. Malcolm, we are so pleased to see you."*

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"It sounded like thunder. By the time I made it to the front door and got it open, the muck was already three feet high. It's quite a way to start off life in a new home—mud, rocks, and bodies all around."

Most people along the mountain front are about as mindful of debris flows as those corpses were. Here today, gone tomorrow. Those who worry build barricades. They build things called deflection walls—a practice that raises legal antennae and, when the caroming debris breaks into the home of a neighbor, probes the wisdom of Robert Frost. At least one family has experienced so many debris flows coming through their back yard that they long ago installed overhead doors in the rear end of their built-in garage. To guide the flows, they put deflection walls in their back yard. Now when the boulders come they open both ends of their garage, and the debris goes through to the street.

Between Harrow Canyon and Englewild Canyon, a private street called Glencoe Heights teased the mountain front. Came a time of unprecedented rain, and the neighborhood grew ever more fearful—became in fact so infused with catastrophic anticipation that it sought the drastic sort of action that only a bulldozer could provide. A


fire had swept the mountainsides, leaving them vulnerable, dark, and bare. Expecting floods of mud and rock, people had piled sandbags and built heavy wooden walls. Their anxiety was continuous for many months. "This threat is on your mind all the time," Gary Lukehart said. "Every time you leave the house, you stop and put up another sandbag, and you just hope everything will be all right when you get back." Lukehart was accustomed to losing in Los Angeles. In the 1957 Rose Bowl, he was Oregon State's quarterback. A private street could not call upon city or county for the use of heavy equipment, so in the dead of night, as steady rain was falling, a call was put in to John McCafferty—bulldozer for hire. McCafferty had a closeup knowledge of the dynamics of debris flows: he had worked the mountain front from San Dimas to Sierra Madre, which to him is Sarah Modri. ("In those canyons at night, you could hear them big boulders comin'. They sounded like thunder.") He arrived at Glencoe Heights within the hour and set about turning the middle of the street into the Grand Canal of Venice. His Cat was actually not a simple dozer but a 955 loader on tracks, with a two-and-a-quarter-yard bucket seven feet wide. Cutting water mains, gas mains, and sewers, he made a ditch that eventually extended five hundred feet and was deep enough to take in three thousand tons of debris. After working for five hours, he happened to be by John Caufield's place ("It had quit rainin', it looked like the worst was over") when Caufield came out and said, "Mac, you sure have saved my bacon."

McCafferty continues, "All of a sudden, we looked up at the mountains —it's not too far from his house to the mountains, maybe a hundred and fifty feet—and we could just see it all comin'. It seemed the whole mountain had come loose. It flowed like cement." In the ditch, he put the Cat in reverse and backed away from the oncoming debris. He backed three hundred feet. He went up one side of the ditch and was about halfway out of it when the mud and boulders caught the Cat and covered it over the hood. In the cab, the mud pushed against McCafferty's legs. At the same time, debris broke into Caufield's house through the front door and the dining-room window, and in five minutes filled it to the eaves.

Other houses were destroyed as well. A garage left the neighborhood with a car in it. One house was buried twice. (After McCafferty dug it out, it was covered again.) His ditch, however, was effective, and saved many places on slightly higher ground, among them Gary Lukehart's and the home of John Marcellino, the chief executive officer of Mackinac Island Fudge. McCafferty was promised a lifetime supply of fudge. He was on the scene for several days, and in one span worked twenty-four hours without a break. The people of the street brought him chocolate milkshakes. He had left his lowbed parked around the corner. When at last he returned to it and prepared to go home, he discovered that a cop had given him a ticket.

A Metropolis that exists in a semidesert, imports water three hundred miles, has inveterate flash floods, is at the grinding edges of two tectonic plates, and has a microclimate tenacious of noxious oxides will have its priorities among the aspects of its environment that it attempts to control. For example, Los Angeles makes money catching water. In a few days in 1983, it caught twenty-eight million dollars' worth of water. In one period of twenty-four hours, however, the ocean hit the city with twenty-foot waves, a tornado made its own freeway, debris flows poured from the San Gabriel front, and an earthquake shook the region. Nature's invoice was forty million dollars. Later, twenty million more was spent dealing with the mountain debris.

There were those who would be quick—and correct—in saying that were it not for the alert unflinching manner and imaginative strategies by which Los Angeles outwits the mountains, nature's invoices at such times would run into the billions. The rear-

guard defenses are spread throughout the city and include more than two thousand miles of underground conduits and concrete-lined open stream channels—a web of engineering that does not so much reinforce as replace the natural river systems. The front line of battle is where the people meet the mountains—up the steep slopes where the subdivisions stop and the brush begins.

Strung out along the San Gabriel front are at least a hundred and twenty bowl-shaped excavations that resemble football stadiums and are often as large. Years ago, when a big storm left back yards and boulevards five feet deep in scree, one neighborhood came through amazingly unscathed, because it happened to surround a gravel pit that had filled up instead. A tungsten filament went on somewhere above Los Angeles. The county began digging pits to catch debris. They were quarries, in a sense, but exceedingly bizarre quarries, in that the rock was meant to come to them. They are known as debris basins. Blocked at their downstream ends with earthfill or concrete constructions, they are also known as debris dams. With clean spillways and empty reservoirs, they stand ready to capture rivers of boulders—these deep dry craters, lying close above the properties they protect. In the overflowing abundance of urban nomenclature, the individual names of such basins are obscure, until a day when they appear in a headline in the Los Angeles *Times:* Harrow, Englewild, Zachau, Dunsmuir, Shields, Big Dalton, Hog, Hook East, Hook West, Limekiln, Starfall, Sawpit, Santa Anita. For fifty miles, they mark the wild boundary like bulbs beside a mirror. Behind chain links, their idle ovate forms more than suggest defense. They are separated, on the average, by seven hundred yards. In aggregate, they are worth hundreds of millions of dollars. All this to keep the mountains from falling on Johnny Carson.

The principal agency that developed the debris basins was the hopefully named Los Angeles County Flood Control District, known familiarly through the region as Flood Control, and even more intimately as Flood. ("When I was at Flood, one of our dams filled with debris overnight," a former employee remarked to me. "If any more rain came, we were going to have to evacuate the whole of Pasadena.") There has been a semantic readjustment, obviously intended to acknowledge that when a flood pours out of the mountains it might be half rock. The debris basins are now in the charge of the newly titled Sedimentation Section of the Hydraulic Division of the Los Angeles County Department of Public Works. People still call it Flood. By whatever name the agency is called, its essential tactic remains unaltered. This was summarized for me in a few words by an engineer named Donald Nichols, who pointed out that eight million people live below the mountains on the urban coastal plain, within an area large enough to accommodate Philadelphia, Detroit, Chicago, St. Louis, Boston, and New York. He said, "To make the area inhabitable, you had to put in lined channels on the plain and halt the debris at the front. If you don't take it out at the front, it will come out in the plain, filling up channels. A filled channel won't carry diddly-boo."

To stabilize mountain streambeds and stop descending rocks even before they reach the debris basins, numerous crib structures (barriers made of concrete slats) have been emplaced in high canyons—the idea being to convert plunging streams into boulder staircases, and hypothetically cause erosion to work against itself. Farther into the mountains, a dozen dams of some magnitude were built in the nineteen-twenties and thirties to control floods and conserve water. Because they are in the San Gabriels, they inadvertently trap large volumes of debris. One of them —the San Gabriel Dam, in the San Gabriel River—was actually built as a debris-control structure. Its reservoir, which is regularly cleaned out, contains, at the moment, twenty million tons of mountain.

The San Gabriel River, the Los Angeles River, and the Big Tujunga (Bigta Hung-ga) are the principal streams that enter the urban plain, where a channel that filled with rock wouldn't carry diddly-boo. Three colossal debris basins—as different in style as in magnitude from those on the mountain front—have been constructed on the plain to greet these rivers. Where the San Gabriel goes

past Azusa on its way to Alamitos Bay, the Army Corps of Engineers completed in the late nineteen-forties a dam ninety-two feet high and twenty-four thousand feet wide—this to stop a river that is often dry, and trickles most of the year. Santa Fe Dam, as it is called, gives up at a glance its own story, for it is made of boulders that are shaped like potatoes and are generally the size of watermelons. They imply a large volume of water flowing with high energy. They are stream-propelled, stream-rounded boulders, and the San Gabriel is the stream. In Santa Fe Basin, behind the dam, the dry bed of the San Gabriel is half a mile wide. The boulder-strewn basin in its entirety is four times as wide as that. It occupies eighteen hundred acres in all, nearly three square miles, of what would be prime real estate were it not for the recurrent arrival of rocks. The scene could have been radioed home from Mars, whose cobbly face is in part the result of debris flows dating to a time when Mars had surface water.

The equally vast Sepulveda Basin is where Los Angeles receives and restrains the Los Angeles River. In Sepulveda Basin are three golf courses, which lend ample support to the widespread notion that everything in Los Angeles is disposable. Advancing this national prejudice even further, debris flows, mudslides, and related phenomena have "provided literary minds with a ready-made metaphor of the alleged moral decay of Los Angeles." The words belong to Reyner Banham, late professor of the history of architecture at University College, London, whose passionate love of Los Angeles left him without visible peers. The decay was only "alleged," he said. Of such nonsense he was having none. With his "Los Angeles: The Architecture of Four Ecologies," Banham had become to this deprecated, defamed, traduced, and disparaged metropolis what Pericles was to Athens. Banham knew why the basins were there and what the people were defending. While all those neurasthenic literary minds are cowering somewhere in ethical crawl space, the quality of Los Angeles life rises up the mountain front. There is air there. Cool is the evening under the crumbling peaks. Cool descending air. Clean air. Air with a view. "The financial and topographical contours correspond almost exactly," Banham said. Among those "narrow, tortuous

residential roads serving precipitous house-plots that often back up directly on unimproved wilderness" is "the fat life of the delectable mountains."

People of Gardena, Inglewood, and Watts no less than Azusa and Altadena pay for the defense of the mountain front, the rationale being that debris trapped near its source will not move down and choke the channels of the inner city, causing urban floods. The political City of Los Angeles—in its vague and tentacular configuration—actually abuts the San Gabriels for twenty miles or so, in much the way that it extends to touch the ocean in widely separated places like Venice, San Pedro, and Pacific Palisades. Los Angeles County reaches across the mountains and far into the Mojave Desert. The words "Los Angeles" as generally used here refer neither to the political city nor to the county but to the multinamed urban integrity that has a street in it seventy miles long (Sepulveda Boulevard) and, from the Pacific Ocean at least to Pomona, moves north against the mountains as a comprehensive town.

The debris basins vary greatly in size—not, of course, in relation to the populations they defend but in relation to the watersheds and washes above them in the mountains. For the most part, they are associated with small catchments, and the excavated basins are commensurately modest, with capacities under a hundred thousand cubic yards. In a typical empty reservoir—whatever its over-all dimensions may be—stands a columnar tower that resembles a campanile. Full of holes, it is known as a perforated riser. As the basin fills with a thick-flowing slurry of water, mud, and rock, the water goes into the tower and is drawn off below. The county calls this water harvesting.

Like the freeways, the debris-control system ordinarily functions but occasionally jams. When the Genofiles' swimming pool filled with cars, debris flows descended into other neighborhoods along that part of the front. One hit a culvert, plugged the culvert, crossed a road in a bouldery wave, flattened fences, filled a debris basin, went over the spillway, and spread among houses lying below, shoving them off their foundations. The debris basins have caught as much as six hundred thousand cubic yards in one storm. Over time, they have trapped some twenty million tons of mud and rock. Inevitably, sometimes something gets away.

At Devils Gate—just above the Rose Bowl, in Pasadena—a dam was built in 1920 with control of water its only objective. Yet its reservoir, with a surface of more than a hundred acres, has filled to the brim with four million tons of rock, gravel, and sand. A private operator has set up a sand-and-gravel quarry in the reservoir. Almost exactly, he takes out what the mountains put in. As one engineer has described it, "he pays Flood, and Flood makes out like a champ."

IT was assumed that the Genofiles were dead. Firemen and paramedics who came into the neighborhood took one glance at the engulfed house and went elsewhere in search of people needing help. As the family remained trapped, perhaps an hour went by. They have no idea.

"We didn't know why it had come or how long it was going to last."

They lost all sense of time. The stuck horn went on blaring, the directional signal eerily blinking. They imagined that more debris was on the way.

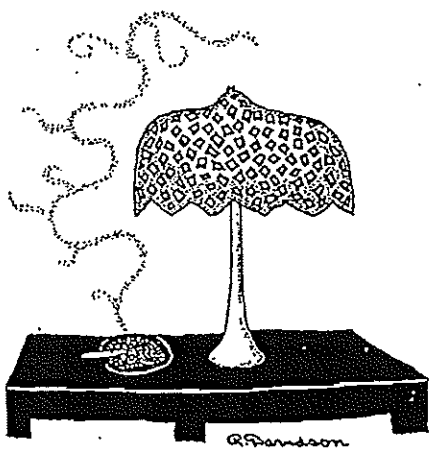
"We didn't know if the whole mountain was coming down."

As they waited in the all but total darkness, Jackie thought of neighbors' children. "I thought, Oh, my gosh, all those little kids are dead. Actually, they were O.K. And the neighbors thought for sure we were all gone. All our neighbors thought we were gone."

At length, a neighbor approached their house and called out, "Are you alive?"

"Yes. But we need help."

As the debris flow hit the Genofiles' house, it also hit a six-ton truck from the L.A.C.F.C.D., the vigilant bureau called Flood. Vigilance was about all that the L.A.C.F.C.D. had been able to offer. The patrolling vehicle and its crew of two were as helpless as everyone else. Each of the crewmen had lived twenty-six years, and each came close to ending it there. Minutes before the flow arrived, the truck labored up Pine Cone Road—a forty-one-percent grade, steep enough to stiff a Maserati. The two men meant to check on a debris basin at the top. Known as Upper Shields, it was less than two years old, and had been built in anticipation of the event that was about to occur. Oddly enough, the Genofiles and their neighbors were bracketed with debris basins—Upper Shields above them, Shields itself below them, six times as large. Shields Debris Basin, with its arterial concrete feeder channels, was prepared to catch fifty thousand tons. The Genofiles' house looked out over Shields as if it were an empty lake, its shores hedged about with oleander. When the developer extended Pine Cone Road up into the brush, the need for Upper Shields was apparent. The new basin came in the nick of time but—with a capacity under six thousand cubic yards—not in the nick of space. Just below it was a chain-link gate. As the six-ton truck approached the gate, mud was oozing through. The basin above had filled in minutes, and now, suddenly, boulders shot like cannonballs over the crest of the dam, with mud, cobbles, water, and trees. Chris Terracciano, the driver, radioed to headquarters, "It's coming over." Then he whipped the truck around and fled. The debris flow came through the chain-link barrier as if the links were made of paper. Steel posts broke off. As the truck accelerated down the steep hill, the debris flow chased and caught it. Boulders bounced against it. It was hit by empty automobiles spinning and revolving in the muck. The whole descending complex gathered force with distance. Terracciano later said, "I thought I was dead the whole way." The truck finally stopped when it bashed against a tree and a cement-block wall. The rear window shattered. Terracciano's partner suffered a broken leg. The two men crawled out through the window and escaped over the wall.



