



# Remembering Carolyn S. Shoemaker (1929–2021)

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The USGS Astrogeology family is grieving the loss of Carolyn Shoemaker, who died on August 13 at the age of 92. Shoemaker was a world-renowned astronomer who discovered or co-discovered 377 asteroids/numbered minor planets and 32 comets, including the co-discovery of the comet Shoemaker-Levy 9 which broke apart and fell into Jupiter in 1994.



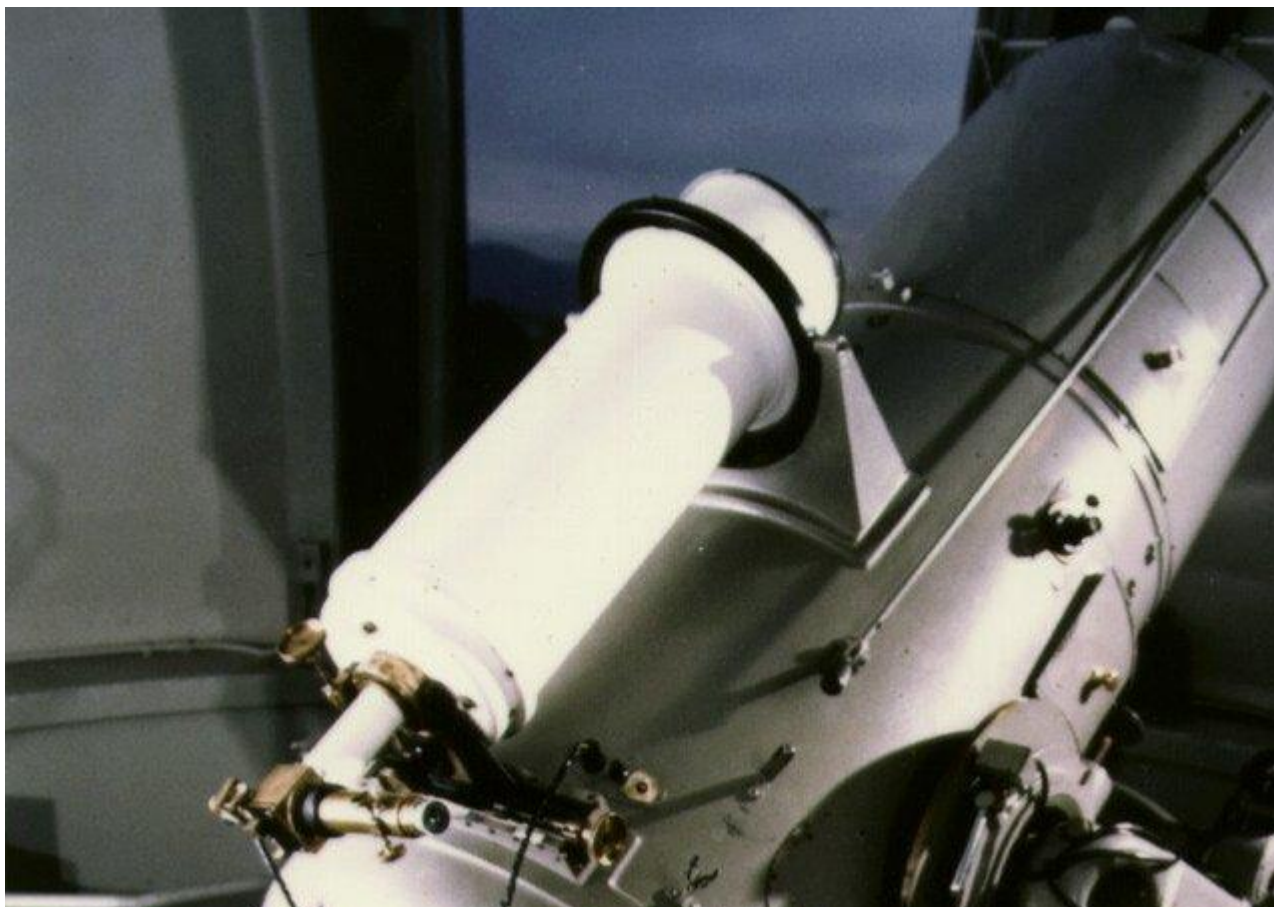
Carolyn Shoemaker at her Flagstaff home, with a view of the San Francisco Peaks in the background. Madeleine Cook – USA Today Network.

