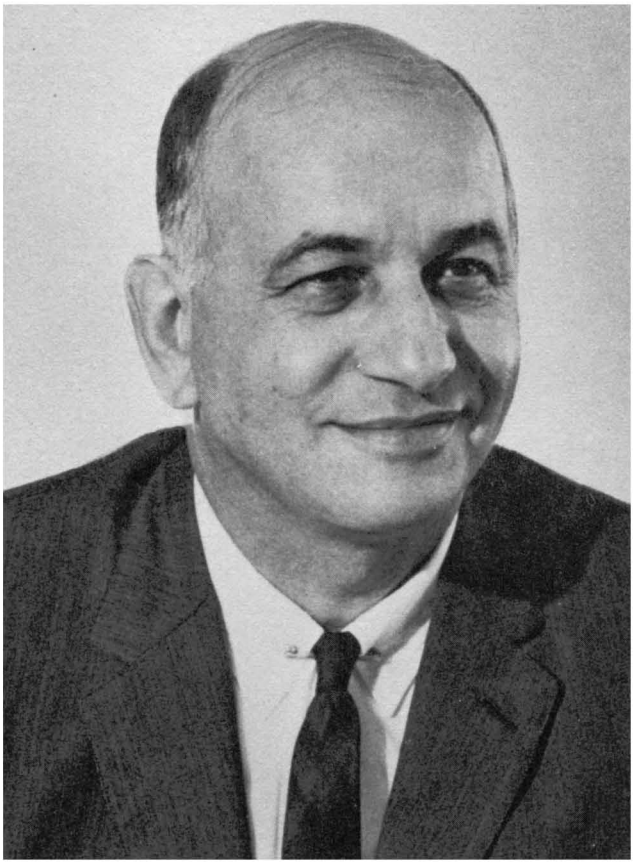
NATIONAL ACADEMY OF SCIENCES

WILLIAM THOMAS PECORA

1913—1972

A Biographical Memoir by
CHARLES A. ANDERSON

Biographical Memoir



WILLIAM THOMAS PECORA

February 1, 1913–July 19, 1972

BY CHARLES A. ANDERSON

WILLIAM THOMAS PECORA was a stimulating and enthusiastic geologist, known as "Bill" to countless friends. He had an exciting career with the U.S. Geological Survey that culminated in his appointment by President Richard Nixon on April 20, 1971, to serve as Undersecretary of the Department of the Interior. In June of 1972, Pecora was hospitalized because of diverticulitis and was unable to survive postoperative complications leading to his death on July 19 of that year. Interior Secretary Rogers C. B. Morton paid high tribute to Bill Pecora, stating, "Our department—and the nation—has lost a singularly talented and energetic scientist and administrator. Few men possess the leadership qualities which Dr. Pecora showed in his quest for balance and harmony in resource development and conservation. Dr. Pecora understood conservation in the true sense. As a scientist, he recognized that Nature's forces are neither angry nor benign; they operate on laws and principles of matter, motion, physics, and chemistry. He felt strongly that man must not seek to subdue these forces, but understand them, work with them, and live in harmony with them." *

Bill Pecora was born in Belleville, New Jersey, the son of Cono and Anna (Amabile) Pecora. Both parents were born in southern Italy in the village of San Arsenio, near Paestrum, an

* Eulogy at St. Patrick's Episcopal Church, July 21, 1972.

early Greek settlement, and the recorded Pecora lineage dates from about 1600 A.D. His parents were married in Newark, New Jersey, and lived in Belleville for a time until they moved back to Newark, where they lived until their deaths. There were ten children in Bill's family—four boys and six girls. Bill was number nine, and in his boyhood he was the unhappy "water boy," assigned to filling the twelve water glasses for the family. The Pecoras were an unusually devoted and close group, and family loyalty seemed to increase with the passage of time. Christmas was a "must" gathering, and one year Bill traveled from South America for thirty-six hours without sleep in order to be present for the Yuletide celebration.

Bill's two older brothers, Louis and Charles, and his eldest sister, Jean, carried on the family business of wholesale imports. His brother Sam, a physician, loved to discuss poetry and science with Bill. Surviving children of the Pecora family are five sisters: Mrs. Ellis Blackman, Mrs. Vincent J. Casale, and Mrs. Frank Immersi of Newark; Mrs. Gerard A. Riccardi, Juno, Florida; and Mrs. James J. Vasselli, Tequesta, Florida.