Within a few miles, other trapped patrols were calling in to say, "It's coming over." Zachau went over—into Sunland. Haines went over—into

Tujunga. Dunsmuir went over—into Highway Highlands. As bulldozers plow out the streets after events like these, the neighborhoods of northern Los Angeles assume a macabre resemblance to New England villages under deep snow: the cleared paths, the vehicular rights-of-way, the parking meters buried within the high banks, the half-covered drift-girt homes. A street that is lined with palms will have debris berms ten feet up the palms. In the Genofiles' front yard, the drift was twelve feet deep. A person, without climbing, could walk onto the roof. Scott's bedroom had a few inches of space left at the top. Kimberlee's had mud on the ceiling. On the terrace, the crushed vehicles, the detached erratic wheels suggested bomb damage, artillery hits, the track of the Fifth Army. The place looked like a destroyed pillbox. No wonder people assumed that no one had survived inside.

There was a white sedan under the house eaves crushed to half its height, with two large boulders resting on top of it. Near the pool, a Volkswagen bug lay squashed. Another car was literally wrapped around a tree, like a C-clamp, its front and rear bumpers pointing in the same direction. A crushed pickup had boulders all over it, each a good deal heavier than anything a pickup could carry. One of the cars in the swimming pool was upside down, its tires in the air. A Volkswagen was on top of it. Bob Genofile—owner, contractor, victim—walked around in rubber boots, a visored construction cap, a foul-weather jacket, studying the damage, mostly guessing at what he couldn't see. A big, strongly built, leonine man with prematurely white hair, he looked like a middle linebacker near the end of a heavy day. He wondered if the house was still on its foundation, but there was no telling in this profound chaos, now hardening and cracking like bad concrete. In time, as his house was excavated from the inside, he would find that it had not budged. Not one wall had so much as cracked. He was uninsured, but down in the rubble was a compensation of greater value than insurance. Forever, he could say, as he quietly does when he tells the story, "I built it, man."

Kimberlee's birthday came two days after the debris. She was a college student, turning nineteen, and her father had had a gift for her that he was keeping in his wallet. "I had nineteen fifty-dollar bills to give her for her birthday, but my pants and everything was gone."

Young Scott, walking around in the wreckage, saw a belt sticking out of the muck like a night crawler after rain. He pulled at it, and the buried pants came with it. The wallet was still in the pants. The wallet still contained what every daughter wants for her birthday: an album of portraits of U. S. Grant, no matter if Ulysses is wet or dry.

The living room had just been decorated, and in six minutes the job had been destroyed—"the pale tangerines and greens, Italian-style furniture with marble, and all that." Jackie Genofile continues the story: "We had been out that night, and, you know, you wear your better jewelry. I came home like an idiot and put mine on the dresser. Bob put his on the dresser. Three weeks later, when some workers were cleaning debris out of the bedroom, they found his rings on the floor. They did not find mine. But—can you believe it?—a year and a half later Scott was down in the debris basin with one of his friends, and the Flood Control had these trucks there cleaning it out, and Scott saw this shiny thing, and he picked it up, and it was my ring that Bob had given me just before the storm."

Before the storm, they had not in any way felt threatened. Like their neighbors, they were confident of the debris basins, of the concrete liners of the nearby stream. After the storm, neighbors moved away. Where Pine Cone Road swung left or right, the debris had made centrifugal leaps, breaking into houses. A hydrant snapped off, and arcing water shot through an upstairs window. A child nearly drowned inside his own house. The family moved. "Another family that moved owned one of the cars that ended up in our pool," Jackie told me. "The husband said he'd never want to live here again, you know. And she was in real estate."

After the storm, the Genofiles tended to wake in the night, startled and anxious. They still do. "I wake up once in a while really uptight," Bob said. "I can just feel it—go through the whole thing, you know."

Jackie said that when rain pounds on a roof, anywhere she happens to be, she will become tense. Once, she took her dog and her pillow and went to sleep in

Bob's office—which was then in Montrose, down beyond Foothill Boulevard.

Soon after the storm, she said, "Scotty woke up one night, and he had a real high temperature. You see, he was sixteen, and he kept hearing the mud and rock hitting the window. He kept thinking it was going to come again. Kim used to go four-wheeling, and cross streams, and she had to get out once, because they got stuck, and when she felt the flow of water and sand on her legs, she said, she could have panicked."

Soon after the storm, the family gathered to make a decision. Were they going to move or were they going to dig out their house and rebuild it? Each of them knew what might have happened. Bob said, "If it had been a frame house, we would be dead down in the basin below."

But it was not a frame house. It was the fort. "The kids said rebuild. So we rebuilt."

As he sat in his new living room telling the story, Bob was dressed in a Pierre Cardin jumper and pants, and Jackie was beside him in a pale-pink jumpsuit by Saint Germain. The house had a designer look as well, with its railings and balconies and Italianate marbles under the tall dry trees. It appeared to be worth a good deal more than the half-million dollars Bob said it might bring. He had added a second story and put all bedrooms there. The original roof spreads around them like a flaring skirt. He changed a floor-length window in the front hall, filling the lower half of it with cement block.

I asked what other structural changes he had made.

He said, "None."

The Genofiles sued Los Angeles County. They claimed that Upper Shields Debris Basin had not been cleaned out and that the channel below was improperly designed. Los Angeles settled for three hundred and thirty-seven thousand five hundred dollars.

From the local chamber of commerce the family later received the Beautification Award for Best Home. Two of the criteria by which houses are selected for this honor are "good maintenance" and "a sense of drama."

I HAVE not been specific about the dates of the stories so far recounted. This was to create the impression that debris pours forth from the mountains continually, perennially, perpetually—



which it does and does not, there being a great temporal disparity between the pace at which the mountains behave and the way people think. Debris flows do not occur in every possible season. When they do happen, they don't just spew from any canyon but come in certain places on the mountain front. The places change. Volumes differ. There are vintage years. The four most prominent in this century have been 1934, 1938, 1969, and 1978. Exceptional flows have occurred at least once a decade, and lesser ones in greater numbers. Exceptional flows are frequent, in other words, but not frequent enough to deter people from building pantiled mansions in the war zone, dingbats in the line of fire.

Why the debris moves when it does or where it does is not attributable to a single agent. The parent rock has been extensively broken up by earthquakes, but that alone will not make it flow. Heavy rainfall, the obvious factor, is not as obvious as it may seem. In 1980, some of the most intense storms ever measured in Los Angeles failed to produce debris flows of more than minimal size. The setting up of a debris flow is a little like the charging of an eighteenth-century muzzle-loader: the ramrod, the powder, the wadding, the shot. Nothing much would happen in the absence of any one component. In sequence and proportion each had to be correct.

On the geologic time scale, debris flows in the San Gabriel Mountains can be looked upon as constant. With all due respect, though, the geologic time scale doesn't mean a whole lot in a place like Los Angeles. In Los Angeles, even the Los Angeles time scale does not arouse general interest. A superevent in 1934? In 1938? In 1969? In 1978? Who is going to remember that? A relatively major outpouring—somewhere in fifty miles—about once every decade? Mountain time and city time appear to be bifocal. Even with a geology functioning at such remarkably short intervals, the people have ample time to forget it.

In February of 1978, while debris was still hardening in the home of the Genofiles, Wade Wells, of the United States Forest Service, went up and down Pine Cone Road knocking on doors asking how long the people had lived there. He wondered who remembered, nine years back, the debris-flow inundations of Glendora and Azusa,

scarcely twenty miles away. Only two did. Everyone else had arrived since 1969.

Wells is a hydrologist who works in the mountains, principally in San Dimas Experimental Forest, where he does research on erosion and sedimentation—the story of assembling debris. With a specialist's eye, he notes the mountain front, and in its passivity can see the tension: "These guys here, they should be nervous when it rains. Their houses are living on borrowed time. See that dry ledge? It's a waterfall. I've seen hundreds of tons of rock falling over it." More often, though, he is thousands of feet above the nearest house, on slopes so steep he sometimes tumbles and rolls. With his colleagues, he performs experiments with plants, rock, water, fire. When I first became interested in Los Angeles' battle with debris flows, I went up there with them a number of times. The mountains, after all, are where the rocks come from. The mountains shape the charge that will advance upon the city. People come from odder places than the East Coast to see this situation. One day, a couple of scientists arrived from the Cordillera Cantábrica, in northwestern Spain. When they saw how rapidly the San Gabriels were disintegrating, one of them said he felt sorry for Wells, who would soon be out of work. When Wells told him that the mountains were rising even faster than they were coming down, the man said, "*Muy interesante. Sí, señor.*"

From below, one look at the San Gabriels will suggest their advantage. The look is sometimes hard to come by. You might be driving up the San Gabriel River Freeway in the morning, heading straight at the mountains at point-blank range, and not be able to see them. A voice on KNX tells you that the day is clear. There's not a cloud in the sky, as the blue straight up confirms. A long incline rises into mist, not all of which is smog. From time immemorial, this pocket of the coast has been full of sea fog and persistent vapors. The early Spaniards called it the Bay of Smokes. Smog, the action of sunlight on nitrogen oxides, has only contributed to a preëxisting veil. Sometimes you don't see the San Gabriels until the streets stop and the mountains start. The veil suddenly thins, and there they are, in height and magnitude overwhelming. You plunge into a canyon flanked with soaring slopes before you realize you are out of town. The San Gabriel Mountains are as rugged as any terrain in America, and their extraordinary proximity to the city, the abruptness of the transition from the one milieu to the other, cannot be exaggerated. A lone hiker in the San Gabriels one winter—exhausted, snow-blinded, hypothermic—staggered down a ridgeline out of the snow and directly into the parking lot of a shopping center, where he crawled to a phone booth, called 911, and slumped against the glass until an ambulance came to save him.

Hang-glider pilots go up the San Gabriels, step off crags, and, after a period of time proportional to their skills, land somewhere in the city. The San Gabriels are nearly twice as high as Mt. Katahdin or Mt. Washington, and are much closer to the sea. From base platform to summit, the San Gabriels are three thousand feet higher than the Rockies. To be up in the San Gabriels is to be both above and beside urban Los Angeles, only minutes from the streets, and to look north from ridge to dry ridge above deeply cut valleys filled with gulfs of clear air. Beyond the interior valleys—some fifty thousand feet away and a vertical mile above you—are the summits of Mt. Baldy, Mt. Hawkins, Mt. Baden-Powell. They are so clearly visible in the dry blue sky that just below their ridgelines you can almost count the boulders that are bunched there like grapes.

If you turn and face south, you look out over something like soft slate that reaches fifty miles to an imprecise horizon. The whole of Los Angeles is spread below you, and none of it is visible. It is lost absolutely in the slate-gray sea, grayer than a minesweeper, this climatic wonder, this megalopolitan featherbed a thousand feet thick, known as "the marine layer." Early in the day, it is for the most part the natural sea fog. As you watch it from above through the morning and into the afternoon, it turns yellow, and then ochre, and then brown, and sometimes nearly black—like butter darkening in a skillet.


Glancing down at it one day while working on an experiment, Wade Wells said it seemed to have reached the hue of a first-stage smog alert. Wells was helping Edwin Harp, a debris-flow specialist from the United States Geological Survey, collect "undisturbed" samples by hammering plastic tubes into the mountain soil.

"If the soil were nice and compliant, this would be nice and scientific," Harp said, smacking the plastic with a wooden-handled shovel. After a while, he extracted a tube full of uncompliant material, and said, "This isn't soil; it's regolith." Regolith is a stony blanket that lies under soil and over bedrock. It crumbled and was pebbly in the hand.

As they prepared to sink another tube, I said, "What's a first-stage smog alert?"

"Avoid driving, avoid strenuous activity," Wells answered.

Harp said, "Avoid breathing."

The slope they were sampling had an incline of eighty-five per cent. They were standing, and walking around, but I preferred—just there—to sit. Needle grass went through my trousers. The heads of needle grass detach from the stalks and have the barbed design of arrows. They were going by the quiver into my butt but I still preferred to sit. It was the better posture for writing notes. The San Gabriels are so steep and so extensively dissected by streams that some watersheds are smaller than a hundred acres. The slopes average sixty-five to seventy per cent. In numerous places, they are vertical. The angle of repose—the steepest angle that loose rocks can abide before they start to move, the steepest angle the soil can maintain before it starts to fail—will vary locally according to the mechanics of shape and strength. Many San Gabriel slopes are at the angle of repose or beyond it. The term "oversteepened" is often used to describe them. At the giddy extreme of oversteepening is the angle of maximum slope. Very large sections of the San Gabriels closely approach that angle. In such terrain, there is not much to hold the loose ma-

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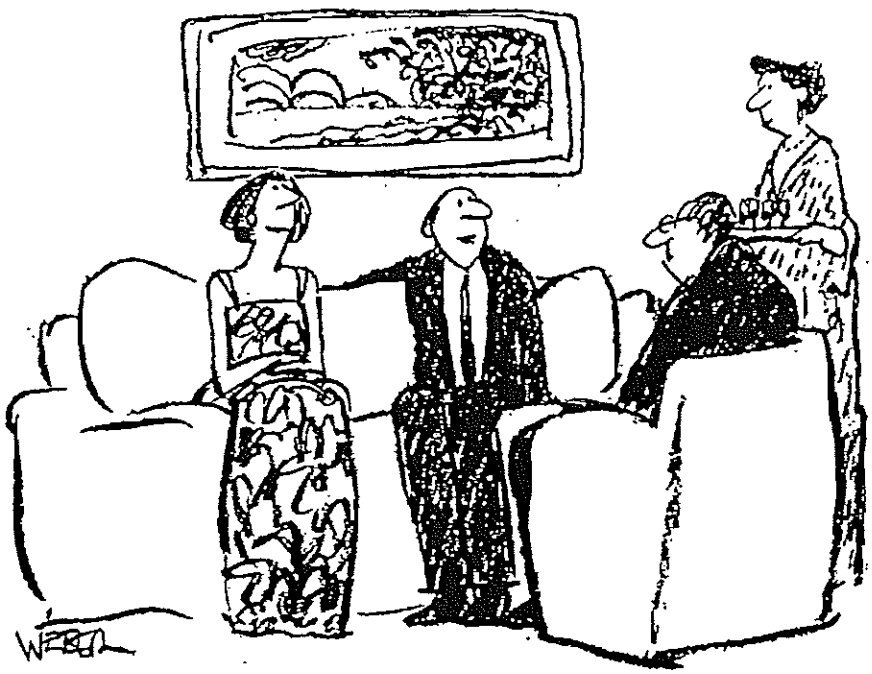
terial except the plants that grow there.

Evergreen oaks were fingering up the creases in the mountainsides, pointing toward the ridgeline forests of bigcone Douglas fir, of knobcone and Coulter pine. The forests had an odd sort of timberline. They went down to it rather than up. Down from the ridges the conifers descended through nine thousand, seven thousand, six thousand feet, stopping roughly at five. The forests abruptly ended—the country below being too dry in summer to sustain tall trees. On down the slopes and all the way to the canyons was a thicket of varied shrubs that changed in character as altitude fell but was everywhere dense enough to stop an army. On its lower levels, it was all green, white, and yellow with buckwheat, burroweed, lotus and sage, deerweed, bindweed, yerba santa. There were wild morning glories, Canterbury bells, tree tobacco, miner's lettuce. The thicket's resistance to trespass, while everywhere formidable, stiffened considerably as it evolved upward. There were intertwining mixtures of manzanita, California lilac, scrub oak, chamise. There was buckthorn. There was mountain mahogany. Generally evergreen, the dark slopes were splashed here and there with dodder, its mustard color deepening to rust. Blossoms of the Spanish bayonet stood up like yellow flames. There were lemonade berries (relatives of poison ivy and poison oak). In canyons, there were alders, big-leaf-maple bushes, pug sycamores, and California bay. Whatever and wherever they were, these plants were prickly, thick, and dry, and a good deal tougher than tundra. Those evergreen oaks fingering up the creases in the mountains were known to the Spaniards as chaparros. Riders who worked in the related landscape wore leather overalls open at the back, and called them chaparajos. By extension, this all but impenetrable brush was known as chaparral.

