Founder of the scientific study of impact cratering

Eugene Shoemaker, who died on 19 July, founded the scientific study of planetary impact cratering on the Earth, Moon, planets and their satellites, as well as pioneering surveys of near-Earth asteroids and comets, often in collaboration with his wife Carolyn. His most important scientific legacy was recognizing how pervasive the impact cratering process was in Earth's early solar system.

Shoemaker was born in Los Angeles, and received his undergraduate degree at Caltech in the age of 19. A few years later, in 1948, the Cold War had directed geological exploration activity in the United States towards identifying uranium deposits in Colorado and Utah. Shoemaker joined this effort as an employee of the US Geological Survey (USGS). But while studying the volcanic rocks of the southwest, Shoemaker became interested in the question of whether the craters on the Moon were volcanic or caused by impacts of asteroids and comets (a question that was only finally answered upon the return of Lunar samples by the Apollo program). After his first visit to Meteor Crater, Arizona, in 1952, he became convinced that both lunar and lunar craters had been formed by impacts.

In 1956, Shoemaker was assigned to map craters formed by nuclear explosions at the Nevada test site. He discovered that the familiar circular crater on the Moon, which he called the same old crater trail with inverted stratigraphy, ejected from the craters, and that this crater was surrounded by deep basins, partially filled by fallback ejecta. This work, described in his PhD thesis, "The ejected surface and the crater environment of the universe."

In 1972, Eleanor Helin and Shoemaker began a programme to search for Earth- and near-Earth asteroids using a 6.66-m Schmidt telescope camera at Palomar Mountain. In the 25 years that they and later, Carolyn, laboured with their 1930s equipment, they discovered some 1,000 of the known 477 Asteroid, Apollo and meteor (near-Earth) asteroids. Also, some 32 craters were discovered that carried the Shoemaker name.

To confirm the impact origin of craters, Shoemaker demonstrated that the size, distribution and fate of existing objects that could hit the Earth is closely correlated with the number, size and age distribution of the relatively recent craters found on the Earth and Moon. Shoemaker was the first to use the Palomar near-Earth asteroid survey along with the Earth's crater density between the age limits, to estimate the frequency with which asteroids hit the Earth. He found that the risk is based on the size impacts are acceptable. The International Spaceguard Survey, which is dedicated to identifying and tracking objects in space that may threaten our future, is a direct product of Gene Shoemaker's pioneering research.

The crowning, and the most famous, achievement of Shoemaker's career was the discovery of the Comet Shoemaker-Levy 9 (SL9) in 1993. With amateur comet-discoverer, David Levy, the Shoemakers obtained a poor image of the broken-up comet on a poor night for observing. The telescope had been made only because they had some film that had been accidentally pre-exposed, and they decided not to waste it. Two hours later, after Carolyn Shoemaker had noticed what looked like a "spotted comet" on the still-wet film, a telephone call was made to James Scotti at the University of Arizona's observatory. He certified the result with "Wow, you guys really have a comet!" Later images showed what looked like a "string of pearls," believed to be fragments of a Jupiter-family comet that was tidally disrupted when passing close to Jupiter in 1992. Several days later, dynamicians determined the orbit, and discovered that SL9 would hit Jupiter the next year. The sensational result, in July 1994, was our first observation of a large planetary impact, and graphically demonstrated the dynamic nature of impact processes in the Solar System. The production of the dark scar from methane and ethane-rich gas was unexpected, and taken with the shock of such events from telescopic observations dating back to 1789, suggests that small-type events are rare, occurring only at intervals of 2,000 to 5,000 years.

Eugene Shoemaker died with his field boots on, in an automobile accident in Arizona's Sonoran desert on his way to map a meteorite crater. Coronation survived the crash.

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