Bill attended the Abington Elementary School and Barringer High School in Newark, and was graduated from the latter in 1929. He was very active in extracurricular affairs in high school, serving as editor of the monthly school paper, "Acropolis," and of the yearbook, "Taps." He contributed an editorial to "Taps" that summarized the four years of student life at Barringer High School, with appreciable emphasis on military jargon in keeping with the title of the yearbook. Baseball, soccer, and fencing used up some of his energy, and he participated in the HiY Club, Latin Club, Italian Club, Thalians (acting), Forum (debating), and Science Club. In his spare time, he wrote the words for the song of the Class of 1929. Louise I. Capen (civics and history), Roger B. Saylor (math and science), and V. L. Sibilia (Italian) were teachers who took much personal interest in Bill and entertained him at their

homes. As might be expected, he was valedictorian of his graduating class.

In 1929, Bill was awarded a Charles H. K. Halsey Scholarship that provided funds for a four-year scholarship of $1000 annually, to be used for tuition and living expenses at Princeton University. Three scholarships were awarded that year to candidates who were residents of New Jersey and had received their preparatory education at one of the public high schools in that state and who, in the opinion of university authorities, would be unable to obtain an education at Princeton without this financial assistance. An additional requirement was that each winner be of a different religious faith—one Protestant, one Jewish, and one Roman Catholic. Bill Pecora was the Roman Catholic selected.

At Princeton, Bill majored in geology and geological engineering, with an emphasis on hard rocks. He received the B.S.E. degree in 1933, and was graduated with honors. His senior thesis was, "The problem of the Susquehanna Complex with special attention to specific gravity variations," with A. F. Buddington, H. H. Hess, and Edward Sampson as advisors. During his undergraduate days, he found time to serve on the editorial board of the campus humor magazine, "Tiger," and was associate editor of two other campus publications, "Nassau Herald" and "Bric-a-Brac." He was a member of the Pistol Club and Rifle Club and was active in varsity fencing, serving as captain of the team in his senior year when he was Intercollegiate Fencing Champion. After graduation, he stayed on for two years at Princeton as a tutor in geology. In the summer of 1934, he was a field assistant to Erling Dorf, who was working in Montana on Paleozoic stratigraphy and on the Beartooth Butte Formation, as well as collecting ostracoderms and fossil plants.

Scholarship aid made it possible for Bill Pecora to start graduate studies at Harvard in 1935, where he concentrated

largely in optical mineralogy and petrography under Esper S. Larsen, Jr. Bill became an assistant to Professor Larsen, which was considered an honor by the graduate students because of the legend that Esper Larsen's absentmindedness required an assistant who was very bright. Later Bill became an instructor in petrography. He was always regarded as one of "the Professor's boys," and Larsen encouraged Bill to select a thesis area in the Bearpaw Mountains, where he had a group of students working on igneous rocks. Bill received a grant from the Holden Fund to finance his fieldwork in 1937–1939 in the western fringe of the Bearpaw Mountains.

For his doctoral thesis, Bill made a petrologic study of the Boxelder laccolith and concluded that it differed structurally and petrologically from all the described laccoliths in the Highwood Mountains and that the syenitic rocks differentiated from shonkinite after the emplacement of shonkinitic magma into the laccolithic horizon. The progression of differentiation was from plagioclase shonkinite to plagioclase syenite to sanidine syenite. In addition, Bill studied the unusual nepheline-bearing pegmatites in the Rocky Boy stock, located about twenty miles southeast of the Boxelder laccolith, concluding that these rocks resemble the unusual pegmatites of the Kola Peninsula in Russia. He also described drusy vugs in a monzonite dike that contained albite tablets associated with prehnite and smaller masses of calcite. Bill was awarded the Ph.D. degree by Harvard in 1940.

During the summer of 1936, Bill was in Germany as a member of the United States Olympic fencing team, and during his later student days at Harvard he continued this activity. In one demonstration, Bill and his partner fenced on roller skates. He was very gregarious and had another social life completely outside the Harvard geology department. To the envy of his friends, Bill liked to brag about the great Italian meals he had enjoyed in South Boston.

Foster Hewett, Chief of the Metals Section of the U.S. Geological Survey, was a frequent visitor to the geology department at Harvard before the outbreak of World War II, and because of the glowing recommendations from the department, he hired Bill Pecora to participate in the Strategic Minerals Program. Bill's first assignment in 1940 was the study of nickeliferous deposits in the western states; the assignment was later expanded to include similar deposits in Brazil. Bill found that the richer deposits of nickel were the result of long weathering of pyroxenite or peridotite during a complex physiographic history and that serpentinite was not a favorable rock for the residual accumulation of nickel. Garnierite in the nickel–silicate deposit near Riddle, Oregon, had three modes of occurrence, reflecting an orderly variation in color, specific gravity, and nickel content, which serve as useful guides for economic geologists.

