The Meteoritical Society

Meteoritics & Planetary Science 42, Nr 1, 149–150 (2007)
http://meteoritics.org

Memorial

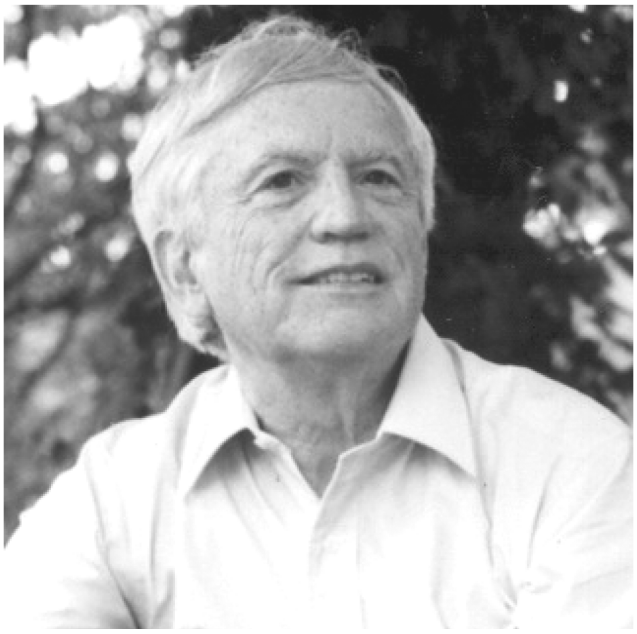
George West Wetherill (1925–2006)

George Wetherill died on 19 July, 2006, after a long illness. George was a major and influential contributor to cosmochemistry and to the understanding of the orbital and accretional dynamics of the inner solar system. He won numerous prizes, including the U.S. National Medal of Science, the Leonard Medal of the Meteoritical Society, and the J. Lawrence Smith Medal of the U.S. National Academy of Science. He was president of the Meteoritical Society in 1983 and 1984.

George's research career divides into three main phases: a) age-dating studies of rocks and meteorites (until 1975); dynamical modeling of the processes that bring meteoroids and larger bodies from asteroids or comets to the Earth and the inner planets (1965–90); and c) dynamical modeling of the formation of rocky planets (1975 until 2006). In each of these areas his papers had a major impact on meteorite and planetary research. Many details from George's early scientific education and the later evolution of his scientific interests are found in his autobiographical article (Wetherill 1998).

George was one of a cadre of physicists and chemists who, after military service during World War II, were educated at the University of Chicago and emerged ready to bring isotopic salvation to geology. George's thesis studies involved the measurement of the spontaneous fission half-lives of U and Th isotopes and the concentrations of neutron-induced fission products in rocks. In 1953 he moved (initially as a postdoc) to the Department of Terrestrial Magnetism (DTM) at the Carnegie Institution of Washington. During 1959 he was a visiting professor at Caltech, and in 1960 he became a faculty member at the University of California in Los Angeles (UCLA). In 1975 he returned to the DTM as director and, after 1991, was Director Emeritus. He was active in research until his health problems started to take a toll around 2000.

George was willing to learn what was needed to enter into new fields. Trained as a physicist, when he first moved to the DTM, he learned field geology and petrographic microscopy. And, starting about 1965, he learned celestial mechanics. Although a skilled experimentalist and hands-on geochemist, George loved mathematics and physical modeling. An early example was his invention of the so-called concordia diagram in which $^{206}Pb/^{238}U$ is plotted against $^{207}Pb/^{235}U$. The redundancy makes this an especially powerful system for dating igneous rocks, including those that may have suffered thermal metamorphism.



George W. Wetherill. (Photo courtesy of Carnegie Institution of Washington, Department of Terrestrial Magnetism)

At the DTM and UCLA, George and his colleagues studied many terrestrial igneous provinces, especially the Canadian Shield. Towards the end of the geochronology phase of his research life, his main focus was the ^{87}Rb-^{87}Sr system, and he devoted a large fraction of his efforts to studying meteorites (e.g., Gopalan and Wetherill 1968) and the returned lunar samples.

Beginning about 1965, following up on earlier studies by Ernst Öpik and Jim Arnold, George began using Monte Carlo calculations to follow the orbital evolution of meteoroids moving through the terrestrial planet zone. He showed that meteoroids in Earth-crossing orbits had limited dynamic lifetimes of about 10 Ma (consistent with their impact liberation from Apollo asteroids with perihelia <1 AU [Wetherill 1967]) before being removed by collisions with Earth, Venus, etc. At the time, it was generally hypothesized that resonances were responsible for bringing asteroidal materials to Earth from the Kirkwood gaps that reflect period resonances with Jupiter. Wetherill and Williams (1973) proposed a second, important mechanism generated by coincidences between the rate of change in the perihelion direction of the meteoroid orbit and that of the planet Saturn.

Stimulated by studies by Viktor Safronov, George started to examine the dynamics of planetary formation by including the effects of the gravitational fields of large (Moon-size) planetesimals on each other and on smaller objects. A key result (Wetherill 1980; 1994) was that the spacing and masses of the terrestrial planets could be roughly reproduced by such simulations.

George, like the remainder of the community, never found a fully convincing way to grow the first generation of kilometer-size planetesimals. He made many contributions, however, to the following stage, the growth of planetesimals to Moon-size and Earth-size objects. One example is the Wetherill and Stewart (1989) recognition that runaway growth can, on a time scale of 10^5 years, convert half of a planetesimal population into Moon-size bodies.

George was responsible for the first published suggestion that SNC meteorites originated on Mars (Wasson and Wetherill 1979—authorship order was determined by George flipping a coin). George thought that an impact into deep permafrost might generate a water-vapor cloud that would entrain meteoroids out of the Martian gravitational field.

George was a raconteur par excellence. He had a wealth of stories to tell, frequently about quirks of fate involving himself, or slightly cynical stories about administrators or fellow scientists. At conference hotels he and a small coterie would still be exchanging stories when most of his colleagues had retired for the night.

He was a low-key colleague and administrator. He avoided conflicts where possible. At faculty meetings and scientific conferences he made few statements and asked few questions, but his statements and questions were stated with authority and backed up with carefully expounded facts.

As can be gathered from his 1998 biography, George had an idealistic approach to science and to life. He was quite capable of taking an unpopular stand on important issues. While at UCLA, George served on a committee that evaluated whether the University of California should continue to manage the weapons laboratories at Los Alamos and Livermore (Zinner 1970); although the committee found many reasons to question the continuance of the arrangement, George was the only member who recommended that the relationship be terminated.

George was very loyal to the Meteoritical Society. As long as his health permitted, he attended each of our meetings. Few past presidents were as faithful as George. He served as an associate editor for the "new" *Meteoritics* (now *Meteoritics & Planetary Science*) from 1989 until 2000.

We will miss George's wisdom, his ability to bridge the divide between meteorite studies and modeling, and his fellowship. We are grateful for our memories and for the many scientific contributions that he left with us.

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