Shoemaker held an honorary doctorate from Northern Arizona University, but had no formal education. She held BS and MS degrees in history and political science, and until the age of 51 primarily worked in raising three children. (Though this did not stop her from earning her pilot's license.) Once her children had left home, she joined her husband Gene in a research program searching for Earth-approaching asteroids. Her patience and attention to detail made her ideally suited to this work and led to her many discoveries.

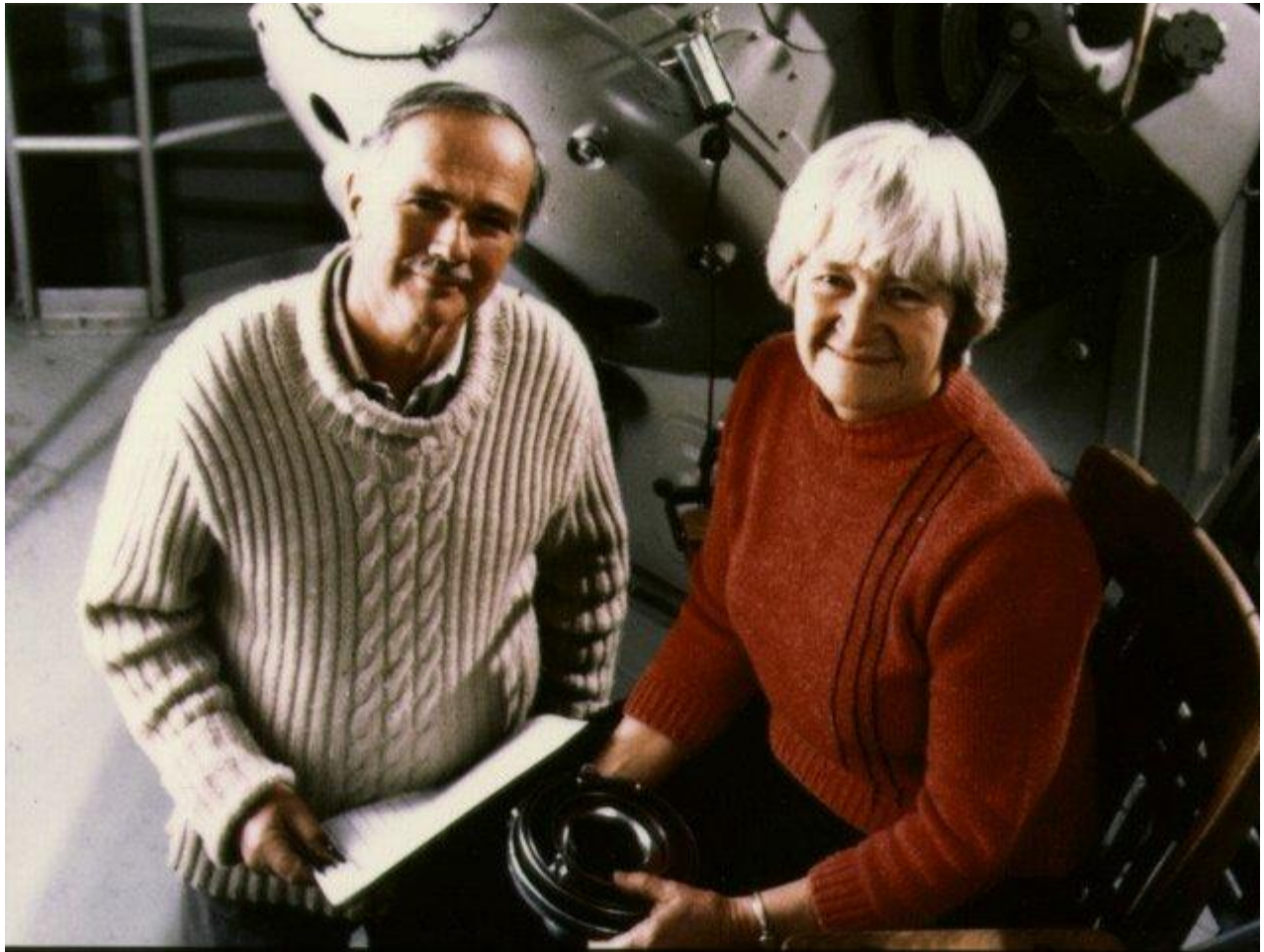
In 1997 Carolyn and Gene were involved in a car crash in Australia while doing field work to identify impact craters. Gene was killed and Carolyn was severely injured. After her recovery she continued to work at Palomar Observatory and USGS Astrogeology for many years. In 1999, Carolyn wrote an [autobiographical piece](#) for the Annual Review of Earth and Planetary Sciences, which provides a fascinating and more detailed overview of her remarkable life up to that point.

