Prologue

There was never any doubt that I would be a geologist by profession. At the age of five, I collected rocks at various stops on our summer vacation through the western United States and dutifully put them into the backseat of our '35 Plymouth. My parents encouraged this semi-rational activity, and our family developed into a full-fledged nest of rock hounds and mineral collectors. Soon our home in Austin, Texas, was full of specimen cabinets containing agates, petrified wood, and various types of crystal groups, and I was learning a little bit about them. My father, a carpenter and general building contractor by profession, became interested in cutting and polishing stones. He was particularly fond of agates and petrified wood and set up a bench with machines to cut and polish these materials. I soon learned to use diamond rock saws as well as grinding and polishing laps.

The father of one of my childhood friends, Dr. Virgil Barnes, was a geologist with the University of Texas Bureau of Economic Geology. He had been awarded a federal grant to study tektites. Tektites are small glassy rocks that superficially appear similar to pebbles of obsidian or volcanic glass (Photo 1); however, they are not associated with volcanoes, and their origin was in dispute for many years.[1] Some investigators believed that tektites were pieces of the Moon. Barnes needed some tektites cut into thin slabs for micro-

[1]E. A. King, "The origin of tektites: A brief review," *American Scientist*, March–April 1977: 212–218.

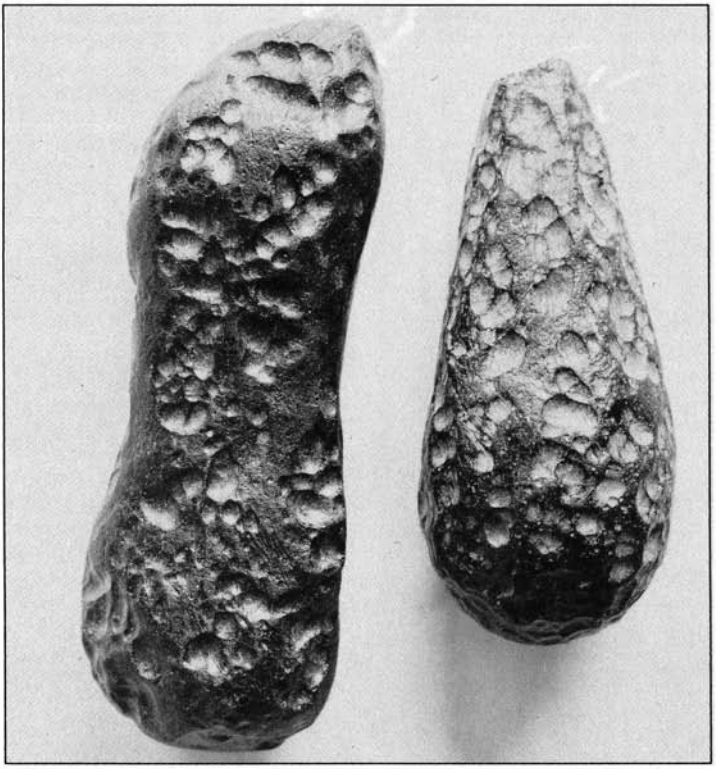

Photo 1. Typical tektites from Thailand. These are very dark brown glass and appear black in reflected light. The length of the largest piece is approximately six centimeters. (Photograph by the author)

scopic examination, but he did not have access to a suitable rock saw. He sent word through his son that he needed some specimens and asked if we could cut them for him. He offered to pay for the work, but we agreed that I could keep a portion of each specimen that we cut for our collection. I picked up the tektite samples from Barnes at his office in an old brick building at the Bureau of Economic Geology, a building I would later get to know very well. I had seen tektites before in museum displays and in the hands of private collectors, but I had never been afforded the opportunity to examine them so closely. I even cut my finger slightly on a sharp glassy edge of a fragment. Strange material to be possible pieces of the Moon. Barnes' tektites were mostly from the Philippines, but a few were from areas in Texas not too far away. It seemed peculiar that pieces of glass from two such widely separated localities should appear nearly identical. I was fascinated by the controversy over their origin. At that time a wide difference of opinion existed about their mode of origin in addition to the argument over whether they had been formed on the Earth or on the Moon. Barnes generously shared his knowledge of tektites with me at the level that a high school student could understand—he was a very patient man.