Mica was an important strategic mineral during World War II, and in 1943 Bill was assigned to southeastern Brazil to participate in and direct investigations of the mica-bearing pegmatites. He and his associates were able to unravel the complexities of the structural controls, which led to the discovery of important mica deposits needed for the war program. Bulletin reports were published by the Brazilian government and by the U.S. Geological Survey. In addition, Bill spent some time in Colombia, Venezuela, and Brazil investigating quartz crystals needed for radio oscillators during World War II.

Bill had a sharp eye and an affection for minerals, and the pegmatites in Brazil were excellent collecting sites for choice specimens. In 1946 he returned to Washington, D.C., with a number of semiprecious gems that he enjoyed displaying to his numerous friends. Phosphate minerals are common in the Brazilian pegmatites, and Bill collaborated with several of his colleagues in mineralogical studies of his specimens that resulted in a series of papers describing new minerals. Later in Montana, he found two new carbonate minerals, which he

named after his friends, Wilbur Burbank and Frank Calkins. Bill described whewellite, a calcium oxalate monohydrate from Montana, the mineral's first known locality in North America. As a result of considerable laboratory work, Bill and his colleagues described nine new mineral species from his mineral collections.

In 1949, he started his large-scale geologic mapping program of eight fifteen-minute quadrangles in the Bearpaw Mountains in Montana. He became a very effective recruiting officer at universities and colleges and selected many promising students as field assistants. Ten of these are named as co-authors on the published maps; seven remained with the U.S. Geological Survey and now have responsible research assignments. The first four geologic maps were published in 1957 on a planimetric base as Miscellaneous Geologic Investigation Maps and the other four were published in bulletins in multicolor on topographic base maps, starting in 1960 and ending in 1963. Bill was very proud of the accomplishments of this mapping project of the Cenozoic alkalic igneous rocks.

In 1956, Bill Pecora published an outstanding review paper on carbonatites, which are essentially carbonate–silicate rocks containing a great variety of minerals. He concluded that the carbonatites were deposited by solutions ranging widely in temperature, pressure, and concentrations that were derived from alkalic magmas during silicate crystallization. He also concluded that a carbonate magma in the normal sense is less likely to exist than carbonate-rich solutions, which at elevated temperatures and pressures can contain higher concentrations of dissolved ingredients than are normally in hydrothermal solutions. At many localities, the carbonatites occur as veinlike or dikelike bodies or as cores in volcanic plugs of alkalic rocks. Demonstrating his awareness of the importance of mineral resources, he emphasized that the carbonatites and related alkalic rocks contain an impressive reserve of rare commodities—nio-

bium, titanium, zirconium, rare earths, and uranium—as well as the common commodities—barium, strontium, magnetite, phosphate, and vermiculite.

In a later paper (1962), Bill concentrated on the carbonatite problem in the Bearpaw Mountains, where a composite alkalic stock contains a volcanic neck of subsilicic porphyritic cancrinite syenite, partly altered to sericite, calcite, sulfide minerals, barite, and zeolites. Subsequent fracturing was followed by introduction of pegmatites and veins, composed of K-feldspar, biotite, calcite, pyrrhotite, pyrite, uranium-rich pyrochlore, rare-earth carbonates, barite, and ilmenite, a suite of minerals that is typical of carbonatites, having considerable economic potential. These differing mineral assemblages pose some problems in geochemical history, but the evidence indicates that early magmatic crystallization of silicates yielded an aqueous residual fluid that became progressively enriched in CO_2, S, F, P, Ca, Fe, and Mg.

Geochemistry has long been one of the fields of major interest in the Geological Survey, and during the mid-1950s there was a growing recognition of its increased importance in the Survey program. In 1957, Bill was selected to be Chief of the Branch of Geochemistry and Petrology because of his background in field geology, mineralogy, petrology, and geochemistry. He effectively recruited talented youngsters to appreciably strengthen the research capability in these joint disciplines. Many of these early recruits are still with the Survey, whereas others were attracted to university positions that they now occupy with distinction. Bill strengthened activities he believed were undernourished, establishing strong programs in geochronology, experimental petrology, and mineralogy. As Branch Chief, he played an important catalytic role when natural coesite was discovered and its significance as an indicator of meteorite impact on both the earth and the moon was pointed out. In 1961, Bill returned to his former status of Re-

search Geologist, and during this interval he wrote an important paper on the carbonatite problem in the Bearpaw Mountains.