Carolyn Shoemaker received the Rittenhouse Medal in 1988 and the Scientist of the Year award in 1999 from the Rittenhouse Astronomical Society. She was awarded the NASA Exceptional Scientific Achievement Medal and she and her husband shared the National Academy of Sciences James C. Watson Medal. An asteroid (4446) Carolyn was named after her. The USGS Astrogeology Science Center is now located in the Shoemaker building, named after Gene and Carolyn.

Though her professional achievements loom large, in the days since her death the outpouring of memories from those who knew her focus on Carolyn Shoemaker as a friend. They reveal a humble, patient, caring person. An inspiration and role model as a scientist and as a human being. We have collected some memories below from those at Astrogeology who knew Carolyn well. Words are inadequate to capture the essence of the wonderful woman that we knew, but words are what remain. In sharing them we are able to smile through our grief as we recall our friend and the remarkable life that she lived.







Gene and Carolyn Shoemaker at Palomar observatory in 1994.

A common theme in many of our memories was that Carolyn and Gene were inseparable, whether in their scientific work, their appreciation for the beauty of nature, or the construction (both literally and figurative) of their life together.

As Ivo Lucchitta puts it: "It is not easy to view or discuss Carolyn and Gene separately because they formed a close entity, whether from the family point of view, or for their love of the Colorado Plateau and then the collaboration in the field of asteroid astronomy. I think that it all may have started during their camping in the early Grand Junction years, when they traveled to remote parts of the then-very-remote Colorado Plateau and were delighted after nightfall in looking up at the stars that were so brilliant and enveloping in the horizon-to-horizon display of those empty places. This may well have been the thread that led them to their extraordinary adventures.

Baerbel and I camped more than once with Gene and Carolyn in some remote corner of the Shivwits Plateau where I was working. It was then that we all engaged in an animated and interesting discussion (and appreciated the starry spectacle displayed above our heads. The experience is still vivid in my mind even after the passage of a half century."

In remembering Carolyn and Gene, Jay Rennilson says: "Gene's success as the founder of Asteroid Watch was due much to Carolyn that words can never be adequate."

Writing in 1999, Carolyn herself commented on the remarkable team that she and Gene made:

"Without Gene, I would never have known the excitement of planetary science nor have had the opportunity

to work in that area; without me, he often said, his search for asteroids and comets and then the Austra work would never have been attempted. Together, we could do more than either of us alone.”

Ken Herkenhoff remembers doing field work with the Shoemakers about a decade later: “I first met Car when she accompanied Gene and a few others to Upheaval Dome in Utah, which Gene suspected was impact structure. She was very comfortable doing field work, despite the heat and rough terrain, and I immediately impressed. Not only was she a capable field assistant, but she was also always friendly a

Carolyn’s friends also remembered her patience with Gene’s larger-than life personality. Jody Swann re meeting Carolyn in 1963, when she came to pick Gene up after work: “She has been a friend since the to her intelligence and good humor, she had the patience of Job where Gene was concerned.”

Jody recalls an evening in the 1980s with Carolyn aboard a paddleboat in New Orleans at the Geologic America meeting: “As soon as we boarded the boat, another scientist grabbed Gene with a few questio the last we saw of him. The three of us enjoyed the Dixieland music, dancing, and food for about three

Several memories mention the ongoing construction of the Shoemakers’ dream house in Flagstaff, wh raised three children and countless dogs and on multiple occasions played host to the Apollo astronaut in Flagstaff for training in planetary geology with Gene and the USGS.

