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## MORRIS MUSKAT

1906–1998

Elected in 1983

*“In recognition of pioneering work in establishing the basic concepts defining the flow of fluids in the earth and establishing the field of reservoir engineering.”*

BY JOSEPH E. WARREN

**M**MORRIS MUSKAT was one of the truly great pioneers in the petroleum industry, who laid a sound analytical foundation for petroleum reservoir engineering by combining fluid mechanics with phase behavior. He died on June 20, 1998, at the age of 92 in Pasadena, California.

Dr. Muskat was born on April 21, 1906, in Riga, Latvia, and he, with his family, migrated to the United States in 1911; he was naturalized as a U.S. citizen in 1914. Muskat attended Marietta College and Ohio State University, where he received B.A. and M.A. degrees. After teaching physics at Bowling Green University, he earned his Ph.D. in physics from the California Institute of Technology in 1929.

After graduating from CalTech, Morris joined Gulf Research & Development Company where he remained in various capacities until 1950. He took a one-year hiatus from Gulf, during World War II, to serve as chief of the Acoustics Division of the Naval Ordnance Laboratory, Washington, D.C. In 1951 he became technical coordinator of the Production Department, Gulf Oil Corporation in Pittsburgh, Pennsylvania. In 1961 he was promoted to technical adviser to the Executive Group of Gulf—a position he held until his retirement in 1971.

Morris Muskat was a fellow of the American Physical Society; a fellow of the American Association for the Advancement of Science; a member of the American Institute of Mining, Metallurgical, and Petroleum Engineers (AIME); a member of the American Petroleum Institute (API); and a fellow of the New York Academy of Sciences. He also served as distinguished lecturer for the Society of Petroleum Engineers (SPE) in 1962–1963, as member of the U.S. delegation to the United Nations Economic Commission for Asia and the Far East (ECAFE) Symposium in Tokyo in 1965, and as chairman of the API's Committee on Petroleum Reserves (1955–1971).

Among the many honors he received were the API's Certificate of Appreciation (1965) and Special Scroll (1971), the SPE's Lester C. Uren Award (1969), the AIME's Lucas Medal (1953) and honorary (life) membership (1972), membership in the National Academy of Engineering (1983), and CalTech's Alumni Distinguished Service Award (1987).

Following the massive overproduction of oil in the 1930s and the subsequent low prices (\$.10/barrel) that resulted in the virtual collapse of the U.S. oil industry, Muskat published his seminal book, *The Flow of Homogeneous Fluids Through Porous Media* (McGraw-Hill, 1937). This book, together with his later book, *Physical Principles of Oil Production* (McGraw-Hill, 1949), established the bases for petroleum reservoir engineering. The evolution of this discipline and the establishment of regulatory bodies such as the Texas Railroad Commission, plus the effective repeal of the "law of capture" (an 1875 judicial opinion that oil and gas were like wild animals and belonged to the person who reduced them to possession), forced the oil industry to abandon its policy of maximizing the rate of production and to accept the concept of maximizing recovery of the hydrocarbons contained in each reservoir.

Muskat's two books contributed to the rationalization of the oil industry and still remain the most widely known books in this field of engineering. His work is probably the most cited; for example, the introduction, translated by R. de Weist, to "Theory of Groundwater Movement" by Polubarinova-Kochina said, "It is a classic, much like Morris Muskat's

*Flow of Homogeneous Fluids Through Porous Media*" (originally published in 1937 and translated into Russian 13 years later). Petroleum reservoir engineering is the most complex of the specialties in petroleum engineering because it must deal with mixtures of liquid and gaseous hydrocarbons that are no longer in equilibrium after production begins and are contained in a poorly defined porous medium at significant depth. Dr. Muskat helped establish the basic principles of this discipline. He defined the fundamental parameters and dynamic concepts governing the flow of oil and gas within a reservoir. His theoretical studies of steady-state and transient flow through porous media are considered classics in the field of hydrology.

Despite his role as the acknowledged founder of reservoir engineering, Morris found time to publish, and to obtain patents, in many diverse fields of science and engineering—for example, quantum mechanics, scattering of alpha-rays, well logging (microwave and neutron), mass spectroscopy, isomerization, lubrication theory, hydrodynamics, and mechanics of shaped charges.

Following the tragic death of his daughter, Rosalyn, in a road accident in Vietnam in 1969 and the death of his wife, Fern, a few years later, Morris relocated to Pasadena, California, and disengaged himself from professional activities. He told me that, although he still maintained a deep interest in U.S. oil and gas reserves, his principal concern was focused on the proliferation of nuclear weapons and the uncertainty of humanity's survival.

His older daughter, Phyllis M. Goddard, of Altadena, California passed away in January, 2004. He is survived by sons David A. Muskat of Painesville, Ohio, and Robert E. Muskat of The Woodlands, Texas, and seven grandchildren.