The low stuff, at the buckwheat level, is often called soft chaparral. Up in the tough chamise, closer to the lofty timber, is high chaparral, which is also called hard chaparral. High or low—hard, soft, or mixed—all chaparral has in common an always developing, relentlessly intensifying, vital necessity to burst into flame. In a sense, chaparral consumes fire no less than fire consumes chaparral. Fire nourishes and rejuvenates the plants. There are seeds that fall into the soil, stay there indefinitely, and will not germinate except in the aftermath of fire. There are basal buds that sprout only after fire. Droughts are so long, rains so brief, that dead bits of wood and leaves scarcely decay. Instead, they accumulate, thicken, until the plant community is all but strangling in its own duff. The nutrients in the dead material are being withheld from the soil. When fire comes, it puts the nutrients back in the ground. It clears the terrain for fresh growth. When chaparral has not been burned for thirty years, about half the thicket will be dry dead stuff—twenty-five thousand tons of it in one square mile. The living plants are no less flammable. The chamise, the manzanita—in fact, most chaparral plants—are full of solvent extractives that burn intensely and ignite easily. Their leaves are glossy with oils and resins that seal in moisture during hot dry periods and serve the dual purpose of responding explosively to flame. In the long dry season, and particularly in the fall, air flows southwest toward Los Angeles from the Colorado Plateau and the Basin and Range. Extremely low in moisture, it comes out of the canyon lands and crosses the Mojave Desert. As it drops in altitude, it compresses, becoming even dryer and hotter. It advances in gusts. This is the wind that is sometimes called the foehn. The fire wind. The devil wind. In Los Angeles, it is known as Santa Ana. When chamise and other chaparral plants sense the presence of Santa Ana winds, their level of moisture drops, and they become even more flammable than they were before. The Santa Anas bring what has been described as "instant critical fire weather." Temperatures rise above a hundred degrees. Humidity drops very close to zero. According to Charles Colver, of the United States Forest Service, "moisture evaporates off your eyeballs so fast you have to keep blinking."

Ignitions are for the most part caused by people—through accident or arson. Ten per cent are lightning. Where the Santa Anas collide with local mountain winds, they become so erratic that they can scatter a fire in big flying brands for a long distance in any direction. The frequency and the intensity of the forest fires in the Southern California chaparral are the great-



*"Mary Jo is a dyed-in-the-wool feminist. Me, too, of course."*

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est in the United States, with the possible exception of the wildfires of the New Jersey Pine Barrens. The chaparral fires are considerably more potent than the forest fires Wade Wells saw when he was an undergraduate at the University of Idaho or when he worked as a firefighter in the Pacific Northwest. "Fires in the Pacific Northwest are nothing compared with these chaparral fires," he remarked. "Chaparral fires are almost vicious by comparison. They're so intense. Chaparral is one of the most flammable vegetation complexes there are."

It burns as if it were soaked with gasoline. Chaparral plants typically have multiple stems emerging from a single root crown, and this contributes not only to the density of the thickets but, ultimately, to the surface area of combustible material that stands prepared for flame. Hundreds of acres can be burned clean in minutes. In thick black smoke there is wild orange flame, rising through the canyons like explosion crowns. The canyons serve as chimneys, and in minutes whole mountains are aflame, resembling volcanoes, emitting high columns of fire and smoke. The smoke can rise twenty thousand feet. A force of two thousand people may fight the fire, plus dozens of machines, including squadrons in the air. But Santa Ana firestorms are so violent that they are really beyond all effort at control. From the edge of the city upward, sixteen miles of mountain front have burned to the ridgeline in a single day.

So momentous are these conflagrations that they are long remembered by name: the Canyon Inn Fire, August, 1968, nineteen thousand acres above Arby's by Foothill Boulevard, above the world's foremost container nursery, above the chief executive officer of Mackinac Island Fudge; the Village Fire and the Mill Fire, November, 1975, sixty-five thousand acres above Sunland, Tujunga, La Crescenta, La Cañada. The Mill Fire, in the words of a foreman at Flood, "burnt the whole front face off."

It is not a great rarity to pick up the Los Angeles *Times* and see a headline like this one, from September 27, 1970:

14 MAJOR FIRES RAGE OUT OF CONTROL
256 HOMES DESTROYED AS FLAMES BURN 180,000 ACRES

In millennia before Los Angeles settled its plain, the chaparral burned every thirty years or so, as the chaparral does now. The burns of prehistory, in their natural mosaic, were smaller than the ones today. With cleared fire lanes, chemical retardants, and other means of suppressing what is not beyond control, people have conserved fuel in large acreages. When the inevitable fires come, they burn hotter, higher, faster than they ever did in a state of unhindered nature. When the fires end, there is nothing much left on the mountainsides but a thin blanket of ash. The burns are vast and bare. On the sheer declivities where the surface soils were held by chaparral, there is no chaparral.

Fine material tumbles downslope and collects in the waterless beds of streams. It forms large and bulky cones there, to some extent filling the canyons. Under green chaparral, the gravitational movement of bits of soil, particles of sand, and other loose debris goes on month after month, year after year, especially in oversteepened environments, where it can represent more than half of all erosion. After a burn, though, it increases exponentially. It may increase twentyfold, fortyfold, even sixtyfold. This steady tumbling descent of unconsolidated mountain crumbs is known as dry ravel. After a burn, so much dry ravel and other debris becomes piled up and ready to go that to live under one of those canyons is (as many have said) to look up the barrel of a gun.

One would imagine that the first rain would set the whole thing off, but it doesn't. The early-winter rains—and sometimes the rains of a whole season—are not enough to make the great bulk move. Actually, they add to it.

If you walk in a rainstorm on a freshly burned chaparral slope, you notice as you step on the wet ground that the tracks you are making are prints of dry dust. In the course of a conflagration, chaparral soil, which is not much for soaking up water in the first place, experiences a chemical change and, a little below its surface, becomes waterproof. In a Forest Service building at the foot of the mountains Wade Wells keeps some petri dishes and soil samples in order to demonstrate this phenomenon to passing unbelievers. In one dish he puts unburned chaparral soil. It is golden brown. He drips water on it from an eyedropper. The water beads up, stands there for a while, then collapses and spreads into the soil. Why the water hesitates is not well understood but is a great deal more credible than what happens next. Wells fills a dish with a dark soil from burned

chaparral. He fills the eyedropper and empties it onto the soil. The water stands up in one large dome. Five minutes later, the dome is still there. Ten minutes later, the dome is still there. Sparkling, tumescent, mycophane, the big bead of water just stands there indefinitely, on top of the impermeable soil. Further demonstrating how waterproof this burned soil really is, Wells pours half a pound of it, like loose brown sugar, into a beaker of water. The soil instantly forms a homuncular blob—integral, immiscible—suspended in the water.

In the slow progression of normal decay, chaparral litter seems to give up to the soil what have been vaguely described as "waxlike complexes of long-chain aliphatic hydrocarbons." These waxy substances are what make unburned chaparral soil somewhat resistant to water, or "slightly nonwettable," as Wells and his colleagues are wont to describe it. When the wildfires burn, and temperatures at the surface of the ground are six or seven hundred centigrade degrees, the soil is so effective as an insulator that the temperature one centimetre below the surface may not be hot enough to boil water. The heavy waxlike substances vaporize at the surface and recondense in the cooler temperatures below. Acting like oil, they coat soil particles and establish the hydrophobic layer—one to six centimetres down. Above that layer, where the waxlike substances are gone, the veneer of burned soil is "wettable." When Wells drips water on a dishful of that, the water soaks in as if the dish were full of Kleenex. When rain falls on burned and denuded ground, it soaks the very thin upper layer but can penetrate no farther. Hiking boots strike hard enough to break through into the dust, but the rain is repelled and goes down the slope. Of all the assembling factors that eventually send debris flows rumbling down the canyons, none is more detonative than the waterproof soil.

In the first rains after a fire, water quickly saturates the thin permeable layer, and liquefied soil drips downhill like runs of excess paint. These miniature debris flows stripe the mountainsides with miniature streambeds—countless scarlike rills that are soon the predominant characteristic of the burned terrain. As more rain comes, each rill is going to deliver a little more debris to the accumulating load in the canyon below. But, more to the point, each rill—its natural levees framing its impermeable bed—will increase the speed of the surface water. As rain sheds off a mountainside like water off a tin roof, the rill network, as it is called, may actually cube the speed, and therefore the power, of the runoff. The transport capacity of the watershed—how much bulk it can move—may increase a thousandfold. The rill network is prepared to deliver water with enough force and volume to mobilize the deposits lying in the canyons below. With the appearance of the rills, almost all prerequisites have now sequentially occurred. The muzzle-loader is charged. For a full-scale flat-out debris flow to burst forth from the mountains, the final requirement is a special-intensity storm.

Some of the most concentrated rainfall in the history of the United States has occurred in the San Gabriel Mountains. The oddity of this is about as intense as the rain. Months—seasons—go by in Los Angeles without a fallen drop. Los Angeles is one of the least-rained-upon places in the Western Hemisphere. The mountains are so dry they hum. Erosion by dry ravel greatly exceeds erosion by water. The celebrated Mediterranean climate of Los Angeles owes itself to aridity. While Seattle is receiving its average rainfall of thirty-nine inches a year, Chicago thirty-three, the District of Columbia thirty-nine, and New York City forty-four, Los Angeles is doing well if it gets fifteen. In one year out of every four over the past century, rainfall in Los Angeles has been under ten inches, and once or twice it was around five. That is pure Gobi. When certain storm systems approach Los Angeles, though—storms that come in on a very long reach from far out in the Pacific—they will pick up huge quantities of water from the ocean and just pump it into the mountains. These are by no means annual events, but when they occur they will stir even hydrologists to bandy the name of Noah. In January, 1969, for example, more rain than New York City sees in a year fell in the San Gabriels in nine days. In January, 1943, twenty-six inches fell in twenty-four hours. In February, 1978, just before the Genofiles' house filled with debris, nearly an inch and a half of rain fell in twenty-five minutes. On April 5, 1926, a rain gauge in the San Gabri-

els collected one inch in one minute.

The really big events result from two, three, four, five storms in a row coming in off the Pacific. In 1980, there were six storms in nine days. Mystically, unnervingly, the heaviest downpours always occur on the watersheds most recently burned. Why this is so is a question that has not been answered. Meteorologists and hydrologists speculate about ash-particle nuclei and heat reflection, but they don't know. The storm cells are extremely compact, deluging typically about ten miles by ten. One inch of rain on a patch that size is seven million two hundred and thirty-two thousand tons of water. In most years, in most places, a winter rain will actually stabilize a mountainside. The water's surface tension helps to hold the slope together. Where there is antecedent fire, water that would otherwise become a binding force hits the rill network, caroms off the soil's waterproof layer, and rides the steep slopes in cataracts into the nearest canyon. It is now a lubricant, its binding properties repelled, its volume concentrating into great hydraulic power. The vintage years present themselves when at least five days of rain put seven inches on the country and immediately thereafter comes the heaviest rainfall of the series. That is when the flint hits the steel, when the sparks fly into the flashpan. On that day, the debris mobilizes.

FIVE miles into the mountains from the edge of the city is a small, obscure, steep-sided watershed of twenty-five hundred acres which is drained by the Middle Fork of Mill Creek, a tributary of the Big Tujunga. The place is so still you can hear the dry ravel. From time to time, you hear the dry cough of semi-automatic weapons. It is the sound of city folk pursuing a hobby. Recreational marksmanship is permitted on the Middle Fork. There are eight million people just down the wash, and they shoot some interesting guns. Amos Lewis, who covered the region as a deputy sheriff for twenty-five years, once found beside the Angeles Crest Highway "a gun you could hide behind your tie—you'd think it was a tie clip." He has also seen enough muzzle-loaders to have made a difference in the Battle of Long Island. In an imaginative, life-loving city, there will always be people with a need to fire antique weapons. On July 24, 1977, a marksman on the Middle Fork rammed Kleenex down his barrel instead of cloth wadding. Under the Kleenex was black powder. In black powder there is more of an incendiary risk than there is in the smokeless kind. When the rifle fired, flaming Kleenex shot out the muzzle and burned down three thousand eight hundred and sixty acres, including the entire watershed of the Middle Fork.

It was a textbook situation—a bowl in the mountains filled with hard chaparral that had not been touched by fire in ninety-nine years. The older chaparral becomes, the hotter it burns. In its first ten years of new growth, it is all but incombustible. After twenty years, its renewed flammability curves sharply upward. It burns, usually, before it is forty years old. The hotter the fire, the more likely a debris flow—and the greater the volume when it comes. The century-old fuel of the Middle Fork was so combustible that afterward there were not even stumps. The slopes looked sandpapered. The streambed, already loaded, piled even higher with dry ravel. The Middle Fire, as the burn was known, was cause for particular alarm, because a small settlement was a mile downstream. Its name —Hidden Springs—contained more prophecy than its residents seemed prepared to imagine. Three hundred and ninety thousand cubic yards of loose debris was gathered just above them, awaiting mobilization.

Dan Davis and Hadi Norouzi, L.A.C.F.C.D. engineers, went up there after the burn to tell the people what they might expect. In midsummer, it is not a simple matter to envision a winter flood if you are leaning on a boulder by a desiccated creek. "We spent a lot of time trying to prevent a disaster from occurring," Davis said recently. "The fact that people would not believe what *could* happen was disappointing, actually. We held meetings. We said, 'There's nothing we can do for you. Telephones are going to go out. Mud will close the road. You're abandoned. If you're here, get to high ground.' " There was no debris basin, of course. This was a hamlet in the mountains, not a subdivision at the front. Conditions were elemental and pristine. "We walked people through escape routes," he went on. "We told them the story of fire and rain. We said, 'If heavy rain

starts, you've got fifteen to thirty minutes to get out.' "

Norouzi told them they were so heavily threatened that no amount of sandbags, barricades, or deflection walls was ever going to help them. "There is nothing you can build that will protect you."

Half a year went by, and nothing stirred. Cal Drake went on making jewelry in his streamside apartment. He and his wife, Mary, shared a one-story triplex with two other couples. The Drakes, from the city, had moved to Hidden Springs two years before, in quest of a "quiet life." Elva Lewis, wife of Amos the sheriff, went on running her roadside café. Gabe Hinterberg stayed open for business at the Hidden Springs Lodge. In December and January, there was an unusual amount of rain, but no flood. By the end of the first week of February, there had been eighteen inches in all. Then, in the next three days, came enough additional rain to make this the winter of the greatest rainfall of the twentieth century, exceeded only by 1884 and 1890 in the records of Los Angeles County. The National Oceanic and Atmospheric Administration selected the word "monstrous" to befit the culminating February storm, in which almost a foot of rain fell in twenty-four hours, and, in the greatest all-out burst, an inch and a half in five minutes. This was the storm that sent the debris down Pine Cone Road, overtopped the Zachau Basin, mobilized the corpses in the Verdugo Hills. In the small valley of the Middle Fork, upon the scorched impenetrable ground, three million tons of water fell in one day.

Toward midnight February 9th, an accidental fire broke out in a small building of Gabe Hinterberg's. A fire truck eventually came. Half a dozen people fought the fire, assisted by the heavy rain. One of them was George Scribner. The five-minute spike of greatest downpour occurred at about one-thirty. Half an hour later, George said, "Hey, we got the fire put out."

Gabe said, "Good deal."

And then Gabe and George were dead.