“I first met Carolyn in about 1966 when the Shoemakers invited Sue and me to camp out on the “roof”, eventually become the main floor, of the forever-project of building their house,” recalls Hugh Kieffer. “It great pleasure to be around her ever since.”

Ivo Lucchitta recalls members of Astrogeology working together to help construct the house: “Part of th construction involved lifting and putting in place a substantial beam in the form of a tree trunk. I vaguely that it was the main support element of an upper terrace. It probably was not feasible to get a crane up and narrow road up to the house, but then why not make use of the collective muscle power of several that was a lot easier to do, and the USGS Center was *family* in those fine days. While this action was t Carolyn was watching and smiling happily as she saw an important part of her dream-home achieving I also tried to keep Gene under some semblance of control.”

David Portree also remembers the “eclectic hilltop house that she built with Gene over the decades. It s love of Flagstaff — a love that brought USGS Astrogeology to the city in 1963. Best views of the San Fi Peaks that I ever saw in a private home.”

Of course, many of us remember Carolyn as both a friend and a scientific colleague, and those memor upon her astronomical expertise and discoveries as well as the unique privilege that comes with discov asteroids and comets: the ability to name them after those you care about.

“Carolyn Shoemaker’s soft-spoken and pleasant demeanor made her an instant friend to everyone s and she directly touched my family over the many years we have lived in Flagstaff,” recalls Gerald Schi

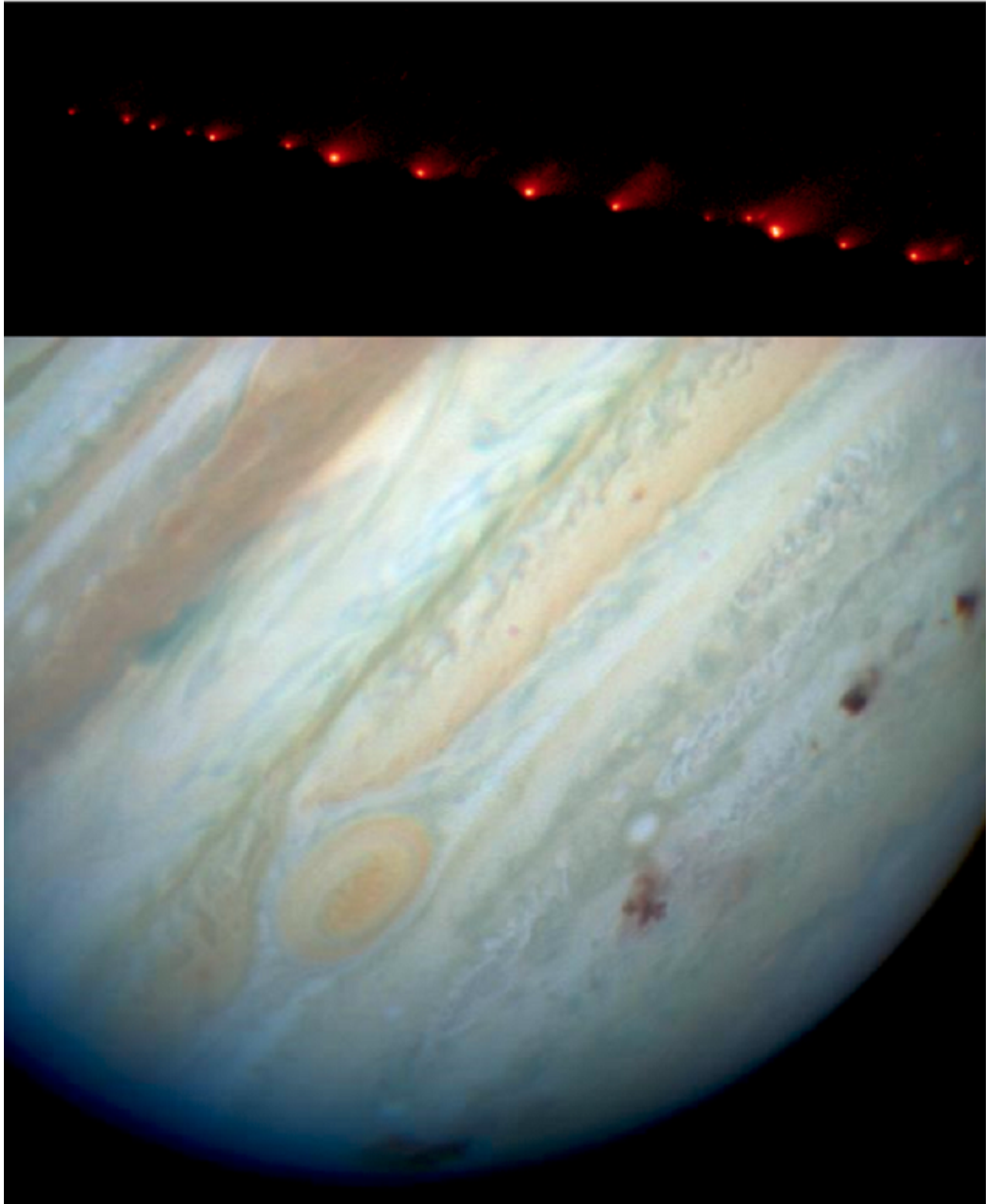
“On one notable occasion, Gene came into my office one day in 1997 and invited me and my wife Sa him and Carolyn for lunch at a local restaurant. I was pleasantly surprised but puzzled by the formality invitation. Following the lunch and some polite conversation, Gene told us what this special occasion v He and Carolyn had formally named a relatively large asteroid after my family surname, SCHABER.