Bill Pecora was named Chief Geologist in 1964, and a year later was appointed Director of the Survey by President Lyndon B. Johnson. As Director, he pressed vigorously for programs that would be responsive to current and emerging national problems, such as the accelerated investigations of gold resources when national stocks were being depleted at an alarming rate and investigations for offshore development of oil and gas in anticipation of the impending energy dilemma. In response to problems revealed by the Alaska earthquake of 1964, he obtained approval to establish the National Center of Earthquake Research in Menlo Park, California, now an important center for earthquake studies.

The Santa Barbara oil spill on January 28, 1969, was the first major challenge to face Bill Pecora as Director, and he moved forcefully into action with the firm conviction that the fundamental facts must be determined in order to reach a rational decision. Many of these facts are available to the public in Geological Survey Professional Paper 679, published promptly under his direction in 1969. An account of Bill Pecora and his activities as Director at that time is given below.

"One old timer among the newcomers in Washington was William Pecora, Director of the U.S. Geological Survey. Pecora had 30 years of distinguished service with the U.S.G.S. to his credit, and was held in high esteem by his colleagues in science and government. For the recriminations associated with Santa Barbara, Pecora was the most senior scapegoat. Secretary Udall was no longer around to take the rap; and Secretary Hickel . . . could scarcely be blamed for the original blowout. But Pecora—Pecora was in command of the agency that was most intimately connected to the original leasing in the Santa Barbara Channel and the subsequent management of operations there. When appointed as director in 1965, he had taken over a staid and

scientifically respectable agency with a history of conservatism. . . . Pecora, a former Olympic athlete, liked action and the personal engagement of Washington politics. His activity in policy matters and in defense of U.S.G.S. programs brought his agency into the rough political world. . . . True, his biography does lean to degrees, scientific societies, research honors, and membership in national academies, but, good poker player that he is, he took bad deals well, and his appointment in 1971 as Undersecretary of the Interior was helped more than hurt by his performance in Santa Barbara." *

The discovery of large reserves of oil and gas in 1968 on the north coast of Alaska led to Bill's second major challenge. A large part of Alaska is underlain by permafrost, which would melt beneath the pipeline proposed to transport hot oil to southern Alaska, where harbors are available for tankers in an area of major earthquake faults. Again, Bill insisted that all of the geological factors involved should be assembled and analyzed before making decisions, and the Geological Survey made a careful study of the geological aspects of the proposed pipeline route. Bill arranged for the mechanism for discussions between industry and government agencies that led to the preparation of environmental and technical stipulations for the construction of the trans-Alaska pipeline. These are now a part of the permit and, if properly monitored, will provide acceptable protection of Alaska's unique environment and will also provide access to the area's vast resources of petroleum.

Bill recognized that conventional methods of gathering resources and environmental data were not providing information as rapidly as our expanding population and economy required. He believed that aircraft and spacecraft might gather important data quickly, effectively, and economically; thus, he actively

* From Carol E. and John S. Steinhart, *Blowout: A Case Study of the Santa Barbara Oil Spill* (Belmont, Calif.: Wadsworth Publishing Co., Inc., 1972), p. 12; reprinted by permission of the publisher, Duxbury Press, North Scituate, Mass.

supported research in photogeology and remote sensing. As a result of this research, new aerial methods were developed for finding fresh water, surveying volcanoes, and assessing the environment. In 1964, he formed an association with the National Aeronautics and Space Administration (NASA) that enabled the Geological Survey to accelerate its remote sensing research and extend it to include analyses of the potential values of surveying the earth from space. Results of these spacecraft studies led Bill to recommend that the Secretary of the Interior establish a departmental program to survey the Earth from space and to extend the research in remote sensing to meet needs of all bureaus of the department. This recommendation led to the establishment of the Earth Resources Observation Systems (EROS) Program, which was announced on September 21, 1966. Bill directed that performance specifications be developed to provide "remote sensing data of maximum usefulness to the maximum number of scientists and technicians throughout the world."

