

CHAPTER 1: HOOKED

5:04 p.m. Pacific Daylight Time, October 17, 1989—game three of the World Series.

A few of us slaves to the retail trade had not closed our stores to watch the World Series. In retrospect, it probably had been a bad idea, for no one had walked past the doors to my Old West Art Gallery next to the Art de Jour Restaurant in Old Sacramento for the past ten minutes, much less come inside to browse and look at the original works of oil and acrylic art covering the walls and display panels.

I remember that my feet ached. I leaned back in the squeaky oaken chair and rolled it around to prop my tight cowboy boots on top of the old oaken desk, well on my way to dozing off. In another hour, at six o'clock, my daughter, Deborah, and I could close the doors to the art galleries and head home to watch the baseball game.

At that cusp in time, 106 miles south of Sacramento, the earth's crust fractured beneath the Santa Cruz Mountains, not far from Loma Prieta Peak, allowing the two sides of the San Andreas Fault to scrape past each other.

The hypocenter of the fracture, the point where the rupture began, lay 19 kilometers beneath the surface. A crack spread out from that point to the north and south, up and down, and in 8.9 seconds it grew into an oval-shaped fissure that measured 40 kilometers in length and 26 kilometers in height, reaching to within six kilometers of the surface. At the point where the fracture had begun, the two sides of the San Andreas Fault had slipped 7.2 feet past each other: 6 feet horizontally and 4 feet vertically.

Pressure waves, called *P-waves*, and the shear waves, called *S-waves*, raced north, east, south, and west from the epicenter of the magnitude 7.1 earthquake. Within 28 seconds, *S-waves* began to pound the soil beneath Candlestick Park, bringing the San Francisco Giants and Oakland Athletics World Series to an abrupt pause. Two seconds later, the Cypress Freeway structure

in Oakland began to settle, sway, and crack. When the *S-waves* coursed through Sacramento, 58 seconds after the initiation of the fracture, my chair rolled about enough to snap me awake.

I opened my eyes and stared around me. My eyes had a hard time focusing. Dizziness swept to the back of my head and down my body as adrenaline pumped into my blood. The memory of open-heart surgery only 18 months before flashed through my mind. I assumed the worst: I must be having a heart attack or stroke. Dropping my boots to the floor, I came forward in the chair and grabbed the edge of the desk.

And then, the brick walls of the gallery began to creak—then groan with the sounds of agony like from an old man.

The Old West Gallery was a large room, 40 by 60 feet, in the northwest corner of the bottom floor of the three-story Whorten Building, one of the original structures built in Sacramento after the 1857 floods. It once opened onto the original Front and K Streets, but when the city fathers raised the level of the streets in the entire business district of Old Sacramento by one story to escape the periodic floods, the Gallery room became a basement.

The 24-inch thick walls of the building had been constructed from fired red bricks and mortar, now ancient red bricks with rounded corners interlaced with 132-year old mortar. The structure continued two stories above current street level to the ornate cornices surrounding the roof, typical of nineteenth century construction. Like most brick buildings built prior to the 1950s, the walls contained no reinforcing. In seismic parlance, the building would be called a URM: UnReinforced Masonry.

The ceiling of the basement room—also serving as the floor of the street level rooms—still consisted of the original three- by six-inch timbers laid side to side, forming a soundproof barrier between floors. Twelve-by-twelve wooden joists and upright timbers supported this solid platform of wood.

In some places alongside the walls a person could see one-inch steel rods that had been strung diagonally from one corner of the building to the other, providing some reinforcement against side-to-side shifting of the walls. In 1989 this satisfied the requirements for an advanced seismic retrofit.

The brick walls reverberated with noise. A couple of louder pops came from across the room, but the sound never became a roar. After maybe five seconds, my mind made the connection of sound and motion: the building shook from an earthquake.

I remember thinking of running, but indecision told me I could never get out and up to the street soon enough. I held tighter to the desk, trying to decide what to do. It never occurred to me that I should crawl under the

desk for protection—not that it would have been any protection from the wooden ceiling above me. I just did not think; there wasn't time.

I could feel the ground shaking, back and forth about once every two seconds, but mildly. My head still felt unsettled, and then after about 15 to 20 seconds it eased. I could not tell when the shaking really stopped. The dizziness and unsteady feelings continued for several minutes afterwards as I anticipated movement that was not there.

Remembering Deborah, I hurried down the hall to our TwoPenny Fine Art Gallery. She stood in the doorway to the patio, clutching the door jam with white knuckles and staring upward at the brick walls towering above her. "Are you okay?" I called as I ran across the room.

Deborah turned, her face pale and strained. "The door to the gallery began rocking back and forth."

"It was an earthquake. It must have been really big and far away."

"That was the biggest earthquake I've ever felt." She left the safety of the door, and I hugged her as she hugged me, each of us trying to calm the fright we felt.