Carolyn had recognized the existence of this asteroid while analyzing films taken by geology profess Bus (Northern Arizona University, Flagstaff) during their joint observations at Mt. Palomar in California ( 1980 . The discovery of the asteroid (1980TG5), now designated (3333) *Schaber*, was reported in the Circular (MPC) 10-549 on 26 March 1986.”



Ken Herkenhoff recalls being lucky enough to learn observational astronomy from Carolyn at Caltech:

“She patiently trained me and others to recognize moving objects by examining the films we acquired a using a stereoscope. Her love of discovery was contagious and made the class a uniquely fun experience up getting to name asteroid (3489) *Lottie* after my wife). She was never critical, even as I slowly learned follow her instructions, which was an unusual experience for a Caltech student!”



(top) Comet Shoemaker-Levy 9 imaged by the Hubble Space Telescope in 1994. (bottom) Hubble image of Jupiter after the Shoemaker-Levy 9 impacts, which left a row of dark splotches on the planet.

Brent Archinal remembers the excitement of meeting Carolyn during one of the most significant weeks

"I first met Carolyn and Gene Shoemaker at an unusual moment in time and history. It was Saturday, July 8, 1994. The impact of the "A" fragment of [Comet Shoemaker-Levy 9](#) on Jupiter had just occurred that day. Carolyn, Gene, David Levy, and others viewed Hubble Space Telescope images of the impact plume from the Space Telescope Science Institute in Baltimore, Maryland.

After the "A" event they immediately drove to the U.S. Naval Observatory in Washington, D.C. Being from David Levy, I had arranged it so they could try to visually observe the impact. The Shoemakers, Levy, and I arrived, and we quickly greeted them in the grand lobby of the classical main building of the observatory. We proceeded to the 12-inch telescope dome, 5 stories up, and began observing Jupiter about 10:30 PM. We viewed Jupiter at fairly high power but the time of the impact came and went with no obvious sign, and we gave up observing about midnight. (We later found that the "B" impact was probably the least visible of impacts.)

The Shoemakers met with President Clinton and Vice President Gore at the White House on Wednesday, July 13. A Nightline program broadcast live from the 12-inch dome on (a cloudy) Wednesday evening, on the 25<sup>th</sup> anniversary of Apollo 11 landing on the Moon. Friday saw a Planetary Society event at a downtown Washington D.C. location where the Shoemakers, David Levy, and Carl Sagan recapped the events of the week and the important Apollo 11 anniversary. I can particularly recall Gene's excitement at hearing from some amateur astronomer who thought they possibly saw evidence of the "B" fragment impact, while observing from Pennsylvania. This was capped by seeing Gene, Carolyn, and David, named the ABC News "Person of the Week".