About a year later, in 1952, a summer job became available at the bureau, and Barnes asked if I might be interested in taking it. The work would entail a variety of tasks, but would mainly involve operating a large rock saw to cut hundreds of feet of oil well cores from deep wells in West Texas for Barnes' paleontologic examination. Of course I was interested! In order to get the job, however, I had to interview with the director of the bureau, Dr. John T. Lonsdale. I was somewhat nervous about meeting Lonsdale, an "old school" gentleman—tall, straight, and cleanly shaven except for a thin moustache. He had served as an artillery officer in World War I and had done a lot of geological field work in Big Bend National Park and other parts of West Texas. It seemed to me that he had been everywhere and done everything, but during our first conversation, he wanted to focus on my interests and experiences,

which seemed very meager indeed. Lonsdale was an extremely gracious and interesting man whose eyes twinkled as he spoke. We had a pleasant conversation for more than half an hour, when he announced that I could have the job. He appeared to be totally fascinated by geology, and I hoped he had formed the same impression about me. Although he tended to be a bit stiff and formal, Lonsdale had put me very much at ease, and I liked him at once.

For the next several years, during my high school and undergraduate days, I worked at the bureau for Barnes and Lonsdale during the summers and part-time during academic semesters. Much of the work was mindless drudgery, but frequently something exciting or interesting came along.

It was at the bureau that I came to know an aging UT doctoral student, John Dietrich, an expert photogeologist who was working on volcanic geology in West Texas. Dietrich later joined NASA and worked at the Johnson Space Center. He became involved in the interpretation of lunar orbital imagery and surface photography and was eventually appointed as curator of lunar samples.

My first face-to-face contact with a meteorite came about through my association with the bureau. One hot summer afternoon while working in the laboratory with Lonsdale, we took a break from some tedious microscope work and began to chat. Lonsdale lit a cigarette—even though he had been trying to quit. I took the opportunity to ask him about a very peculiar rock in a nearby specimen cabinet. He took the rock of eight or 10 pounds from the cabinet and handed it to me. It was covered with a thin cream-colored fusion crust (an atmospheric friction-melted thin layer) on two sides and contained large gray crystals. It turned out to be a fragment of the Peña Blanca Spring meteorite that had fallen in West Texas in 1946. Lonsdale had published the original description and analysis of the stone.[2] As he told me the story of how 150 pounds of rock had fallen on an August afternoon into a partially

[2]J. T. Lonsdale, "The Peña Blanca Spring meteorite, Brewster County, Texas," *American Mineralogist*, vol. 32 (1947): 354–364.

dammed, spring-fed creek that was used as a swimming pool at a ranch headquarters near Marathon, Texas, I was enthralled. The fall of the stone was accompanied by "sonic booms" and occurred within plain sight of a dozen people, some of whom were badly frightened by the event. That a meteorite should choose a swimming pool out of all of West Texas as its place to fall seemed truly remarkable. "Where do meteorites come from?" I asked. Lonsdale told me that not all scientists agreed on the matter, but that most believed they were fragments of asteroids that had been deflected into Earth-crossing orbits by gravitational interactions with Jupiter, Mars, or another large asteroid. I knew the asteroid belt was between the orbits of Mars and Jupiter, but the fact that I was standing there in Austin, Texas, with a rock in my hands that had come from outside the orbit of Mars seemed truly miraculous. Lonsdale said the Peña Blanca Spring meteorite was a very rare type of stony meteorite containing huge crystals of enstatite, a magnesium silicate mineral, and he pointed them out to me. I asked Lonsdale if he had pieces of any other meteorites. He didn't, but he was certain that Barnes did. Barnes was out of town.

For several days I had to content myself with reading about meteorites in textbooks and general publications, but I also looked up both Lonsdale's and Barnes' publications about meteorites. Barnes had described at least three meteorite finds: a stony meteorite from Cuero, Texas; another stone from Kimble County, Texas; and an iron meteorite from Nordheim, Texas.[3] In addition, he had compiled a catalog of Texas meteorites. Not only were the Cuero, Kimble County, and Nordheim meteorites very unlike those from Peña Blanca Spring, they were also different from each other. It seemed curious that four pieces of asteroids should be so different.