Amos Lewis, nearby, was holding a fire hose in his hand and was attempting to prevent it from kinking. In his concentration, he did not see danger coming. He heard nothing ominous. He only felt the hose draw taut. Through his peripheral vision he became aware that the fire truck—with the hose connected to it—was somehow moving sideways. Seconds later, Amos Lewis, too, was swept away.

The snout of the debris flow was twenty feet high, tapering behind. Debris flows sometimes ooze along, and sometimes move as fast as the fastest river rapids. The huge dark snout was moving nearly five hundred feet a minute and the rest of the flow behind was coming twice as fast, making roll waves as it piled forward against itself—this great slug, as geologists would describe it, this discrete slug, this heaving violence of wet cement. Already included in the debris were propane tanks, outbuildings, picnic tables, canyon live oaks, alders, sycamores, cottonwoods, a Lincoln Continental, an Oldsmobile, and countless boulders five feet thick. All this was spread wide a couple of hundred feet, and as the debris flow went through Hidden Springs it tore out more trees, picked up house trailers and more cars and more boulders, and knocked Gabe Hinterberg's lodge completely off its foundation. Mary and Cal Drake were standing in their living room when a wall came off. "We got outside somehow," he said later. "I just got away. She was trying to follow me. Evidently, her feet slipped out from under her. She slid right down into the main channel." The family next door were picked up and pushed against their own ceiling. Two were carried away. Whole houses were torn loose with people inside them. A house was ripped in half. A bridge was obliterated. A large part of town was carried a mile downstream and buried in the reservoir behind Big Tujunga Dam. Thirteen people were part of the debris. Most of the bodies were never found.

As Amos Lewis suddenly found himself struggling in the viscous flow, he more or less bumped into a whirling pickup, coming down in the debris from who knows where upstream. One of the roll waves picked him up and threw him into the back of the truck. As the vehicle spun around and around, it neared one bank. Lewis saw an overhanging limb. He reached for it, caught it, and pulled himself above the rocky flow. Years later, just about where this had happened, he told Wade Wells and me the story. "I got pushed to one side," he said as he finished. "I lucked out." Lewis is a

prematurely white-haired man with a white beard and dark-brown eyes. On this day in late spring, his muscular build and deeply tanned skin were amply displayed by a general absence of clothing. He wore bluejean shorts, white socks, mountain boots, and nothing else. When people began to discover human remains in the reservoir, he had gone in his patrol car to investigate the fate of his neighbors. "I had to go roll on them calls," he said. "A deputy sheriff has to roll on any type of body being found. I carried out at least four, maybe five, skulls."

The thirteen people who died in Hidden Springs were roughly a third of the year-round community; there was a much larger summer population. The main house of Lutherglen, a resort-retreat of the First English Evangelical Lutheran Church, remained standing but in ruins. Houses that stayed put were gouged out like peppers and stuffed with rocks. Lewis gestured across the canyon—across foundations with no houses on them, bolts sticking up out of cinder blocks where sills had been ripped away—toward some skeletal frames made of two-by-fours. "They used to be trailer stalls," he said. "The people left their cars by the river and walked up the bank to the trailers. The cars ended up in the dam." The First English Evangelical Lutherans sued the Los Angeles County Flood Control District for twenty million dollars. The judge threw the case out of court—followed, moments later, by the collection plate. Since the act in question was God's, the defendant might as well have been the plaintiff, and the Plaintiff the target of the suit.

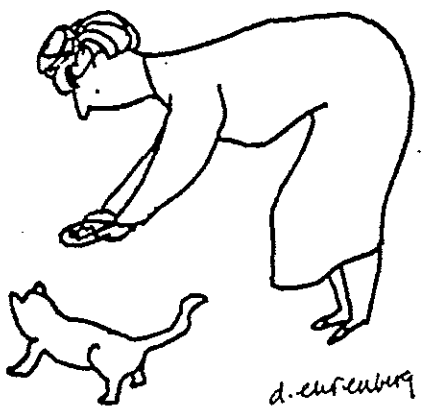
I remarked to Lewis, who is now retired as sheriff, that I thought I'd heard a machine gun earlier in the day. "I worked the canyon car here for twenty-five years," he said. "I probably rolled on a minimum of a hundred and fifty calls where people said they heard machine guns. I never saw a machine gun."

Wells was attentive to this remark, raising his eyes with interest. Behind his mild ecological look—his tortoise-shell glasses, his amiable scientific manner—lay a colonel's affection for ordnance. At the time, in the Reserve, he was a lieutenant colonel and rising. He'd been on active duty seven years, two in Vietnam. He told me one day that if California were to secede from the United States it would be one of the richest countries in the world and, with its present units of the National Guard, be among the best defended. "You can take a file and in fifteen minutes make an automatic weapon out of an M1," he said to Amos Lewis. "It can sound like a machine gun."

This set off a long and highly technical discussion between the scholarly hydrologist and the shirtless mountaineer, each slipping into a second self against a backdrop of huge boulders that had been somewhere else a short time before and had been delivered by a force that was high in the kiloton range. Most of the mud, sand, and rock had gone into the Big Tujunga, behind the dam, and the county had spent more than two million dollars taking it out. The debris that had stayed in the valley closely resembled glacial debris—chaotic, unsorted till, a round-rock mélange. Far up the hillsides framing the valley, some of it clung like bits of plaster stuck to an old wall, thus recording the high edges of the discrete slug, where six hundred thousand tons went by.

WHEN you walk in the stream valleys of the San Gabriels, you will see rocks the size of heads wedged among the branches of trees. In a small tight valley called Trail Canyon, I saw two boulders that were a good deal wider than the bed of the brook that had carried and rounded them. They were bigger than school buses. Surrounded by lesser debris, they had moved a long distance in its company. At a guess—from their dimensions and specific gravity—the aggregate weight of the two rocks was a hundred and sixty tons.

In February, 1978, a boulder weighing three hundred and fifteen tons ended up on a residential street about a third of a mile inside the Los Angeles city limits. Through some neighborhoods, boulders in great numbers advance like Chinese checkers. People pile them up against fences, use them in retaining walls. When Dan Davis was working for Flood, he found debris—on an urban thoroughfare after a storm—a mile and a half from the nearest debris basin. ("When I saw that, I knew we had a real problem.") In 1938, a restaurant on the main street of Sierra Madre was destroyed by invading boulders. Two-foot boulders rumbled through Claremont, coming to a stop three miles from the mountain front. Five miles from the front you can see boulders a foot in diameter. If you ask people how the rocks got there, they assume it was by a process that is no longer functioning. If you suggest that the rocks may have come from the mountains, people say, "No way." Off the eastern end of the San Gabriels, rocks the size of soccer balls are eight miles south of the front.




Building stones in places like Glendora and Covina were delivered by streams from high in the mountains. The stream-rounded rock is more vulnerable to earthquake than bricks would be, but bricks are not shipped F.O.B. by God, and in a land of kaleidoscopic risks what is one more if the rocks are free? Mike Rubel's castle, in Glendora, is made of stream-rounded debris in sizes approximating cannonballs. Dunsinane was not much larger than this suburban home. The ground level of Rubel's castle is twenty-two thousand square feet. From its battlements rise towers sixty-seven feet high and seventy-four feet high, built with San Gabriel boulders and store-bought cement. There are six towers, four set in the walls and two in the courtyard freestanding. Bees live in the Bee Tower, and emerge through archery slits. All around the walls, muzzles of cannons protrude from crenels that are lined with shark-fin glass.

The intensity of the electronic surveillance is high, but the owner is not unfriendly. He likes to sit on a balcony above the courtyard, looking out over his walls and through the crowns of palms at the ridgeline of the mountains. He is a large man to the point of private tailoring. He began his castle in 1959 and completed it in 1985. When he had been working on the project ten years, he took an unexpected delivery of building materials in the form of a

debris slug that breached his defenses, untimbered his portcullises, and got into the inner bailey.

"The ground was shaking just like an earthquake. In the washes, the water was going three billion miles an hour. You could hear the boulders rumbling. It was marvellous."

As a result, there is now a twelve-foot curtain wall on the periphery of the castle. Rubel calls his domain, which is surrounded by commoner houses on a most conventional street, the Kingdom of Rubelia. Numerous crafts are practiced there, and he has a hand-set-printing operation called the Pharm Press. In the Kingdom of Rubelia, F is Ph and Ph is F. There are hand-cranked phorges in the blacksmith phoundry. There are potters' wheels, looms, and lathes.

Sitting beside him on his balcony and dreamily looking at the mountain peaks, I said, "The castle is obviously the result of something."

Rubel said, "Yes. A genetic defect."

Rubel explained that he had built the castle with the help of numerous friends—friends from his days in Citrus High School, friends from his briefer days at Cal Poly. "We were twenty-year-old kids," he said. "And we were flunking out of school. We said, 'If we can't amount to anything, we might as well build a castle.' "

Prince Philip of Great Britain, who is not a Rubelian and gets no F, has made two visits to Rubel's castle.

Cal Poly—the California State Polytechnic University—is not to be confused with Caltech. I bring this up because I went to Caltech one day and, in a very impromptu manner, asked to see a geologist. Any geologist. It had not been my purpose, in pursuing the present theme, to get into the deep geology. I meant to roam the mountains and the mountain front with foresters and engineers, to talk to people living on the urban edge, to interview people who sell the edge—a foreign correspondent covering the battle from behind both lines. But not beneath them. This was a planned vacation from projects in geology—the continuation of a holiday that had begun with stream capture in the lower Mississippi and had spread forth into such innocent milieus as eruptions in Iceland and flowing red lava in Hawaii. Now, in Los Angeles, I had been avoiding geologists in the way that one tries to avoid visits to medical doctors. All had gone well for a matter of weeks, but then, one morning, I just happened to be in Pasadena looking up into the veiled chimeric mountains, and severe symptoms began to develop. Right off the street—in much the way that a needful patient would seek out a Doc-in-the-Box—I walked into the geology department of the California Institute of Technology, found the departmental office, and asked for professional help.

After a short wait, spent leafing through a magazine, I was shown into the office of Leon Silver, whom I knew only by reputation—an isotope geologist whose exacting contributions to geochronology have not repressed his interest in crustal settings, global tectonics, the Big Picture. An ebullient man, husky, in his sixties, he spread out the local sheets from the geologic map of California for a brief rehearsal of the rocks and faults before leading me to the roof of the building, where he continued his diagnosis in the panoramic presence of the rock itself. The roof was flat, a deck. Funnel vents and other apparatus gave the impression that the Caltech geology department was a cruise ship in the lee of seventy miles of mountains.

The institution as a whole, in its remarkable beauty and surprisingly compact size, is sort of a bonsai university—with pools, rialtos, inclined gardens—above which the mountains seem all the more immense. Silver said that if I was looking for first causes in the matter that concerned me I had come to the right place. "The geology provides the debris," he went on. "The San Gabes are a climber's nightmare. Several people a year die on the incompetent rock."

"Yes," I said. "The rock up there is really rotten."

Silver seemed offended. Drawing himself up, he said, "I beg your pardon, sir. It is not rotten. It is shattered." The region was a tracery of faults, like cracks in ancient paint. The mountains were divided by faults, defined by faults, and framed by them as well: on the near side, the Raymond Fault, the Sierra Madre Fault, the Cucamonga Fault; on the far side, the San Andreas Fault. The rock of the San Gabriels had been battered and

broken by the earthquakes on these and related faults. In 1971, Silver had flown over the San Gabes immediately after an earthquake that reached 6.2 on the Richter scale. Like artillery shells randomly exploding, the aftershocks were sending up dust in puffs all over the landscape. Something like that would add quite a bit, he said, "to the debris potential." Some of the rock up there had become so unstable that whole hunks of the terrain were moving like glaciers. One mountaintop was heading south like a cap tipping down on a forehead. Things like that had been going on for so long that the mountains were in many places loaded with debris from ancient landslides—prime material, prepared to flow. "The ultimate origin of the debris flows," he said, "is the continuous tectonic front that has made this one of the steepest mountain fronts in North America and produced a wilderness situation not a hundred metres from people's houses."

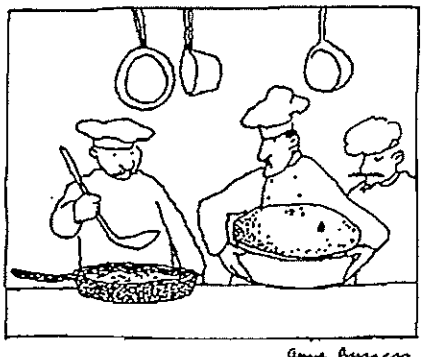
The continuous tectonic front is where the North American and Pacific Plates are sliding past each other—where Bakersfield moves toward Mexico City while Burbank heads for Alaska. Between Bakersfield and Burbank lie the San Gabriel Mountains. With the San Bernardino Mountains east of them, they trend east-west, forming a kink in the coastal ranges that come down from San Francisco and go on to Baja California. The kink conforms to a bend in the San Andreas Fault, which runs along the inland base of the mountains. The kink looks like this:

It could be a tiptoeing h. It resembles a prize-winning chair. Los Angeles is like a wad of gum stuck to the bottom of the chair. The mountains are one continuous system, but its segments are variously named. The upper stretch is called the Coast Ranges. The lower leg is called the Peninsular Ranges. The kink is called the Transverse Ranges.

My hieroglyph represents, of course, not only the mountains but the flanking San Andreas Fault, which comes up from the Gulf of California, bends left around Los Angeles, then goes on to San Francisco and north below the sea. As if this regional context were not large enough, Silver now placed it in a larger one. The East Pacific Rise, the ocean-basin spreading center away from which the Pacific Plate and other plates are moving, sinuously makes its way from the latitude of Tierra del Fuego all the way north to Mexico, where it enters the Gulf of California. The East Pacific Rise has splintered Mexico and carried Baja California away from the mainland—much as the Carlsberg Ridge has cracked open the deserts of Afro-Arabia and made the Red Sea. Baja is not moving due west, as one might guess from a glance at a map, but north by northwest, with the rest of the Pacific Plate. The cumulative power of this northward motion presses on the kink in the San Andreas, helping the mountains rise.

That much has long seemed obvious: as the two sides of the San Andreas slide by each other, they compress the landscape at the kink. It has been considerably less obvious that a compressional force accompanies the great fault wherever it goes. Until recently, the building of the Coast Ranges and the Peninsular Ranges has in no way been attributed to the San Andreas Fault. A paper published in *Science* in November, 1987—and signed by enough geologists to make a quorum at the Rose Bowl—offers evidence that the San Andreas has folded its flanking country, much as a moving boat crossing calm waters will send off lateral waves. The great compression at the kink is withal the most intense. The Coast Ranges and the Peninsular Ranges are generally smaller than the Transverse Ranges. The San Gabriels are being compressed about a tenth of an inch a year.

Why the kink is there in the first place is "not well understood." Just to the northeast, though, in the Great Basin of Utah and Nevada, the earth's mantle is close, the earth's crust is thin and stretching. In the past few million years, the geographic coördinates of Reno and Salt Lake—at the western and eastern extremes of the Great Basin—have moved apart sixty miles. This large new subdivision of the regional tectonics is in every way as entrancing as it is enigmatic. Almost all of California may be headed out to sea. Already, the east-west stretching of the Great Basin has put Reno west of Los Angeles, and it may be what has bent the San Andreas Fault.



Anne Burgess

Some of the rock of the San Gabriels is two hundred times as old as the San Andreas Fault, which has been in existence for less than a five-hundredth of the history of the world. Plates come and go—splitting, welding, changing through time, travelling long distances. Before the present North American and Pacific Plates began to work on this particular rock, Silver said, it may have been "bashed around in Mexico twice and perhaps across the Pacific before that." He continued, "It's a bedrock ridge up there. It's a weirdo wonderful block of rocks, the most complicated mountain range in North America. It includes the oldest rocks on the West Coast. The San Gabes look like a flake kicked around on plate boundaries for hundreds of millions of years."