Little did I know that a few years later my career path would change, I'd become an employee of the USGS Astrogeology Science Center and become good friends with Carolyn Shoemaker. I was honored when David Levy recommended that the IAU name one of their asteroid discoveries after me: (11941) *Archinal*.





Carolyn and David Levy in front of the Shoemaker building in 2011. Photo by B. Archinal.

The tragic car accident in 1997 that killed Gene and injured Carolyn was a turning point in her life, and for many memories. Baerbel and Ivo Lucchitta recall hearing the news of the accident while in an airport.

"Gene and Carolyn were in Australia to investigate impact structures. On a remote dirt road in the north Australia, they had a head-on collision and Gene died. Carolyn was severely injured and in the hospital in Alice Springs. Ivo and I were returning from a glaciology meeting in Tasmania and were in the Melbourne airport waiting for change planes on the way home to the United States. Suddenly, there was an announcement over the intercom asking me to go to a courtesy phone for a message. I froze. "Who died?" was my first thought. One does not get a message in an airport on another continent unless something drastic happened. With trepidation I answered the phone. The call was from Ginny, the then secretary of Astrogeology, who informed me about the accident and asked me to convince Ivo and me to visit Carolyn in the hospital. She did not realize that the hospital was half a continent away from us in the center of Australia. Unfortunately, we were locked into our travel arrangements, and even if we wanted to help Carolyn, it was not to be. Also, we heard that her relatives were already on the way to Australia to see her. So, dejectedly, we traveled home hoping all the while that Carolyn was going to be alright and eventually return to the U.S, albeit sadly, without Gene."

"I first met Carolyn at their rented house in Flagstaff in 1961," Jay Rennilson remembers. "I stayed over and had breakfast with the entire family of 5. Our children were the same ages, and throughout the years, Ivo, Renate and Carolyn were close and together faced many of the challenges of raising children. One thing I remember was that fateful day in Australia where Gene died and the call to her bed in Alice Springs where she was living. But Carolyn was a strong woman and never gave up."

David Portree remembers connecting with Carolyn as someone who had also shared such a tragic loss. "I was very closely with Carolyn to be sure the archival materials she and Gene generated over the decades were preserved. She invited me into her home many times to collect documents, maps, books, and files. We had in common that we both lost a spouse and had our life course changed irrevocably by a senseless head-on car crash out of control and out of nowhere. That brought us together. I feel fortunate that Carolyn was my friend."

"Ever since the accident," Ken Herkenhoff says, "seeing her reminded me of Gene and therefore made me feel that he was gone, but she was always glad to recall and discuss the time she had with him, which lifted my spirits. I miss both of them very much."

After Gene's death, Carolyn continued to work in astronomy, enjoying both the thrill of discovery and the deserved recognition that came with her fame. She welcomed the chance to give lectures and served as a role model for many young women with an interest in astronomy and space.

Baerbel Lucchitta remembers that Carolyn loved to travel. "When Gene was still alive, they traveled together. After he died, she traveled on her own, giving lectures all over the world. She was delighted to be invited to a meeting about the giant Ries impact structure in Germany. But she also gave lectures in the United States."



loved it. She liked to be picked up at the airport, to be wined and dined, and she enjoyed the limelight. ! of enthusiasm about her work with asteroids, comets, and impact craters. When she became too old for hardships of foreign and even domestic travel, she missed it greatly. But even then, she never said no to give a local lecture, because it was important for her to spread the word."





Carolyn greeting Apollo 16 Lunar Module Pilot General Charlie Duke in 2019. Photo by B. Archinal.



NASA astronaut candidates meeting Carolyn in 2019. From left: Kayla Barron, Zena Cardman, Loral O Moghbeli, Frank Rubio, Raja Chari, Warren Hoburg, Jonny Kim, Bob Hines, Matthew Dominick). Photo Archinal

In 2019, Apollo 16 Lunar Module Pilot General Charlie Duke gave the keynote presentation at the Flag of Science. "Carolyn Shoemaker attended and was fortunate enough to meet Charlie," Brent Archinal immediately remembered her, and they talked warmly, even though they had not seen each other in the



since the mission. He recalled his geology training with Gene Shoemaker.”

