FRANK F. APLAN
1923–2020
Elected in 1989

“For contributions to education and research in the mineral industry through the integration of theory and practice covering metallic ores, industrial minerals, and coal.”

BY DOUGLAS W. FUERSTENAU AND RAJA V. RAMANI

FRANK FULTON APLAN, one of the most influential leaders of the mineral processing industry and academia for 60 years, and Distinguished Professor Emeritus at Pennsylvania State University, passed away peacefully in Berwick, Pennsylvania, on November 3, 2020, at the age of 97.

His association with the mineral engineering profession had many dimensions—engineer, scientist, manager of research, and teacher, to name a few—and his performance in each of these roles was exceptional. Most of all, Frank was an outstanding human being: brilliant, dedicated, gritty, hardworking, and demanding. He expected excellence from himself and from everyone else. His friends learned many lessons about how to accept and deal with adversity from Frank’s four difficult but successful campaigns against cancer.

Frank was a warm and friendly person who provided wise counsel and a helping hand. He often said that “no man is an island. There are a half-dozen or more people that probably helped you along in your career…. my philosophy is that often you cannot pay back but you can pay forward…. that is why I’ve gone out of my way to recommend all kinds of people for awards and honors and so forth and I try to give generously to charity and education.”
He was born August 11, 1923, in Boulder, Colorado, to Frank F. and Helen Fischer Aplan, and raised in Fort Pierre, South Dakota, during the decade-long depression, drought, and plague of grasshoppers of the 1930s. His illustrious career in science, engineering, and technology of mineral processing, spanning five universities and five major mineral industry companies, began with an early interest in the chemistry of paints, sparked at the age of 10 by a house painter. To develop his interest in chemistry, his mother bought him a Gilbert “Chemistry Lab.” Ever the entrepreneur, Frank charged neighborhood children $0.05 to watch his experiments. All went well until he began extracting hydrogen from water, leading to a small fire.

He entered the South Dakota School of Mines and Technology (SDSM&T) in 1941 in chemical engineering, but interrupted his education to enlist in the army in November 1942. He was extremely proud of his wartime service, serving as an infantryman in a rifle company of the 69th Infantry Division carrying a mortar across Europe, for which he received the Combat Infantryman’s Badge and Bronze Star Medal. Discharged as a technical sergeant in 1946, he returned to SDSM&T and completed his BS degree in metallurgical engineering in 1948; 2 years later he got an MS in mineral processing engineering from Montana School of Mines (later known as Montana Tech).

In 1948–51 Frank worked at Homestake, Day Mines, and Climax Molybdenum, and from 1951 until 1953 as an assistant professor at the University of Washington (Seattle). From there he enrolled in the Massachusetts Institute of Technology as a graduate student in mineral engineering (metallurgy), receiving his ScD in 1957 for a classic piece of work on the thermodynamics of the adsorption of hexyl mercaptan on gold. While at MIT, he met Clare Marie Donaghue of Dorchester, Massachusetts; they married July 30, 1955.

Upon graduation, Frank joined the research staff of Kennecott Copper in Salt Lake City as a senior scientist but soon accepted an offer from Union Carbide as research engineer in the research laboratories of Electrometallurgical
Company in Niagara Falls as he felt “they had an excellent laboratory...there were close to two hundred people there.... It was the best postgraduate school in the field.” By 1968 Frank had risen to group manager and was closely involved in the development of processing a wide range of ores for Carbide’s domestic and international production of a multitude of metals and nonmetals; his experience led him to justly claim “you name the commodity, and I have probably worked with it one time or other.” He traveled to many of these operations, particularly in their development and early operational stages, gaining the skill for which he later became an acknowledged leader—integrating theory with practice in the processing of coal, ores, and industrial minerals.

Frank joined Penn State in 1968 as professor and head of the then Department of Mineral Preparation and moved quickly to enlarge the research program on the science and technology of mineral processing, particularly in the area of coal flotation, motivated by the importance of coal mining to the state of Pennsylvania. In addition, he initiated new programs in particle technology, applied surface chemistry, chemical processing, and mathematical modeling of processes. By the time he retired in 1992, he had also served as the chair of mineral processing and metallurgy programs and a guiding member of the newly formed Environmental Systems Engineering Program in the Department of Mineral Engineering.

The growth of the Penn State Mineral Processing Program to preeminence was primarily attributable to Frank’s breadth and depth of academic and industrial experiences and his outstanding leadership in attracting and fostering young faculty to become leaders themselves. This was perhaps stated best by Kwadwo Osseo-Asare, Distinguished Professor of Material Sciences and Engineering: “I’m on the Penn State faculty today because of Prof. Frank Aplan, a giant in our field. He brought me to Penn State.... I mourn the departure of a kind, humble, and transparent mentor.... I write with tears in my eyes, of sorrow and also of gratefulness.”

Frank supervised about 50 MS and PhD candidates and developed and taught several new undergraduate and graduate
courses to hundreds of students from several other programs. He was a demanding but master teacher, and undergraduate students loved his classes and insightful stories of plant experiences that he sprinkled throughout his lectures. In directing graduate students, his principal aim was to develop in them self-reliance and independence, qualities he knew from his own experience to be key to success and in which he excelled. Even after he retired he remained active at PSU for more than a decade, teaching classes, directing students, and attending technical meetings.