The Santa Monica Mountains, a sort of footnote to the big contiguous ranges, stood off to the southwest of us, discrete and small. Like any number of lesser hills freestanding in the region, they were flexures of the San Andreas system. Oil people had found pay in the traps formed by such flexures. The Santa Monica Mountains were as shattered as the San Gabes. The several debris basins in the Santa Monicas had worked with varying success. People had died in their beds there, buried alive by debris.

The San Gabriels were rising faster than they were disintegrating, Silver said. The debris basins had given geomorphologists an unparalleled opportunity to calculate erosion rates. They could even determine how much mountain is removed by a single storm. On the average, about seven tons disappears from each acre each year—coming off the mountains and heading for town.

Between the geology-department roof and the San Gabriels, the city gradually rose. A very long, ramplike, and remarkably consistent incline ended in the sheerness of the mountain

wall. This broad uniform slope is where the seven tons an acre had emerged from the mountains, year upon year for a number of millions of years—accumulating as detrital cones, also known as fans. Broad at the bottom, narrow at the top, the fans were like spilled grain piling up at the edge of a bin. There were so many of them, coming down from stream after stream, that they had long since coalesced, forming a tilted platform, which the Spaniards had called the bajada.

"I used to live on the mountain front," Silver said. "By Devils Gate, at the mouth of Arroyo Seco. We could hear the big knockers go by—the three-metre boulders. The whole front face of the San Gabes is processed."

"Processed?"

"Shattered and broken. It is therefore vulnerable to landsliding, to undercutting by the streams, to acceleration by local earthquakes, to debris flows."

"Why does anybody live there?"

"They're not well informed. Most folks don't know the story of the fire-flood sequence. When it happens in the next canyon, they say, 'Thank God it didn't happen here.'"

"Why would a geologist live there?"

"It's a calculated risk. The higher you build, the cooler it is. There are great views. And at night, up there, the cool air off the mountains flows down and pushes the dirty air masses back. The head of our seismological laboratory lives on the mountain front. In fact, most of the Caltech geology department lives on the mountain front."

"Where do *you* live?"

"Way out on the fan."

Silver passed me along to his colleague Barclay Kamb—the tectonophysicist, X-ray crystallographer, and glaciologist, who discovered, among other things, the structures of the high-pressure forms of ice: ice II through ice IX. Kamb once studied the Sierra Madre Fault Zone on the San Gabriel mountain front, and walked the relevant canyons. Recently, he has been using a surging glacier near Yakutat as a laboratory for the study of how rocks move, since ice deforms in much the way that rock does. He was about to leave for Alaska when I dropped in on him in his office. His mother was there, his father, and his son Linus, who was named for Kamb's father-in-law, Linus Pauling. In a swirl of ropes, ice axes, grad students, and relatives, Kamb, who has been described by another colleague as "the smartest man in the world," tracked six conversations simultaneously, one of which summarized concisely his sense of flowing debris. "There's a street in Altadena called Boulder," he began. "It is called Boulder for a very good reason. It is subject to severe threat. Boulder Road, below the Rubio Debris Basin, is the former course of Rubio Creek. You see encroachment of human habitation in many areas like that, which are most at risk. Above the debris basins, there are crib structures in the canyons. The theory is to prevent sediment from coming out of the mouths of the canyons. I think most geologists would say that is ridiculous. You're not changing the source of the sediment. You are just storing sediment. Those cribworks are less strong than nature's own constructs. The idea that you can prevent the sediment from coming out is meddling with the works of nature. Sooner or later, a flood will wipe out those small dams and scatter the debris. Everything you store might come out in one event. We're talking human time—not geologic time." Kamb lives in Pasadena, close by the mountain front.

Just upstairs was Andrew Ingersoll, the planetary scientist. In the San Gabriels, he had lived behind the lines. In the nineteen-sixties, he moved his family into a cabin that was so far up Big Santa Anita Canyon that they had to hike a mile and a quarter just to get to their car. They leased the place from the Forest Service. When they moved in, the children were three and four. Ingersoll was an assistant professor. "My colleagues in the geology department thought I was becoming a permanent hippie," he said. "But in those days everybody was some sort of hippie." The canyon was full of crib structures, arresting debris. Ingersoll did not know how to make sense of them unless they were "an example of bureaucracy doing something for its own sake." (In any case, the small wash above the Ingersolls' cabin was unprotected.) In January of 1969, during a nine-day series of storms, twelve inches of rain fell in one night. A debris flow hit the cabin, broke through a wall, and delivered three feet of mud, innumerable rocks, and one oak to the Ingersolls. The family regarded this as

"just a lot of fun," he said, and continued, "Those little dams must have been nearly insignificant. They were based on the experience of Swiss farmers, and this may have been a totally different situation. It might have been a very poor concept to try to control the San Gabriels."

I also met Vito Vanoni, who is now a professor emeritus. A formal, small, wiry man with a husky voice and a sweet smile, he is a civil engineer, and a founding and still central figure in Caltech's Environmental Quality Laboratory. "That's an awful pile of rock and dirt up there, and we're proposing to hold it back," he said. "To do something like that is extremely expensive, but there are so many of us here to pay the bill, to protect those who insist on living up there. Our zoning is not strong enough to prevent this. The forces of development are hard to oppose. Most people who buy property in those areas never see the map and wouldn't know what they were looking at if they saw one. Very few are aware. When they see the concrete stream channels, I don't know what they think. How many people really realize why the channels are there and why they are as big as they are? You can't build a channel without a debris basin, or the debris will fill up the channel and then start sashaying back and forth. Debris basins have been built in response to the need of the community —after people have had sediment in their living rooms."

I asked Vanoni where he lived.

"Up there," he said. "Below Eaton Basin—since 1949. Like my neighbors, I figure that I'm protected. I haven't seen anything across my yard yet." After a pause, he added, "If they should have a failure up there, I'm afraid I'd get wet." There was a longer pause, then another sweet smile, and he said, "I live a hundred yards from the Raymond Fault."

—JOHN MCPHEE

*(This is the first part of a two-part article.)*

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REMARKS WE DOUBT EVER GOT MADE

*[From the Times]*

Mr. Quayle said that throughout his Southern trip, people came up to him to say, "We cannot afford to lose and to turn over the reins of government to somebody who doesn't have the qualifications and the experience to handle the national security of America."

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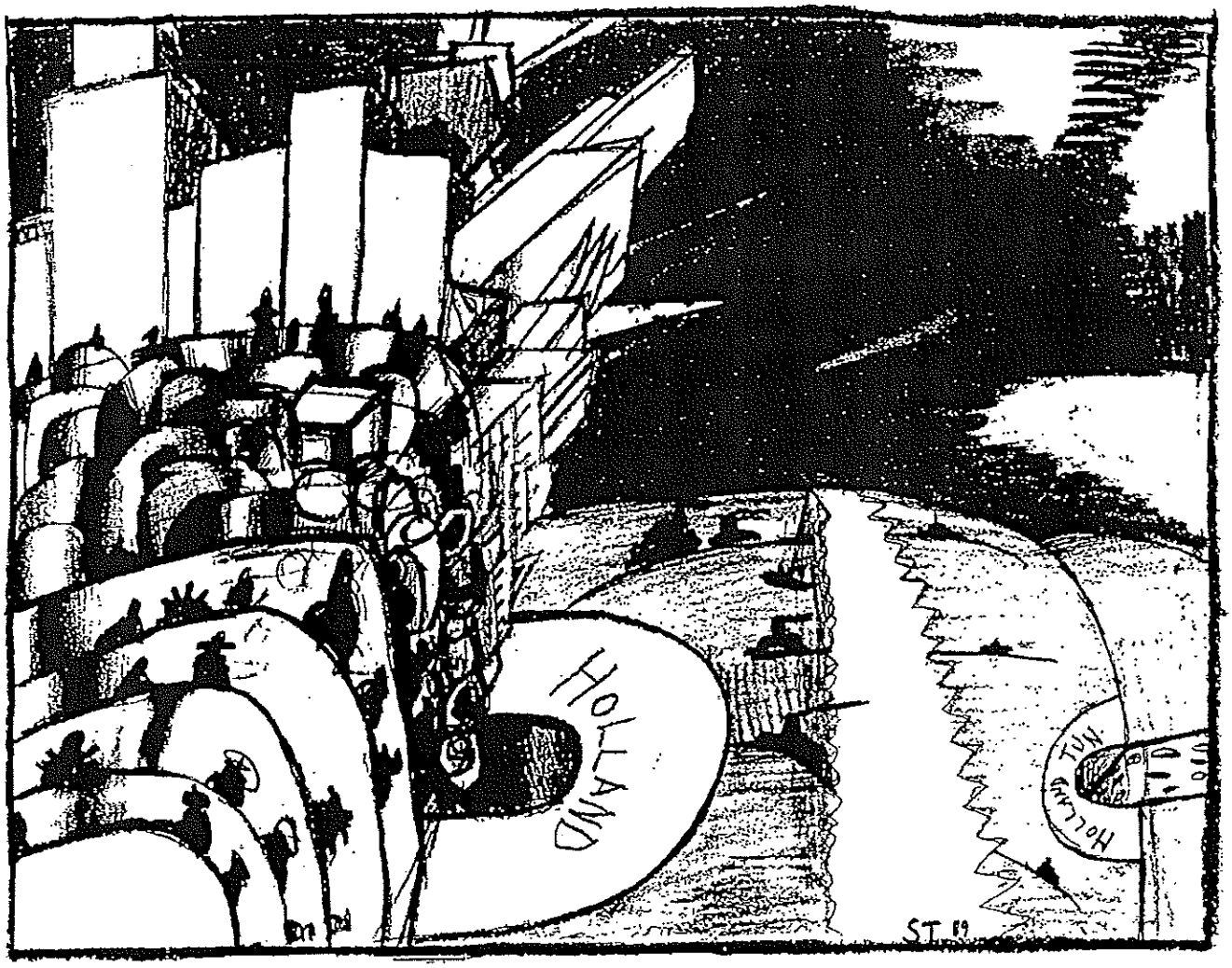
# A REPORTER AT LARGE

## CANAL STREET




CANAL STREET, in lower Manhattan, is the shortest route from an East River crossing to a Hudson River crossing on the island. To the east, Canal Street leads across the Manhattan Bridge, to Brooklyn; to the west, it leads into the Holland Tunnel, to New Jersey. Canal Street is actually an extension of Brooklyn's Flatbush Avenue and of any number of roads in New Jersey laid through the crooked alleys of downtown. The traffic on Canal Street never stops. It is a high-energy current jumping constantly between the poles of Brooklyn and New Jersey. It hates to have its flow pinched in the density of Manhattan, hates to stop at intersections. Along Canal Street, it moans and screams. Worn brake shoes of semi trucks go "Ooohhhh nooohhhh" at stoplights, and the sound echoes in the canyons of warehouses and Chinatown tenements. People lean on their horns from one end of Canal Street to the other. They'll honk non-stop for minutes at a time, until the horns get tired and out of breath. They'll try different combinations: shave-and-a-haircut, long-long-long, short-short-short-long. Some people have musical car horns; a person purchasing a musical car horn seems to be limited to a choice of four tunes—"La Cucaracha," "Theme from 'The Godfather,'" "Dixie," and "Hava Nagila." Eventually, the flow of traffic knocks over everything upright along its route—mailboxes, fire hydrants, light poles, signs. Litter, fruit, rats, pigeons, and hats it flattens and pulverizes. Smaller pieces of metal it presses into the asphalt and makes two-dimensional. House keys, safety pins, gaskets, pop tops, bottle caps, watch gears, buckles, umbrella ribs, alligator clips, and oil-paint tubes (many artists have studios nearby) shine dully in the pavement. When the traffic lets up a little—on the weekends, in the early morning—men working on the street with jackhammers erect barricades and break up the asphalt and throw it and its collection of lost objects into dumpsters and cart it away.

At either end of Canal Street, billboards on the sides of buildings take a last shot at the traffic before it gets by. Canal Street is a gantlet of billboards and signs; Courvoisier, Pearl Paint, Bally's Grand Hotel, Salem Cigarettes, Lincoln Savings Bank, McDonald's, and signs in Chinese impend on the traffic, which is covered with signs and graffiti itself. A white panel truck with "Lust" graffitied on its side in black

cuts off a Floors by Palumbo van and gets a horn blast in the back. Perk Up, Inc., of Tarrytown, gives a blast to Budget Rent-A-Truck; Taglianetti's Furniture Delivery Service blasts Palmieri Truckmen of Brooklyn; Firebird Freight stops inches from Basic Leasing Corp. ("We Lease Dishwashers and Ice Makers") and emits a bellow of rage. A yellow moving truck with the motto "On the Move Since 1873" stalls in an intersection through several changes of the light as horn blasts bounce off its side. Weekly, the billboards flicker and change. Signs painted on buildings cover each other, fade, fall in flakes, reappear. Billboards shed strips of paper. One night, the car-burglar-alarm store near the corner of Canal and Thompson began to burn when Tony, the guy who sleeps in the store, apparently set fire by accident to a dish of rubbing alcohol in which he was soaking his earring studs, and suddenly flames were all around him, and he dived out under the security gate, which he could get only half open, and soon flames were shooting clear across the sidewalk, and the Fire Department came, and Tony was shivering on the street in a Black Sabbath T-shirt among the hoses saying, "I know I'm fired. I've already accepted that," and I brought from my apartment an old down vest and gave it to him, and he said, "Hey, this is comfortable. How much do you want for it?" and we stood and watched as the flames reached the big letters "Auto Alarms" on the top of the store, and they began to burn smokily, and the firemen on the roof knocked them off with axes, and they fell to the sidewalk and burned themselves in scrambled order into the chalk-white cement.

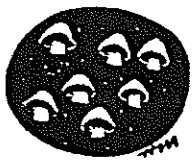
I lived two doors down, in a loft above an Army-Navy-surplus store. The next night, burglars came through the burned-out building, climbed our back fire escape, got into a second-floor storeroom, and stole several boxes of boots—all left feet, as it turned out. When my landlord, the proprietor of the Army-Navy-surplus store, learned this last fact, he was almost happier than if he hadn't been robbed in the first place. The landlord is from Romania. His first name is Hugo, but he calls himself Gary; once I asked him where he got that name, and he said, "A chick gave it to me." Gary is Jewish, but he has an alternative set of business cards printed with an Arabic-sounding alias to give to people who might not like Jews. The surplus American Army shirts he wears at work generally have a name like "McCoy" or "Seagraves" over the breast pocket. When people he doesn't want to talk to come into his store looking for the owner, he tells them, "The owner is in Africa."