Brent also remembers that NASA's newest candidate astronauts were in attendance: “They were in Flagstaff, Arizona, for geology training with USGS geologist Lauren Edgar and others. They happened to sit nearby and upon Carolyn Shoemaker was there in front of them, they all wanted to meet her and introduced themselves. Although they appeared to also be meeting Charlie Duke for the first time, they genuinely seemed more interested to meet Carolyn.”

“Despite Carolyn's historic achievements, she was always modest about them and her other accomplishments. Herkenhoff says. Baerbel Lucchitta recalls this modesty in how she came to share an office with Carolyn.

“In Building 1 of the USGS campus in Flagstaff, I had a nice, spacious office with views of the San Francisco Peaks. When the building was demolished, I was relegated to several small offices all over campus. Eventually I moved back into the new Astrogeology building and assigned a small internal office without windows. The offices with views of the San Francisco Peaks were allocated to professionals of standing, not to retired persons like Carolyn, by then being of comet-and-asteroid fame, and having the building named after her and her husband. I was assigned a palatial office with the coveted view of the peaks. At that time, Carolyn was slowing down physically and visited her office only occasionally, mostly to read her emails, of which there were many from all over the world. At some time, she decided that her office was not fully utilized, and she graciously invited me to share it. Thus, we became roommates. Of course, I was delighted. Now this office became unique in that it was shared by two white-haired, old ladies. When Carolyn eventually gave up her space because of advancing age, I moved again into much less desirable quarters. I did not mind. I was happy to have had the opportunity to share her office and to have had so many enjoyable conversations.”

“Whenever Carolyn had finished looking at her emails, we chatted. Sometimes the conversations stretched for hours. She was always interested in what was going on at the USGS, among our acquaintances, within our profession, in the world. We spent many pleasant hours with each other and enjoyed each other's company. When visiting her office, which was located on the west end of the building, Carolyn would enter the main entrance at the east end and slowly progress through the hallway greeting everybody whom she passed and who had remembered her. I remember well how eventually, when age caught up with her, she would walk slowly, bent over, and with a cane. I miss her.”

Many younger members of Astrogeology also fondly remarked upon Carolyn's circuits of the building: how kind and encouraging she was, and her genuine interest in everybody's science.







Lunar Legacy event, Flagstaff, AZ, 2019. From left to right: Jody Swann, Ivo Lucchitta, Carolyn Shoemaker, Ivo Lucchitta, Gerry Schaber, Ray Jordan. Photo by B. Archinal.

In our parting thoughts there is a common theme: that our lives were universally enriched because we were fortunate enough to know Carolyn. We miss her more than words can say.

"I will continue to cherish my memories of her and Gene and am fortunate that I was able to spend as much time with them as I did. She set a fine example for me and countless others, and I will continue to try to live up to that example."  
Ken Herkenhoff

"My life and so many others were blessed to have known her." – Jay Rennilson

"I feel privileged that I could be part of Carolyn's life. And, wherever she is now, I wish her peace and happiness."  
Baerbel Lucchitta

"Having known Carolyn is a privilege and a joy that reside in my heart. For me, the death of Carolyn Shoemaker marks not only the departure of a person whom I knew and admired, but also, in some indefinable way, the end of an era, the Shoemaker Era." - Ivo Lucchitta

We conclude here with Carolyn's own words, written in 1999, and reflecting on her life with Gene and without him. They resonate now more than ever as we mourn the loss of Carolyn herself and face a future without her:

"What more could I ask for as I go into the future? That question leads me to one more thought. Since the accident in which I lost Gene, the awareness of our human need for others has dominated much of my life. Family and friends have been very important in my own recovery, and the concept of their importance, as essential as the need for knowledge of our physical world.

*"Without the human relationships we cherish, knowledge would count for naught; both are to be nourished. Henceforth, I'll continue my scientific exploration, knowing that I must not neglect the other side of living."*  
S. Shoemaker