Penn State recognized Frank’s outstanding performance with the Matthew J. and Anne C. Wilson Excellence in Teaching Award in 1977 and named him to the first class of Distinguished Professors in 1990. At the national level, his outstanding teaching was recognized in 1992 with the AIME Mineral Industry Education Award.

At the time of his retirement, the Frank F. and Clare M. Aplan Centennial Scholarship in Mineral Engineering was established and endowed at Penn State to celebrate Frank’s contributions and encourage future generations to follow his lead. At SDSM&T, Frank and his wife had established the Frank F. and Clare M. Aplan Native American Fund in Metallurgy to support a scholarship for native Americans to attend the school.

Frank was a world authority on flotation processes, especially known for his fundamental studies of the wetting of solids and their control through the adsorption of surfactant films and for his work on the effect of atomic defects on the properties and behavior of solid-liquid interfaces. His contributions to the areas of gravity concentration, suspension rheology, industrial mineral processing, and environmental pollution control are particularly noteworthy. He also emphasized environmental remediations by building on the past strengths of the existing academic program and an increased environmental emphasis in all courses. This was a logical extension of the program because the separation of metals and glass from municipal solid waste, the removal of acids and metals from water, and the trapping of fine particles
from industrial off-gases all require techniques that extractive metallurgical engineers were using long before environmentalism became popular.

In addition to his academic engagement he was a major contributor to the affairs of professional societies and to technical symposia and congresses. He belonged to the American Institute of Mining, Metallurgical, and Petroleum Engineers (AIME); Society for Mining, Metallurgy, and Exploration (SME); Metallurgical Society (now the Minerals, Metals and Materials Society; TMS); Engineering Foundation; American Chemical Society; American Institute of Chemical Engineers; and Archeological Institute of America. His services to each of them, in both the trenches and leadership, were extensive. He was a member of the board of directors of SME and the Engineering Foundation; chair of the SME Mineral Processing Division and TMS Hydrometallurgy Committee; member of the editorial board, coeditor, and section editor for major books including *Mineral Processing Handbook* (SME), *Froth Flotation* (SME), and the proceedings of the 1974 Solution Mining Symposium; and a program evaluation visitor for the Accreditation Board for Engineering and Technology (ABET) for mineral processing (SME) and metallurgy (TMS) programs. In addition, he authored, presented, and published over 150 research papers in prestigious journals and national and international symposia that would continue to illuminate mineral processing aspirants with his findings and knowledge.

Frank was very active in the Engineering Foundation. He chaired a conference on fine and ultrafine particles in 1967 and served on a number of conference committees beginning in about 1975. He was a member of the foundation’s board of directors from 1977 onward, and his dedicated and distinguished service as board chair (1987–89) was recognized by the foundation’s creation, in 1989, of the annual Frank F.

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Aplan Award as a tribute to his “lifelong productive career in coal and mineral processing research and education,” to be awarded to eminent contributors to the mineral processing field. Frank was the first recipient.

Mineral processing researchers around the world celebrated his role in their lives and in the field of mineral processing by contributing papers to a special volume of the *International Journal of Mineral Processing* (vol 17(3–4), 1998) in honor of his 75th birthday. And in 2003 Frank’s oral history, *Mineral Education Generalist, Professor of Metallurgy and Mineral Processing, 1951–1998*, was published by the Oral History Center of the Bancroft Library at the University of California, Berkeley, as part of the Western Mining in the 20th Century series.

Frank’s contributions to the science, engineering, and education of mineral processing were widely acknowledged by his peers with a number of honors: honoris causa, Engineer of Mines, Montana School of Mines and Technology (1968); distinguished member of SME and Robert H. Richards Award of AIME (both in 1978); Arthur F. Taggart Award of SME and Centennial 100 Alumni of the South Dakota School of Mines and Technology (both in 1985); election to the NAE (1989); honorary member of AIME and Antoine M. Gaudin Award of SME (both in 1992); SDSM&T Distinguished Alumnus Award and Guy E. March Medal (both in 1996); AIME/ASME Percy Nichols Award (1997); South Dakota Hall of Fame (1998); Chancellor’s Medallion, Montana Tech (2015); and election to the National Mining Hall of Fame (2016).

For all Frank’s name and fame in the profession, he was a very modest, devoted family man. Outside of work, he was a devout Catholic, a soldier, a gardener, an avid photographer, a jazz aficionado, and a philanthropist. Other interests included reading, theater, crawling around most of the old mills and ghost mining camps of the West, mining history of the western United States, the US military, and the railroad. His keen sense of humor and repertoire of stories and anecdotes always contributed to an enjoyable time in his company. He will be missed.
Frank was preceded in death by his wife of 55 years, Clare, and daughter Margaret Anne (in childhood). He is survived by daughters Susan Bower and Lucy, son Peter, five grandchildren, and four great-grandchildren.