Everyone in the other art galleries and at the Art de Jour Restaurant seemed dazed, wandering around like they had nothing to do. Business stopped as people ferreted out radios to learn what had happened. An announcer interrupted the music to tell us there had been a big earthquake somewhere in the San Francisco area. We leaned close to the radio, talking softly and listening for more news about damage in San Francisco. Then we heard the World Series had been stopped.

Deborah and I returned to check the galleries for damage. There was none. Someone working in the restaurant said they had lost some plates, but that could have happened because one of the dishwashers just got scared, or careless.

"Let's close up and head home?" I said.

"That's fine with me." She shuddered. "I just want to get out of this building." She locked the door to the restaurant patio as I went back to the Old West Gallery, turned out the lights, and locked the entry door. We walked up the stairs that opened onto the First Street Alley and headed towards the parking lot where we had left the car that morning, holding each other's hand for security.

Passing the open door to the Alley Street Bar I looked inside. "There's a TV. Let's check what it's saying." Walking inside I waved to the bartender and

turned to look up into the TV screen, tuned to KCRA-TV, Sacramento's NBC affiliate.

The scene was an aerial view of the San Francisco Bay, looking west from an airplane. The voice from the set announced, "We're now flying across the Oakland hills, and from here we can see more plainly that there is at least one large fire in San Francisco." The camera zoomed in to show a tall column of black smoke north of the San Francisco hills. I recognized the locale as out towards the Marina District.

As the small craft, which turned out to be the traffic-spotter airplane KCRA-TV used to monitor the commuter mess each morning and afternoon, flew across Oakland, the cameraman panned up and down the San Francisco Bay and around the cities that lined the water, looking for other signs of destruction. The camera zoomed in on some possible fires, but nothing large. The announcers in Sacramento and on the airplane continued their on-going dialogue of what they saw, or did not see.

The camera scanned down towards the base of the Bay Bridge in Emeryville, the area where 15 years earlier my partners and I had begun our software and electronics startup. The spotter commented, "Hey, looks like that freeway is down." I leaned forward to see better and recognized the stretch of the Highway 17 freeway that ran south from the Bay Bridge interchange, the infamous Cypress Structure. It was the route I had always used when driving from our offices down to Silicon Valley.

It took a moment before I realized that a one-and-a-half-mile section of that structure had fallen. From above you could not tell much of what had happened, but I could see something was terribly wrong. It simply did not look right.

The fire and flames in San Francisco recaptured the announcer's attention and conversation, and the pilot flew over the Cypress and on across the bay to circle the column of smoke. I screamed at the TV. "You idiots. Down there, right below you. That's the real story. That's where the real damage is. What are you, blind?"

Deborah understood. She started to cry. "Dad, there must be hundreds of people there, trapped in that freeway."

It would be hours before the news teams sorted out where the worst damage could be found. It would be days before the serendipity of the timing of the earthquake to coincide with the World Series would be apparent, saving hundreds—possibly even thousands—of lives that otherwise would have been lost in the ruins of a structure *that should not have fallen*.

Twenty-nine years before Loma Prieta, in 1960, I left the University of Illinois with my Masters in Physics and moved my family—wife Alice with two kids and one in the oven—to California. We found a home in the suburb of Walnut Creek, 17 miles east of the Bay Bridge in the greater San Francisco Bay Area. I went to work as a computer-programmer for the high-energy physics group headed by Dr. Luis Alvarez at the place they then called the University of California Lawrence Radiation Laboratory, now simply known as the Berkeley National Laboratory.

At the Radiation Lab I had the privilege of spending four years in Luis's group before transferring to the computer systems group. I remember how he sent some of my friends to X-ray the Egyptian Pyramids with cosmic *muons*. In 1968 I visited with the group and my old friends to celebrate when Luis won the Nobel Prize for Physics. Later, he and his son, Walter, theorized that the demise of the dinosaurs resulted from the impact of a giant asteroid 65 million years ago.

My offices at the Lab were in Building 50A, a five-story structure that rested on the side of the Berkeley Hills overlooking the UC campus, 200 feet above and 250 yards east of the flat where lay the UC Golden Bears football stadium and the Greek Theater. I soon learned that that flat area marked the actual trace of the Hayward Fault, a companion fracture paralleling the San Andraes Fault 17 miles further west.

Over the 13 years I spent at the Lab, we never had a major earthquake, but I did feel several small temblors. The one I best remember occurred one afternoon when I sat in a solid wooden chair visiting a sick co-worker at her home in Orinda. I leaned forward with my elbows on my knees when it felt like someone had stuck the bottom of my chair very hard with a baseball bat. One whack—that was all. No noise—just a jolt. I later learned that I had felt a shallow 2.0 magnitude temblor, hardly worthy of the news, but I remember vividly how unexpected it had been and how strong it felt.