When Barnes returned to his office I was impatiently waiting to

[3]V. E. Barnes, "The stony meteorite from Cuero, Texas," University of Texas Publication No. 3945 (1939): 613–622; "The stony meteorite from Kimble County, Texas," University of Texas Publication No. 3945 (1939): 623–632; "The iron meteorite from Nordheim, Texas," University of Texas Publication No. 3945 (1939): 633–644.

see him. I knew he would have lots of mail to catch up on, so I asked to see him on his second day back in the office. I explained how I had developed some interest in meteorites and asked him if I might see some of his specimens. Barnes seemed genuinely pleased by my enthusiasm. He showed me all his meteorites and tektites and allowed me to handle and examine many of them. We spent more than an hour discussing the subjects. I was elated. A well-prepared display in a case or cabinet can be interesting, but the real magic of discovery comes with the intimacy of touch and contact with specimens. Good teachers know this technique and use it shamelessly.

In 1954, during my sophomore year at the University of Texas, I took a required mineralogy class taught by Dr. Fred Bullard. Bullard was a superb lecturer and teacher. I was interested in and well-prepared for the subject, so I excelled in his class. Bullard asked me to serve as teaching assistant for the mineralogy labs the very next semester—quite an honor for an undergraduate. Of course I could not refuse. Before accepting, however, I had to clear it with Lonsdale, who was counting on me for the same semester. Lonsdale understood completely, and I had the impression when talking with Lonsdale that he had already discussed the subject with Bullard.

Working as a teaching assistant in mineralogy labs for Bullard was enjoyable. Bullard was a kind, rational, and fair man. One day while preparing specimen trays for the labs, I mentioned something about meteorites to Bullard. Bullard took me into his office and, to my amazement, showed me several specimens that he had obtained through the years (Photo 2). Meteorites are rare objects, yet three men I knew and respected had samples and had worked with them. They were fascinated by these rare objects as much or more than I was. In any event, I was hooked on the space-related aspects of geology.

Not all my undergraduate classes went so well. I tended to work on the classes I liked and slid through the rest, as many students do. Structural Geology was a required course for geology majors. It wasn't my favorite class by any means, but it was ably taught by

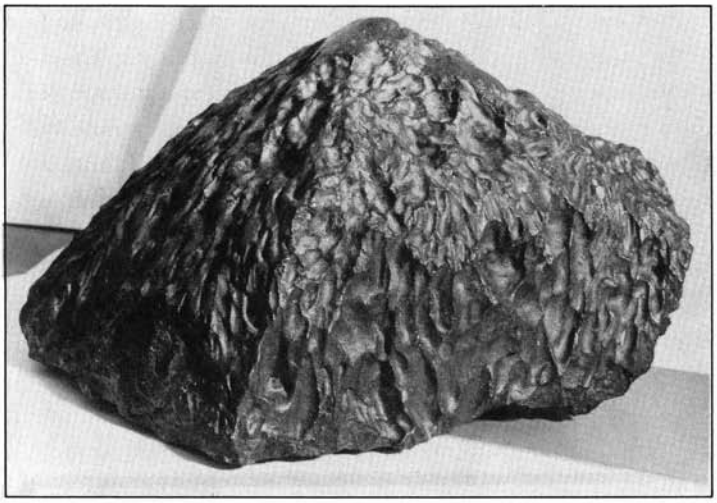

Photo 2. The Rosebud, Texas, stony meteorite (chondrite) showing a well-developed ablation surface due to heating by friction with the atmosphere during entry at high velocity. Maximum dimension is approximately 40 centimeters. (Photograph by the author)

Dr. William Muehlburger, who had recently joined the UT faculty from Cal Tech. Muehlburger, who was a large, very physical man, had played football for Cal Tech. He was an accomplished pianist and was very articulate. Muehlburger also taught the required summer Field Geology course, a stimulating course held in the summer heat of the Marathon Basin of West Texas. The course was physically and mentally demanding and, in retrospect, was exceptional experience for young geology students, though few students were fond of the course. Muehlburger later participated in the astronaut geology training courses both in the field and at the Johnson Space Center. He also led the lunar field geology team that kept track of the astronauts' lunar surface activities during the later Apollo missions. In any event, my undergraduate studies progressed fairly well, although I generated a rather undistinguished academic record with a transcript full of Cs.

During one semester when I was again working part-time at the