The unit of exchange on Canal Street is the dallah. Dallahs are dollars crossbred with dinars, pesos, yen, dirhams, zlotys, rubles, piastres. Salesmen in storefronts and sidewalk venders who know almost no other English yell "Fifty dallah!" and "T'ree dallah!" and "Ten dallah!" up and down the street. Dollars often exist only on paper or video-display terminals; dallahs are always real. Dallahs are green, of small denomination, faded, crumpled, marked with ink and duck sauce and fingerprints and smears of blood. Dollars are carried in a bankbook or a wallet; the proper way to carry dallahs is in the right-front pants pocket in a folded wad with a red rubber band around it. When I ask Gary to lend me forty, he says, "Take sixty." He pulls his wad from his pocket and peels off three twenties. Then he stands looking at me with his eyebrows raised and his thumb poised above the bills, in case I might want more. He says, "All you got to do is ask." He says now if he gets robbed that's sixty he won't lose. Dallahs suggest robbery. To defend against it, Gary takes elaborate measures, which include surrounding himself with Doberman pinschers named Prince and Contessa and a Rottweiler named Spirit. Prince is Gary's favorite. One day, Gary and Prince chased a suspected shoplifter from his store into a deli, where I was standing in the checkout line. Prince was hanging from the guy's sleeve, and Gary was beating the guy's head with a varnished brown billy club. The expression on Gary's face looked like one you might make to frighten a child. He was screaming from down in his throat. Shortly afterward, Prince was stolen. A photograph of Gary with tears in his eyes holding up a reward check for a thousand dollars for the return of his dog appeared on page 4 of the *Post*. The next day, Prince was returned by a man who took the precaution of arriving with a police escort. Gary asked how much he wanted, and he said he'd take five hundred. Gary wrote him a check.


Canal Street, which jury-rigs Brooklyn to New Jersey, is the place to go if you want to jury-rig something. Stores on Canal Street sell a lot of duct tape, extension cords, plastic sheeting to put over your windows in the winter, stapling guns, twine, plastic wood, miracle glues, quick-drying epoxy resins, and multi-plug connectors. The street carpenters all kinds of shaky combinations. In hot weather, the passing traffic with its windows down blasts from many speakers a mixture of songs, like a radio dial being spun. Near the corner of Canal and Broadway is a store that used to sell luggage, jewelry, and takeout Chinese food but now just sells luggage. Another store sells plastic sheeting and imitation classical statues made of fibreglass. The nymphs and dryads and goddesses are displayed out front, chained to a security grate with bicycle locks around their necks. At Christmas, an automotive store at Canal and Hudson used to run a string of Christmas lights through the coils of razor wire above the fence surrounding its collection of old tires. Gary is not big on Christmas decorations. One year at Christmas he hung a white dove above the cash register from a strip of flypaper. Gary's store used to be as hodgepodge as any on Canal Street, with bins of gay and straight porno books, Statue of Liberty paperweights, needle-nosed pliers, and underwater wrist compasses for skin divers. Now he sells mainly Army-Navy surplus and survival gear. Among his most popular items are defused Second World War hand grenades. He sells two kinds—good and rusty. Sometimes I could hear him calling on the loudspeaker to an assistant in the storeroom beneath me, "Danny. Bring me two *good* hand grenades, and two *rusty* hand grenades."

Some of what I know about Gary: he

is forty-three years old; he lost relatives in the Holocaust; he spent a happy childhood in Israel, with a car, girls, trips to the beach; he lived for a time on a youth kibbutz, where boys occasionally swam naked with American girls; he moved without his family from Israel to New York to Canada; he once had a job in Toronto making the molds for three different sizes of Tek plastic toothbrush handles; he is handy with locks; he moved back to New York after his family moved there from Israel; he likes living in Forest Hills, Queens, because every morning on his lawn he sees ("Danny, what are those things I see in my yard, that I like?") squirrels; he has two brothers, one who manufactures corrugated-cardboard boxes and one who has been a caretaker-cashier in an S & M club; he works six or seven days a week, from ten in the morning to seven at night; he smokes cigars so strong that I could smell him coming up the stairs; he wears a little gold hand grenade on a chain around his neck; he likes to eat yellow rice from the Cuban restaurant, and it leaves a mustache; he has no real laugh, just a loud bark of sarcasm, triumph, or joy; his father was a scrap-iron dealer named Leo. I got to know Gary a first-day-of-the-month at a time, as I brought him my rent. One April 1st or October 1st, he said to me, "I should get married—it's time." He began to subscribe to a publication called *Jewish Singles*, which he received at our building. One night, a friend who was visiting me saw *Jewish Singles* by the mail slot as he was leaving, took it home, and then called me to read me excerpts. I made him bring it back. At a dance, Gary met an American girl some years younger than he, and they were married. They named their first son Leo, after Gary's late father. Leo is now nine. Gary says, "When I bring him to Canal Street, I want to attach him to me by handcuffs."

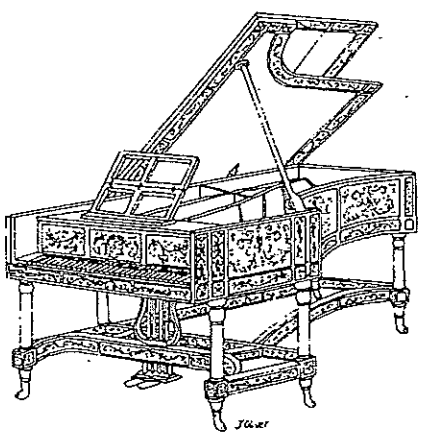


On sunny weekends, Gary's store is so crowded that you have to turn your shoulders sidewise and sidle through. Gary's men Danny, Ezra, Mark, Kabul, Jeff, Eric, Walter, and Abbas watch the crowds. Customers Gary especially mistrusts do their shopping surrounded by his men, more or less in custody. From a raised step behind the cash register, Gary says to me, "See those bleck guys—they're t'ieves. If you ever see those guys around here, call the police. Danny. Abbas. Will you help these gentlemen, please? That white guy, with the earring, he's a junkie. He beats that girlfriend with the sexy T-shirt. He wanted me to sell him some Mace, I said, 'I'll sell Mace to her, not to you.' The Japanese kid there—A No. 1. Japanese A No. 1 people in the *world*. He will spend a hundred and fifty dallah, at least. Japanese, I kiss their foot. That guy with the hat, he's a lawyer, a Chassidim. He's a rich guy, he don't want to share, always wants me to give him some kind of deal. He's hungry, like a typhoon. That other guy's a lawyer, too. He's sharp, are you kidding me? He's English, like the Beatles. (Yes, Zippo lighter, best lighter you can buy, it will burn for twenty years. Don't forget your brochure. Thank you.) That big guy? With the big hands, like baseball gloves? He's Russian, came over to Brighton Beach ten years ago, now he's the toughest landlord, the best landlord, in New York. Compared to him, I'm like a baby sheep. When the tenants don't pay the rent—POW!—he smacks them in the head. Russians don't play, you know. See those two guys? Out on the street? They'll come in in a minute. They're Arabs—P.L.O. They speak Yiddish ten times better than me. They buy a lot of stuff here—clothes, equipment—but no knives or nothin'. I know they would probably kill me, but then business is business."

Although the people Gary is talking about are only a few feet away, they don't hear him. Gary not only speaks several languages—Romanian, English, Yiddish, Hebrew, Greek, some Turkish, some Arabic, some Spanish —but also speaks in several frequencies. He has different channels for conversations with suppliers, customers, employees, and members of his family. In situations where he does not want to use words at all, he resorts to an ultra-high frequency consisting of eye gestures, winks, and headshakes. These signs might mean Yes, No, Shut up, Look out, or I'll explain later. One day, some atmospheric scientists down in Delaware were performing cloud-seeding experiments on a thunderstorm and perhaps the storm got away from them because one came up the coast and

hit New York City at about eight in the morning and dropped more rain than had ever fallen on the city on that date in the history of weather reporting. I was lying on my bed looking out my back door at the fire-hose stream coming from the broken drainpipe of the neighboring building and listening to the rain on the fire escape when suddenly I realized that some of the falling-water sound was coming from inside my apartment. I got up and saw water coming through my ceiling everywhere. I was on the third floor, with two floors above me. I ran to the roof, which is flat and bordered by a waist-high wall, and found it knee-deep in water. I ran down and got Gary, and we waded back onto the roof, and he reached his arm into a drain up to the shoulder and fished some trash out of the filter, and the water formed a big whirlpool and roared down the drain. A few moments later, we heard small cries from the street. The storm drain in the building's basement, unable to take such a volume of water, had instantly backed up, and two guys working in a little room down there had almost drowned in the flood. Thousands of dollars' worth of stuff Gary had stored in the basement was ruined. The tenant on the fifth floor, a costume designer, lost a lot of property, including several life-size frontal male-nude portraits, which he valued at some thousands of dollars each. The costume designer asked Gary to pay for the damage. Gary called his insurance man, who came by and took a tour of the costume designer's apartment with an expressionless face. Back on the street, he said to Gary, "Did you get a load of those naked guys!" and he began to laugh. The insurance company supposedly refused to pay for all the damage. Gary offered the costume designer a smaller amount than he had asked for. The costume designer refused it, and sued Gary. Gary sued him back. Gary offered him money to leave, and he also refused that. One afternoon, someone broke into the costume designer's apartment and slashed up what remained of his stuff. The costume designer said he was sure Gary was responsible, and I said I could see how he might think that. Gary called me into his store and said, "How could you *say* such a thing, I would never *do* such a thing." I said, well, O.K., but now I was worried about my apartment. How did I know a break-in like that wouldn't happen to me? With the tiniest of gestures, just between me and him—a slight downturning of the corners of the mouth, a hooding of the eyes, a shake of the head—Gary indicated that it wouldn't.

BEFORE Gary bought the building, in 1976, it was the Knickerbocker Candy factory. Some of its pipes ran caramel, and there were gobs of crystallized caramel on the walls. When I moved in, my floor still had hundred-pound sacks of imitation coconut flakes lying around, no john, and no door. Back then the rent was three hundred and twenty-five dollars a month. Strangers used to walk in and ask me how much rent I was paying, and when I told them they would laugh in my face. Now a rent that low in this neighborhood would be unheard of. I had to hire a dumpster to get rid of all the candy-factory relics in my place. At first, I used the john at the Mobil station across the street. Then I hired a guy named Larry to install a bathroom. Larry was from Brooklyn, and he said he remembered visiting this building on a field trip when it was a candy factory and he was a kid in elementary school. He charged me eight hundred dollars, which I asked my mother for. She said she would be glad to help, and when I said how much I needed, her mouth dropped open. But afterward she gave me a check, enclosed in a greeting card. For a few years, I had just a bathroom and a bed and a phone —no kitchen, no TV or stereo. In the blackout of '77, I hunted all over the floor in the dark for the ringing phone, and when I found it, it was my mother calling to be sure I was all right. Eventually, I put in a new floor, so that it was possible to walk without shoes on, and a kitchen, and walls around the bathroom. The neighborhood, meanwhile, was getting tonier and tonier, and rents were climbing, and I could see Gary calculating. I had a five-year lease, but after three years I told Gary that I could afford to pay more. I said that from then on I would pay a hundred and fifty dollars a month more. Gary's eyes softened with wonder and love. To this day, he says, "Sandy, you don't know what you did to me. You touched me here"—with a finger to his sternum, next to the nametag that says "McCoy."



At the time, people told me I was crazy to raise my own rent. But it turned out to be one of the smartest things I've ever done. After the flood, the building entered a long period of feuds, suits, and countersuits, which I was able to stay out of. The feud between Gary and the costume designer went on for years. The guy on the fourth floor—below the costume designer, above me—also sued Gary over the water damage, and Gary alleged in a countersuit that the trash that had clogged the roof drain and created the whole problem had been left there by that guy in the first place, when he used to lie on the roof and sunbathe. Because just a single layer of boards constituted both my ceiling and that guy's floor, I knew him well, although we rarely spoke. I could hear when his cat jumped off his kitchen counter. The fights the guy had with women no amount of pillows on my head could drown out. Sometimes he and the women threw crockery at each other, and shards rained down on me through holes in my ceiling. The guy was a technician for a television studio when he moved in, but later he became possibly a drug dealer, possibly some other kind of criminal. His telephone rang non-stop. Once, it rang so long it made me fret and start to pace around. I decided to time it, and the continuous rings went on for twenty minutes, thirty minutes, forty. I was now breathing hard and talking to myself. I stood up on a ladder and looked through a hole in the floor. By standing on tiptoes I could just make out his phone, ringing away on the wall. I happened to have a long section of half-inch copper pipe, which the plumber had left, and experimentally I pushed it through the hole, past his chair, past his kitchen counter, past his dish drainer. The pipe was just long enough to reach the bottom of the phone receiver. I lined everything up

as if this were a long pool shot. With a little tap, I knocked the phone off the hook, and it swung and dangled from its cord. The silence was sweet. Then I began to feel guilty. I wrote the guy a note explaining what I had done, and left it on his door. I heard him come home at about three in the morning, I heard him unfold the note, I heard him laugh. A few minutes later, a note slid under my door. The guy was a fan of Pauline Kael, and she had heavily influenced his prose style. He said he imagined the building's plumbing in "a macabre, twilight zoney revolt of anthropomorphic metals." I couldn't think of anything to respond, and did my best to avoid him for the next several years.

WALKING east on Canal Street from Gary's building, you might have passed an electronics store with a pile of computers in the trash out front and a man picking through the pile, yanking out panels of circuitry like honeycombs from a hive; a onetime nice diner now taken over by heaps of VCRs and clock radios and radar detectors in cardboard boxes sold at cut rates by a family of Moroccan Jews who wear headphones outside their knit caps and park illegally during rush hour and litter the sidewalk with packing material and call their store "Big Zubby," which means something dirty in Arabic; the 3 Roses Bar, which changed the color of its crêpe-paper decorations for each holiday, and which used to be filled with black working people and then began to attract young white people and then moved to 311 Church Street; a flea market in the parking lot next to the post office with gilt picture frames priced at five dollars each accidentally framing the Day-Glo graffiti on the wall behind them; Uncle Steve, a TV-and-stereo store where the owner did his own radio commercials, which ended "I *lo-o-o-o-ve* you"; Ollie (Something), a tall West Indian man in a leather skullcap who sold old record albums and old copies of *Playboy;* the intersection of Canal and Broadway, a famous intersection, which has appeared on television, in movies, and in a realistically detailed sculpture by Red Grooms now on display at the Cleveland Museum of Art. In the next block, Chinatown begins. The Excellent Dumpling House, near the corner of Canal and Lafayette, announces it with the ozone smell of oil heating in a wok. If the time is between October and New Year's, Christmas carols in Chinese are playing from the leather-goods, makeup, jewelry, and videotape store by the Lexington Avenue I.R.T. subway entrance. Carp show the red of their gills as they gasp in the milky water of a big metal tank in a seafood store at the corner. One carp swims upside down.

Farther on, you might have seen Chinese-vegetable stands, with their crates of non-supermarket produce—lotus root, and white carrots, and green carrots, and Chinese chives, and water chestnuts, and wrinkled bitter melons —which the people who work there are sick of telling tourists the names of; a store that sells mostly shellfish, and has a wooden counter full of sea-colored lobsters writhing in very slow motion beneath a sign saying "$6.50 LB. NO PICTURES"; sidewalk venders selling live crabs and assorted mushrooms and pieces of dried shark stomach; a sign advertising the House of Watch; lots of jewelry stores, with clerks in the windows arranging necklaces on velvet stands shaped like headless necks; black security guards in front of the jewelry stores flirting with women wearing gold charms in the shape of the Dominican Republic; a shopping arcade where (according to the *Times*) young ethnic-Chinese refugees from Vietnam hang out between errands of extortion against local businesses, which they perform for the Chinatown gangs. Police think some of the refugees belong to a gang that killed two members of another gang in 1988 near 269 Canal. If the time is between Memorial Day and the Fourth of July, Chinese kids and Italian kids wearing white shorts, sneakers, no shirts, and towels around their necks try to sell you fireworks. The sidewalk here is narrow and polished smooth by feet. Some days, the crowds are so thick that people come to a complete stop and stand and wait.