What with living and working on the fault lines, I found the subject of earthquakes fascinating, and I began to collect maps of the Bay Area, then of California, then of the continent. I learned to identify fault traces in the cuts made for the roads in northern California. I purchased Bruce Bolt's book, *Earthquakes*, and read it cover to cover, doing my first real study into seismology.

In 1973 I left the Berkeley Lab to devote full time to a software consulting business my friend Bill Gage (another computer programmer/physicist) and I had started as a part-time venture in 1970. We soon became Adaptive Science Corporation, and in the mid-1970s we worked closely with a company in Sacramento called Exploration Logging (Exlog), a subsidiary of Baker

International. Their business centered about the geological logging of oil and gas well drilling operations.

Exlog had begun automating their logging processes. They needed help bridging the gap between geological data logging and computers, especially in the analysis and interpretation of the results. Adaptive Science's expertise in computers and physics fit nicely with their expertise in geology and instrumentation. Together we created some of the early systems used to monitor and analyze the drilling operation with on-site computers.

I co-authored several papers and magazine articles with geologists at Exlog on subjects like directional drilling, rock mechanics, and pore pressure analysis. It was an exciting time in geology, with discussions about plate tectonics and its role in mountain building and hydrocarbon reservoir creation hotly pursued. Occasionally, we talked about earthquakes.

Over those years the business of Adaptive Science grew to include computer board design and manufacture. By then I had moved into corporate management and marketing, and in 1982 the company merged with SBE, Inc. and largely dropped the consulting business. After the merger, I left SBE to try another couple of startups, but I never succeeded like we had with Adaptive Science.

In 1984 I joined Exlog as their Director of Computer Science and moved to Sacramento, continuing the development of automated data logging systems. I chose to stay in Sacramento when the company moved to Houston in 1988. My timing proved to be inopportune, and I unexpectedly entered the hospital two weeks after my resignation for heart-bypass surgery. I retired from the engineering business to work with Alice and Deborah to establish several fine art galleries and picture framing shops in the area.

Then in 1989, the Loma Prieta earthquake happened. As I watched the news on TV of the attempts to extricate the victims of the collapse of the Cypress Structure—a failure that should not have happened—I became hooked. I had to know more about the causes of earthquakes and how solid concrete structures could fail so catastrophically.

Spurred by my resurrected interest in geology and seismology, I purchased a more recent edition of Bolt's book and several other volumes on plate tectonics. Our picture-framing gallery had expanded to include first edition and used books, and I used this as an excuse to search other bookstores and garage sales for background material on past earthquakes and seismic theory.

My focus on the New Madrid Fault resulted from finding a used copy of *The Frontiersman* by Allen W. Eckert. Published in 1967, the book tells the story of Simon Kenton, a contemporary of Daniel Boone and Tecumseh, the great Shawnee chief who fought against the westward advance of the Europeans throughout the Ohio and Mississippi River valleys in the early 1800s.

The book relates how in 1811 Tecumseh instructed the Indian tribes to act peacefully and lull the settlers into thinking they were safe, but to wait for a great signal. He said that when the time came that their teepees fell to the ground, all the Indian tribes were to rise up and slaughter every one of the white invaders. But Tecumseh's half-brother grew impatient, and began a series of small attacks throughout the summer, alerting the settlers to the dangers and bringing in the army to control the natives. When the great earthquake struck on December 16, there were a few uprisings, but nothing massive. The Indian revolt was quickly put down.

Mixed with this story of the Indian wars are several accounts of what happened to the settlers scattered throughout the lands affected by the New Madrid Fault. After finishing that book, I began to collect other books telling of the great earthquakes of 1811 and 1812.

In 1990 I discovered to my chagrin that no health insurance company wanted a semi-retired, self-employed art gallery owner who had a history of heart bypass surgery on their roles. After investigating options for a year, I returned to SBE as a full-time employee to obtain group health benefits, working as a Senior Computer Board Product Manager in the Marketing Department. Alice and I soon moved back to the Bay Area, leaving Deborah to operate our last picture framing gallery and bookstore.

In January 1994, a magnitude 6.8 temblor wrecked a 600-square-mile area in and around Northridge, California. About the same time Deborah tired of being a solo slave to the retail trade, and we closed our framing business in Sacramento. Shortly afterwards, Deborah informed us that she had found a new position at the California Seismic Safety Commission in Sacramento. She would be formatting the Commission's Report to the Governor on the Northridge Earthquake.

Deborah took the opportunity to provide me with reports from the United States Geological Survey (USGS) and the Earthquake Engineering Research Institute as they came out and gave me some of the preliminary draft materials of the Commission's Northridge Report for review. My education and interest in seismology and the disastrous effects of large earthquakes grew. I watched closely as California went through its review of building standards and retrofit and repair plans for buildings, bridges, and dams.