Just beyond the intersection of Canal and the Bowery, across an asphalt expanse of traffic lanes and concrete dividers and yellow stripes painted on the pavement, is the arch at the entrance to the Manhattan Bridge. Traffic going to and coming from the bridge drives on ramps around long, columned wings extending from either side of the arch. Depending on the time of day, traffic going one direction or the other

drives under the arch itself. The arch is maybe forty feet high, embellished with goddesses of victory, shields, fasces, tridents, spears, flags, helmets, winged lion heads. Across the top of the arch, in bas-relief, is a frieze of Indians on horseback hunting buffalo. The Indians draw their bows all the way back among a galloping herd of adults and calves. One horse prances on its hind legs. At the keystone of the arch, a buffalo head looks down on the tops of passing trucks. An afterthought of twin steel cables stretched from one leg of the arch to the other holds yellow traffic-signal boxes. Along the wings of the arch, in between the columns, people with no place to live store folded-up cardboard cartons, plastic bags of clothes, a laundry cart, sneakers, a broom. Sometimes sanitation men come along and clean this out, and then all that is left, on a ledge at the base of a column, is a single plastic vial of those scented oils people sell in the subway. Windrows of trash pile up on one side of the traffic dividers that route the cars coming off the bridge. As you approach, pigeons leap from the trash like flames.

Actually, Canal Street does not stop at the bridge but angles off to the east for eight blocks. Here it is not an artery but just a Lower East Side street. Guys lie in it to work on their cars. The gutter holds blue safety glass from a shattered car window, birdseed, a squashed gherkin, puddles of fluorescent-green radiator coolant. Nobody yells at trucks that double-park. A Chinese man standing at the back of a truck loads garments that come to him down a long cord strung directly from the truck to a window on the top floor of a nearby building. Pastel sports shirts on hangers descend one after another in five-story swoops. On this part of Canal Street, Chinese businesses mix with kosher delis, locksmiths, upholstery stores, and Chassidic hardware stores, which are closed on Saturday. Just below Canal is a network of narrow streets centuries older than the bridge roaring above them. It is Chinatown, but not the part where conventioneers come to eat Chinese food. Some of the side streets are so narrow they barely have curbs, much less sidewalks. Flatiron buildings almost small enough to put your arms around occupy tiny wedge-shaped lots. Gentrification has left this place untouched; rents here are probably about the same as they were in Carthage, or Nineveh, or Peking under the Tangs. Shoes have worn shallow depressions in the stone of apartment-house steps; hands have polished the paint off railings. Ancient paint on door lintels is cracked and ridged like alligator hide. This is the basic city that people have always lived in, of which the rest of New York is only the twentieth century's approximation. Market Street, which runs parallel to the bridge just south of it, angles down to the blue of the East River like a lane in a seacoast town.

In the Sun Sing Theatre, on East Broadway directly under the bridge, in the middle of the day, two dozen Chinese men in white short-sleeved shirts are watching a movie about the adventures of a fisherman from mainland China who comes to visit his more sophisticated relatives in Hong Kong. Outside, little kids with backpacks and with the hoods of their jackets drawn tight around their faces run to meet their mothers. Some teen-age kids walk by singing a song about you've tried the rest, now try the best. Big yellow Chinese characters painted on the sidewalk translate as "Seriously no park car." In a store on Henry Street filled with small, bright birds in wooden cages, two men unroll and discuss an illuminated Chinese scroll. Sparrows on a fire escape across the street answer the birds singing through the open door. A few doors down, guys in red smocks are laughing in a printing store that sells mainly Chinese-restaurant menus. A boy goes by wheeling a long-haired white cat in a wheelbarrow. At the corner, a woman cobbler has set up her bench. She bends over and saws at the heel of a burgundy leather boot while its wearer holds on to a street sign for balance. A mounted Norman Rockwell print of a red-cheeked cobbler leans against the wall nearby.

WALKING west on Canal, away from Chinatown, toward the Hudson River, you can understand why people who drive this street become so upset. In the course of its half mile or so, they are going a long way—from the Old World to the New, or vice versa. If the eastern end of Canal Street is Nineveh, its western end is Brasília. When you head in this direction, each intersection seems a little less ethnic than the one before it, and there is a scent of the American continent up

ahead. At certain times of year, the red sun sets right at the end of the street. Westward, the buildings get bigger and farther apart, with growing vistas of sky between. The light and the space probably tempt drivers to think they are about to soar onto one of those empty skyways of the car commercials, when in fact they're not. At the river, just beyond the cars speeding by on the West Side Highway, the island ends like a piece of paper on a table. A plaza at the foot of Canal is empty except for some cars and a collection of snowplow attachments the city has lined up in rows. Fewer horns honk here. On the opposite bank, you can see the lights of Jersey City and Hoboken and farther upstream. The water is unoccupied, the sky as big as any in Manhattan. Eighty years ago, right at the river's edge is where the worst traffic jam was, as cars, trucks, and horse-drawn wagons waited to get on the several ferries across. The sky and the water here used to be almost invisible for the piers and shipping warehouses. Now a few splintery pilings are about all that remains. As the sun goes down, the sky becomes a darker blue, and you can make out the lights of airplanes at different altitudes above Newark Airport.

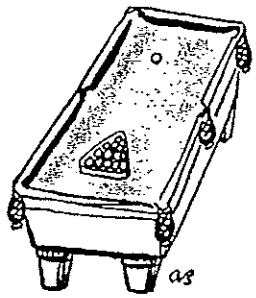
Westbound traffic on Canal Street does not soar but instead descends slowly three blocks from the river into the entrance to the Holland Tunnel. Few tunnel-bound cars have any passengers besides the driver. Guys prop the *Post* on the steering wheel and read as they wait to roll the next few feet. Traffic reports on the radio sometimes predict delays of over an hour. Weighted yellow cylinders hanging from a cable just before the tunnel entrance bump the top of any truck taller than twelve feet six inches, and an electric eye sets warning bells ringing, and brings a cop running from a little booth. A sign above the entrance says "12'6" WE MEAN IT!" In fact, clearance in the tunnel is thirteen-six, but the tunnel authorities leave themselves an extra foot in case a broken vehicle needs to be jacked up for repairs. Trucks roar and creak their way into the tunnel, and give off enough exhaust to make the air here some of the most heavily polluted in the city. Set back in a niche at the tunnel entrance, like a man eternally waiting to cross, is a bronze bust of Clifford Milburn Holland, the engineer who designed the tunnel and worked himself to death building it.

Clifford Holland was born in 1883, in Somerset, Massachusetts. Among his ancestors were Puritan ministers who came to New England in the sixteen-hundreds. Holland graduated from the Cambridge Latin School in 1902, worked his way through Harvard, got a degree there in civil engineering in 1906, and came to New York to work on tunnels. As tunnel engineer with the Public Service Commission, he built four double-tube subway tunnels under the East River that the B.M.T. trains run through. In 1919, partly to relieve traffic congestion downtown, a new agency called the New York and New Jersey Vehicular Tunnel Commission decided to build a tunnel under the Hudson River, from Canal Street to Twelfth Street in Jersey City. They hired Holland as chief engineer to design and build it. At the time, Holland was probably the country's leading expert in the shield method of tunnel construction. This method uses a steel-plate cylinder, or shield, which is driven into the earth by powerful jacks at its back edge while men remove the rock and the dirt in the middle. As the shield advances, a tunnel wall of iron rings is set in place behind. One benefit of the method is that the shield can be divided into sealed compartments, and filled with compressed air to counteract the pressure of water; that allows subaqueous tunnelling through wet substances like silt. The bottom of the Hudson is many feet deep in tiny particles of granite, sand, and basalt eroded from the rocks along its banks—"plain, black mud," as Holland described it. Holland's plan called for two parallel tunnels, one for eastbound traffic and one for westbound. In October of 1922, the first shield began digging toward New Jersey from the intersection of Canal and West Streets. The joint tunnel commission had budgeted twelve million dollars for the project, and paid Holland a starting salary of ten thousand dollars a year.

The Holland Tunnel was the first tunnel in the world designed for motor traffic. Holland and his staff spent a lot of time finding a way to get combustion gases out of the tunnel, and finally

devised a system using ventilating shafts, giant blowers, and ducts below the roadway and in the ceiling for outgoing and incoming air. Like many of the automobile drivers in the Canal Street traffic jam today, Holland was a commuter. He belonged to the first generation of men who drove to work from the suburbs in cars. Holland lived in Flatbush, in a three-story house with a yard and a driveway, at 2416 Avenue J. He had a wife, Anna, and four daughters—Anne, Clarissa, Venita, and Lydia. Lydia was only a year old when digging on the tunnel began. Today, Holland's old neighborhood is occupied mostly by Hispanics and Orthodox Jews. Crowds of strollers with clear-plastic covers fill the crosswalks at eleven in the morning, and the only trash among the well-trimmed hedges is an empty bottle of a vitamin that claims to improve fertility. Nothing about 2416 distinguishes it from hundreds of other brick-and-stucco houses extending for miles along Avenue J.

There is no reason to expect that a man who built a famous tunnel should be remembered, or that the house his body was brought back to should have a plaque in the yard. The urge to tunnel is partly an urge to disappear, and its product, no matter how monumental, is visible only from the inside. People have written scores of books on the Brooklyn Bridge and its engineers, the Roeblings; the only book on the Holland Tunnel is a sixty-eight-page volume put out by the company that built the tunnel's ventilating fans. One of the authors of that book visited Clifford Holland inside the tunnel, and described him joking and relaxing in the pressurized air of the shield's forward compartment while work went on around him. In photographs aboveground, Holland appears as an inconspicuous business-suited man of less than average height with a bullet-shaped head, sloping shoulders, and rimless spectacles. His body angles slightly away from the camera; he seems to blink in the light. It is hard to avoid the observation that he looks like a mole. "Head Mole" was how the newspapers sometimes referred to him. Tunnel workers liked him. Construction bosses said that Holland could persuade them to efforts that no one else could.



Digging tunnels is so difficult and dangerous and unlike other kinds of work that it amounts to a vocation. The laborers who do it call themselves sandhogs. Because of the physical demands of the job, and because the sandhogs often worked in the shield's forward compartment under air pressure up to fifty pounds per square inch, they had to pass regular physical exams. They were not supposed to be over thirty-nine, but many were. Working in pressurized air is enervating, and the sandhogs' union would not allow shifts of more than four hours; as the pressure went up, the shifts became shorter and the pay greater. The highest-paid sandhogs earned eight dollars and fifty cents a day. Under the river, beneath bare light bulbs in the advancing shields, with the smoke of blasting hanging permanently in the gloom, and the racket of pneumatic grouting machines echoing off metal walls, the sandhogs picked and shovelled at the slaty gray bedrock. In this intense, pressurized atmosphere, a cigarette burned down to a butt in three puffs, and it was impossible to whistle. Entering or leaving pressurized air, the sandhogs had to pass through an air lock to accustom their bodies to the change. A sandhog who became impatient to go home and left the air lock too soon was liable to get the bends, a painful and occasionally fatal condition produced by bubbles of nitrogen in the blood, which could make him stagger as if drunk, fall down, and lose consciousness. Sandhogs wore medical ID bracelets around their wrists in case they should be overcome by the bends away from the job.

Sandhogs are a tribe, with their own rituals, myths, and hero tales. Many sandhogs are related to one another. Sitting in the air lock, or showering after their shift, or drinking in a sandhogs' bar, they tell stories. The favorite sandhog hero tales are about men who have been in blowouts and survived. A blowout is a catastrophic event in tunnel construction which occurs when the pressure of air inside the shield suddenly becomes greater than the water pressure in the material the shield is tunnelling through. If the

shield happens to hit a seam or a bubble or a weak spot underground, the pressurized air in the shield will sometimes blow right up through the river bottom, through the river, and into the sky in a tall geyser, taking men and equipment with it. Among the most famous sandhog heroes was a man named Marshall Mabey, who survived a blowout that shot him through yards of river bottom and onto the top of a geyser twenty-five feet above the East River during the construction of the I.R.T. subway tube to Brooklyn in 1916.

When the Holland Tunnel was built, it was the longest subaqueous tunnel in the world. New York and New Jersey both ended up spending more money on it than they had ever spent on a local work before. The tunnel used a hundred and seventeen thousand tons of cast iron from mills in Pennsylvania, hundreds of miles of steel reinforcing rods, eight hundred thousand ten-pound bolts, a billion five hundred million board feet of lumber from Georgia and Oregon, steel-and-concrete caissons made in Staten Island, granite paving from New England, and concrete from Cementon, New York. It employed seventeen hundred men (including the undaunted Marshall Mabey). At the height of construction, six shields were digging the tunnel and its approaches —two shields heading west from Manhattan, two heading east from New Jersey to meet them, and two more digging land entrances in Jersey City. Work went on seven days a week, twenty-four hours a day. After spending all day at the site, Holland often came back in the evening to see how work was progressing.

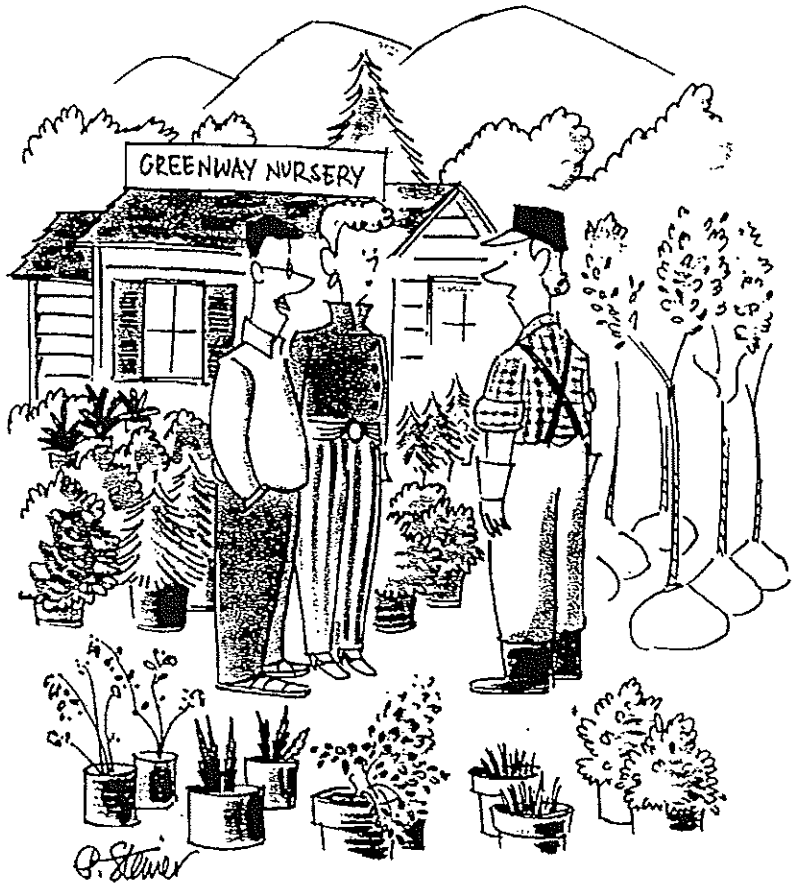
In Manhattan, the work went slowly. The two shields—the second one began digging from the corner of Spring and West Streets in April of 1923—took many months to go the few hundred feet from their starting points to the edge of the island. The problem was that their routes underground led not through natural mud or rock but through all kinds of miscellaneous landfill and rubbish that Manhattanites had been dumping along the edge of the island to enlarge it for over two hundred years. There were no records of when this land was filled or what it was made of, so Holland did not know what to expect. Mostly, the fill consisted of waterlogged cribs of immense rough-hewn planks enclosing piled-up heaps of granite in chunks. In the high air pressure needed to hold back the sand and the ooze, sandhogs sawed the wood and blasted the rocks. A canal that had been dug in 1805 to drain a pond where Foley Square is now—the canal that gave Canal Street its name—apparently also washed a lot of rock and brick and ancient refuse to the river's edge. Before or after the canal was covered over, in 1820, it was lined with bricks, to make the largest storm drain in the city. Holland had to reinforce these old bricks with iron plates as he tunnelled carefully past. He also came within five feet of a cofferdam at a sewage-treatment plant at West Street, and almost as close to several gas lines, water mains, and electric cables. Some days, the shields moved forward only a few inches, or not at all. Holland said that every foot of tunnel progress in Manhattan was a new story.