The Internet and World-Wide Web became important channels for my research. I still have the 5Mbyte .pdf file that I downloaded of the 1996 USGS Report, *Northridge '94*.

This document provided a vital insight for my understanding of earthquakes, for it illustrated in a time sequence how the fracture started beneath the San Fernando Valley and moved north to the Santa Susana Mountains over the next eight seconds. It had never occurred to me before that earthquakes happen over time and move along a fault.

In the spring of 1996 my wife and I took vacation time and drove our three-quarter ton pickup with slide-in camper back to Dayton, Ohio. We attended our youngest son's graduation with his Masters in Logistics from the Air Force Institute of Technology at Wright Paterson Air Force Base. After the graduation ceremonies, we helped pack up furnishings and family to head to Collinsville, Illinois, where he and his family would live while he was stationed at Scott Air Force Base, just east of St. Louis.

On that trip I paid close attention to the construction of the buildings, bridges, and overpasses of the central United States. With my accumulated knowledge of the dangers from the New Madrid Seismic Zone a hundred miles to the south of St. Louis and the efforts being expended in California to upgrade standards and structures, what I saw around the area alarmed me. When I asked local people about earthquake preparedness in the area, they looked as if I had gone over the deep end. Touching such a deep well of complacency added to my concerns.

As we returned from that trip, Alice and I discussed our experiences in the RV and on the trip. Driving across the Mojave Desert, I surprised her when I said, "I could do this full-time, just live in an RV and travel around the country." When she realized I meant what I said, we began the serious planning. I would be 60 years old the next year, and March 1997 became our target for retirement.

At the same time I declared, "And I can spend my time writing a book about what will happen on the New Madrid Fault when a big earthquake hits. That way I won't get bored." Those two decisions, made to the drum roll of rubber tires on the hot asphalt in southern California, changed the whole course of our lives.

However, upon returning to our home in San Ramon, California, I learned that our plans had already encountered their first slip. SBE had just undergone a RIF—a then-popular acronym for Reduction In Force—and I was asked to assume a major role in Marketing. A short time later the corporate shakeup

suffered an aftershock, and I moved to the position of Vice President of Engineering, making a commitment to Bill Heye, the CEO, to continue for at least a year.

Meanwhile, I became very serious about researching for my book. I searched all over the Internet and, among other materials, found and purchased *Damages & Losses From Future New Madrid Earthquakes* by David Stewart, Ph.D. This pamphlet, sponsored by the Federal Emergency Management Agency (FEMA), proved to contain a wealth of material and formed the basis for much of the scenario I subsequently constructed.

After studying Stewart's book and method for estimating casualties and damage at the county level, I wondered just how bad a large earthquake would be for the entire affected area. I searched the Internet for a FEMA or USGS report that provided such a summary, but to my surprise, I found nothing that really addressed the issue. I began building a spreadsheet on my PC estimating the damage to each and every county in the eastern United States so I could know what the total effect would be.

When I summed over all the counties, the results from my first attempt at a scenario astounded me. A giant earthquake on the New Madrid Fault would kill tens of thousands, injure hundreds of thousands, and leave millions homeless. My first SWAG (scientific wild-ass guess) of what it would do to our country's economy was somewhere between a 5% and 25% loss.

I began to ask if my estimates were within reason, and if so, why was I the only one who seemed to be talking about them. My queries were returned unanswered, and my faith in the process began to falter. I did not understand until six years later, after the publication of my first book, that there was—and still is—a real reluctance on the part of the authorities to openly discuss the danger.

By the time I turned 60 years of age in the spring of 1997, I wondered if I might ever have a chance to retire. The lure of corporate management with its lucrative salary and benefits and the adrenaline boost of high-pressure work had become addictive.

But when I suffered a small heart attack that fall, the choice became clear: retire and live, or work and die. My body could no longer tolerate the stress I had placed on it in younger years. I apologized and gave my firm notice to Bill Heye that I would retire at the end of March, 1998.

About this time I decided that I probably would not be very successful in telling people about the danger of a giant earthquake on the New Madrid Fault in yet another scientific-type article or book. I had found too many other works that identified the dangers, and they did not seem to be making any difference.

I rationalized that I would rather write fiction anyway. I would use the scenario I had built as the background for a story I wanted to tell, a story of what it would be like to live through such a catastrophe. With that motivation, I began to collect and read books on writing fiction as well as books on earthquakes, geology, and seismology.

The next spring I kept my promise. Alice and I purchased a new truck and fifth-wheel trailer, sold or gave away everything that would not fit into the two vehicles, and closed escrow on our condominium. On April 3, 1998, after a grand farewell party at SBE, we drove south on I-680 into a life of full-time RVing. Now the serious writing could begin.