On the New Jersey side, where sedimentary mud was hundreds of feet deep, Holland expected progress to be much more rapid. But there his biggest problems turned out to be aboveground, in the form of the New Jersey Interstate Bridge and Tunnel Commission. This group was half of the New York and New Jersey Vehicular Tunnel Commission. A nine-member commission from New York made up the other half. The two halves did not get along. The chairman of the New Jersey commission was a man named T. Albeus Adams. He praised the project with a speech to the effect that this tunnel would be like Lincoln's proclamation freeing the slaves, but even before digging had begun he was accusing the New York commissioners of denying him adequate desk space in the offices the commissions shared, on


Centre Street. This dispute continued for some time, until an acceptable desk was installed. A more serious argument had to do with the tunnel entrance in Jersey City. The New Jersey commissioners thought its design insultingly small; they wanted a big plaza, and widened streets leading to it. The New Yorkers thought the Jerseyites were trying to improve their city unnecessarily at the tunnel's expense. Whenever the subject of street widening came up at joint commission meetings, people shouted and stalked out. Neither side would yield. New York prepared to sue New Jersey in federal court; New Jersey said that the governors should step in. Holland and a consulting engineer on the New Jersey commission devised a compromise plan for the plaza, which both sides seemed to accept. Then the commissioners disagreed about the construction in the plaza of a ten-thousand-dollar stone-and-bronze monument honoring both commissions, which New Jersey said was New York's idea and New York said was not. The delay continued. Finally, Holland and a small crew secretly went out to Jersey City just before dark one evening and broke ground for the tunnel themselves. One of the Jersey commissioners referred to this as a "contemptible, mean trick" seven times at a commission meeting. Later, when workmen tried to do further tunnel construction on the Jersey side, the Jersey City police stopped them for not having the proper permit. Eventually, months behind schedule, work in New Jersey did begin. The joint tunnel commission had long planned an elaborate formal groundbreaking there, with ten thousand guests and President Harding to attend. When the time came, the two sides of the river were so fed up with each other that the celebration was cancelled.

After tunnelling through Manhattan landfill all winter, the shield that had started from the intersection of Canal and West Streets entered the silt at the bottom of the Hudson River. Here progress went five times as fast. When the shield was well out under the river, eleven hundred and thirteen feet from its starting point, it encountered a wall of rock extending in front of it for eight hundred feet. This rock was Manhattan schist, part of a formation that extends to the Jersey Palisades

upstream. Progress again slowed, from twelve and a half feet a day to less than a foot. The shield digging the parallel tube west from Spring Street hit the same rock a month or so later. Because the rock face did not extend all the way to the ceiling of the tunnel, Holland had to be especially careful in gauging the force of the dynamite charges he used. The blasts had to be strong enough to break the rock without damaging the shield or disturbing the silt at the ceiling. Despite precautions, at 7:45 A.M. on April 3, 1924, water began streaming through a hole in the two feet of silt at the ceiling of the Canal Street tube. Sandhogs tried to stop the hole with bales of hay, but, in a sudden hiss of escaping air, it grew into a tear twenty feet long. As water gushed into the shield, a foreman, David Brown, shouted, "Run for your lives, men!" Thirty-five sandhogs scrambled through the shield's escape hatch and up the tunnel with the incoming river at their heels. Meanwhile, a fifty-foot geyser of compressed air shot through the hole and into the sky over the Hudson, nearly capsizing a cement barge. The sandhogs made it up the slope of the tunnel before the water, and no one was injured. Additional air pressure drove the water from the tube, and the hole in the river bottom was plugged with two bargeloads of clay.




*"I think we're ready for a tree."*

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In addition to solving engineering problems never before encountered in tunnel construction—such as anchoring a ten-thousand-ton caisson for the west ventilating shaft to bedrock through two hundred and fifty feet of riverbed muck, and designing metal joints so the tunnel could move fractions of an inch with changes of temperature and the action of the tides—Holland continually had to explain things. He had to explain why a concrete tunnel, championed by T. Albeus Adams, would probably float, and why two smaller tunnels were better than one big one, and how the money spent on the New Jersey entrance plaza was actually more than that spent on the Manhattan plaza, and why work was going so slowly in Manhattan, and why it made more sense to hire an experienced tunnel-construction firm rather than an inexperienced one championed by T. Albeus Adams, and why the tunnel was going to cost sixteen million dollars more than the original estimate (it eventually cost a total of forty-eight million dollars), and why he refused to allow an engineer hired at the urging of a New Jersey commissioner to leave work for a week to get out the vote for the Hudson County Democratic organization. Over and over, he explained to people worried about carbon-monoxide poisoning how the tunnel's ventilation system would work; when a traffic jam in a tunnel in Pittsburgh ended with hundreds in the hospital, he explained why that couldn't happen here. As the tunnels reached midstream, construction sometimes delayed the departures of cruise liners, to the annoyance of society swells on board. In detail, Holland explained the routes through the construction that cruise ships could take, and why the mounds of clay on the river bottom that they had to avoid were necessary to protect the workmen below.

By the late summer of 1924, the shields tunnelling west from Manhattan were within a few hundred feet of the shields coming east from New Jersey. Everyone awaited the "holing through"—the moment when east and west shields would meet and the first tube would finally go all the way from one end to the other. Newspapers said that the tunnel was approaching its zero hour, and that the engineers were lying awake nights worrying that the meeting would not be exact. Tunnelling simultaneously from both sides of the river, Holland was like a person drilling holes through opposite sides of a block of wood; if the holes didn't meet, the project would be ruined. Each shield had an instrument man who kept track of the shield's position inch by inch. Holland stayed in close touch with the instrument men to hold the shields exactly to line and grade. Once the hole was made, there could be no correction. Holland hoped for a margin of error of less than an inch. Despite a weak heart, which he had had since youth, he went in and out of pressurized chambers many times a day. His wife saw that the work was a

strain on his health. "If I had known that it was sapping his strength so much, I would have urged him to be more careful," she said later, "but he was so completely wrapped up in his work that I really do not know if my pleadings would have had any effect." On September 27th, the two shields digging the northern tube were within a hundred and sixty-five feet of each other. A meeting was expected within a month. The first week in October, Holland had a nervous breakdown. The joint tunnel commission adopted a resolution giving him a month off with pay, and a second month if he needed it; uncharacteristically, no one dissented. Holland went to the Battle Creek Sanitarium, in Michigan. His friend Robert Ridgway, the chief engineer for the New York Board of Transportation, went to visit him a few weeks later, and Holland stayed up late talking about how much he wanted to finish the tunnel. Sad not to be returning himself, Holland saw Ridgway off at the train station. That night, Holland had a heart attack and died.

Two days later, the tunnel's northern tube was holed through. Again, the tunnel commissions had planned a celebration: the President (now Coolidge) would press a gold-and-platinum telegraph key in the White House library, which would touch off a blast removing the last eight feet of rock between the two halves of the tube; radio station WOR would broadcast the sound of the blast to the tri-state area; a band would play "The Star-Spangled Banner"; governors and senators would observe. Out of respect for Holland, no celebration was held. All the workers decided to treat the event as part of an ordinary day. A few minutes after the blast, when the debris and the smoke had cleared, the New York superintendent of the work crawled through a small hole in the wall and shook hands with his counterpart from the Jersey side. The sandhogs did not cheer. When the remaining rock and mud were cleared away, it was found that the two borings diverged from each other by three-quarters of an inch.

Holland's body was brought back from Michigan to 2416 Avenue J, Flatbush, and after a memorial service in Brooklyn he was buried in Somerset, Massachusetts. In a letter to Governor Alfred E. Smith, of New York, Theodore D. Pratt, the general manager of the Motor Truck Association of America, suggested that the new tunnel be named the Holland Tunnel. Soon afterward, the joint tunnel commission agreed to this idea, and the Hudson River Vehicular Tunnel (as it had been called) became the Holland Tunnel. The southern tube was holed through a month after the northern tube. Anna Holland and her four daughters moved from Flatbush to Cambridge, Massachusetts. The tunnel's twin tubes were lined with concrete, ventilated, paved, tiled, lit, and opened for traffic at one minute after midnight on November 13, 1927.

When the tunnel commission hired Holland as engineer, in 1919, he had insisted that several men who had worked closely with him in the past be hired also. Milton Freeman, his second-in-command, who took over for Holland at his death, knew Holland's plans and methods so well that the work continued with no interruption. Freeman's dedication was at least as great as Holland's. "Mr. Freeman practically slept in the tunnel," Anna Holland recalled. On March 24, 1925, five months after becoming chief engineer, Milton Freeman died of acute pneumonia. The tunnel commission honored him by naming the Manhattan entrance plaza Freeman Square; today, that name has been forgotten. Holland's third-in-command, a man named Ole Singstad, took over from Freeman, and survived to the end of the project. Besides Holland and Freeman, thirteen sandhogs died building the Holland Tunnel. The *Times* gave their names as Philip Healey, Steve Rolzek, Christopher Kelly, John Hues, Joseph Richard, G. J. Slade, Dennis Sullivan, John Taggart, Sezoy Palischick, Feodor Tarashicp, August Nevola, Charles Svenson, and James G. Godfrey. Other newspapers printed the same thirteen names but disagreed on some of the spellings. When the first shield began to tunnel west from Canal Street, Holland described the men "rejoicing as if we were giving a battleship its first spin." The men who built the tunnel had a rallying cry: "Ten minutes to New Jersey by wheel!"

As if Clifford Holland's profession, diffidence, and short life weren't enough, his name itself was the final guarantee of his anonymity. At the time the tunnel was named for him, editorial writers worried that people would think that the name had something to do with Holland the country. In later years, that happened. Today, almost no one knows who Clifford Holland was. When I asked where the name of the Holland Tunnel came from at Tunnel Discount Stationers, near the corner of Canal and Broadway, a guy behind the counter with a blue knit short-sleeved shirt and a mustache said, "I really couldn't tell you. Library'd be your best shot." When I asked at Tunnel Machinery Exchange, Canal and Wooster, a tall guy with a pockmarked face and a mustache said, "The name of the Holland Tunnel comes from the Dutch— No, you stumped me." When I asked at Tunnel Garage, Thompson and Broome Streets, a guy with a gray-and-black knit shirt and a mustache said, "Ask at the tunnel. For us, it is a little difficult." A traffic cop at the intersection of Canal and Sixth said, "I couldn't tell you that one, pal. I sure couldn't." A fireman by the firehouse at Canal and Allen said, "I have no idea. I imagine from somewhere over in the Netherlands." A woman in a blue jacket and black slacks at Lee Nam Sneaker, 316 Canal, said, "Don't know. Sorry." A gray-haired woman in a gray sweater at the cash register at Canal Deli Grocery, Canal and Greenwich, said, "I never even t'ought about it, frankly." When I asked Gary in his store one afternoon, he didn't know, and he repeated the question to the shoppers at large. A tall Japanese tourist with white hair at his temples who was comparing pairs of American and Israeli military goggles said, "It was named for engineer."

A plaque beneath the bust of Clifford Holland at the westbound entrance describes the tunnel as "the underground highway which joins a continent to a city." Gary has been through the tunnel only a few times; he is of the city. When I moved to New York from Ohio, in 1974, I thought of myself as a person from the continent. I made a point of how "American" I was, and spoke in a down-home accent that surprised my friends from the suburb I grew up in when they came to visit. I moved into Gary's building in the summer of '76, while the Bicentennial celebration was going on. From my front fire escape I could see all the way down Canal to a tall, thin slot of scenery at its end—a rectangle of Hud-

son River, a stripe of New Jersey, a column of sky. When the Tall Ships parade went by, each mass of sails seemed to cross this view in an instant, like a tiger sneaking from one tree to another in a cartoon. Back then, my fire escape was the only part of the apartment that did not need work, and I spent a lot of time out there staring westward. The sight of a truck from Storm Lake, Iowa, or Cape Girardeau, Missouri, heading down Canal to the tunnel was enough to make me happy. By concentrating on the sun on a peaked roof of a building downtown, I could imagine the sun on the roof of a boathouse in Michigan or a picnic kiosk in Nebraska—places I believed I would rather be.

The farthest west Gary has ever been is Caesars Pocono Palace Resort, in Pennsylvania, ten miles off Interstate 80 and just across the New Jersey state line. He spent thirty-six hours there with his wife some years ago—the only vacation I have ever known him to take. In the opinion of boosters of Pennsylvania who have put up a billboard that says "PENNSYLVANIA—AMERICA STARTS HERE" next to the interstate where it leaves New Jersey, Gary can say that he has been to America. His knowledge of its geography, however, is vague. The first time I told him I grew up in Ohio, he said, "Ohio, Michigan?" A large part of his America falls into an area known as Upstate. (Me): "I just came back from New Haven." (Him): "Oh—upstate?" In fact, his map of the country could be divided into thirds—Florida, California, and Upstate. When I sublet my place to my sister, in 1982, and moved to Montana for three years, that name suddenly appeared on Gary's map—alone and remote at the end of a long causeway, and occupied only by me. He pronounced it "Mon-*tah*-na." Since I returned, he has forgotten that name. Now he calls it "the place you went to."

In Gary's mind, America beyond New York is a land of no headaches: no traffic jams, no eight-and-a-quarter sales tax, no public-transportation tax, no water bills, no fire inspectors, no building inspectors, no lawsuits, no burglar alarms ringing in the middle of the night. He probably thinks of it as a giant slumbering baby: he often tells me it is my country, not his, and he often tells me I am a baby. "Sandy, Sandy, you sit up in a room writing, you like a baby, you don't know"—about the things people do to each other, about the Holocaust, about people paying off insurance adjusters, about how to make women behave, about black people on welfare laughing at me, about what the Palestinians would do to Israel if they had a chance, about how the rest of the world is waiting to come over here and take everything I've got. He says, "You an American, so you straight. But the world is not straight, it's crooked."

While I stand talking to Gary—which I still do, often—people come in and ask for rattraps, martial-arts equipment, gold braid, Mussolini youth medals, Civil War forage caps, earplugs, gas masks, white mosquito netting, wires to keep pants cuffs straight, camouflage paint, police whistles, flare guns, handcuffs, and holsters for guns of every description. One guy wanted to bring his Uzi machine gun from the car to see if the holster would fit. Another guy wanted to talk flashlights. He told Gary he would give his right arm for a certain model of flashlight. Then he went on about different kinds of batteries, bulbs, buttons, cases, and techniques of manufacturing flashlight reflectors. After the guy left, I asked Gary if he had any idea what the guy was talking about. He said, "If I did, would I be here?"

Recently, a developer offered Gary two and a half million dollars for his building. This offer did not delight Gary, despite the fact that he paid sixty thousand for the building originally. He said he would need two and a half million to buy a new building on Canal, so what was the difference? I told Gary he should take the money. I asked, "Don't you have a dream of something you'd like to do?"

"I'll tell you my dream—you'll probably laugh. I'd like to go to the place you went to."

"Montana?"

"Mon-*tah*-na. Yes. I'd go there, in the trees, with peace and quiet and no headaches. Give me ten million, not two, I'll go to Mon-*tah*-na, you'll never hear of Gary again."

—IAN FRAZIER