The performance specifications for the space survey, coordinated and refined in cooperation with the Department of Agriculture, were delivered to NASA on October 21, 1966, for implementation; and the first Earth Resources Technology Satellite (ERTS-1) was launched on July 23, 1972, just three days after Bill's death. Without the vision and drive of Pecora, there might never have been an EROS Program.

Although the announcement of the EROS Program produced varied reactions, Bill strongly emphasized the need and soundness of the program, and on December 10, 1974, the *New York Times* quoted Dr. James C. Fletcher, Administrator of NASA, as saying, "If I had to pick one spacecraft, one space age development, to help the world, I would pick ERTS and the operational satellites which I believe will be evolved from it, later in this decade." Bill placed Earth in a new perspective.

Directors of federal organizations make annual pilgrimages

to Congress to defend their requests for funds, and Bill Pecora was superb in his meetings with the appropriation committees, always presenting his requests in an articulate and friendly manner. Because of his excellent memory for detail, he could answer pertinent questions from the members of the committees clearly and forcefully and with a delightful sense of humor if the situation was appropriate. He always left the members of the committees well aware of the importance of the USGS program and its benefits to the taxpayer.

During the period Bill Pecora served as Director of the Geological Survey and Undersecretary of the Department of Interior, he became increasingly involved with the geological aspects of problems concerning our environment. In his Horace M. Albright conservation lecture, given at Berkeley on January 18, 1972, he emphasized "inadequate data persist in the arena of assessment and decision making. Consumers demand a continuing supply of energy and resource products on one hand, and demand maximum pollution protection on the other. . . . Geologic science demonstrates that nature is a massive polluter of the environment. In comparison, man's activity is of little consequence on a planetary scale in some issues, but may be of serious consequence in a local context. . . . Science and research are needed more than ever to provide guidance to courses of national action aimed at fulfilling human needs. As the most intelligent species on earth, man can certainly provide for himself and yet prudently protect the total ecosystem from unnecessary and unacceptable degradation."

A Committee on Geological Sciences of the National Research Council sponsored a study, "The Earth and Human Affairs," and Bill Pecora met informally with this group on several occasions, inspiring the members with his enthusiasm for the job at hand. In appreciation, the published report*

* National Academy of Sciences, *The Earth and Human Affairs* (San Francisco: Canfield Press, 1972).

was dedicated "To the memory of William T. Pecora, an early, effective, and enthusiastic advocate of 'the geologic perspective'."

Bill Pecora made many contributions to the official and nonofficial activities of the employees of the Geological Survey. During the period from 1947 to 1967, he was an effective member of the U.S. Civil Service Commission's Board of Examiners for Geology, concerned with the development and maintenance of high standards in the selection of geologists for federal employment. He was always a live wire at the various scientific meetings of geologists held in Washington, D.C., where he could be counted upon to probe the strengths and weaknesses of the speakers' presentations and stories. For many years, he was an active participant in the Survey's Pick and Hammer shows, which were presented primarily to poke fun at the Survey brass. Some of his particularly hilarious performances are still vividly remembered by the cast and audience. Shortly after becoming Director, he was a speaker at a conference including two eminent science advisors and the President of the National Academy of Sciences. When Bill was introduced, he began by addressing these gentlemen as "Your Highness," "Your Excellency," and "Your Worship"; the character of the meeting was somewhat modified after that greeting.

Bill Pecora was the recipient of many honors during his professional career. Among these that deserve mention are the presidencies of the Geological Society of Washington (1964) and of the Cosmos Club (Washington, D.C., 1968). He was a Fellow and Councilor of the Geological Society of America and of the Mineralogical Society of America. He was elected Honorary Member of the Rocky Mountain Association of Geologists. He received the Doctor of Science degree from Franklin and Marshall College (1969) and Doctor of Engineering degree from the Colorado School of Mines (1970). The American Association of Petroleum Geologists presented him with its Public

Service Award (1972). He received the Distinguished Service Award of the Department of the Interior (1968) and the Rockefeller Public Service Award (1969). He was a Foreign Member of the Brazilian Academy of Sciences. The American Philosophical Society elected him to membership (1970) and he was a Fellow of the American Academy of Arts and Sciences (1965). He was elected to the National Academy of Sciences in 1965.

On April 7, 1947, William T. Pecora married Ethelwyn Elizabeth Carter from Franklin County, Kentucky. They had two children, William Carter, born in 1949, and Ann Stewart, born in 1953. The Pecora family lived in a house near the Potomac River that was designed by an architect friend. After becoming a homeowner, Bill developed into an enthusiastic gardener, which helped him to forget temporarily troublesome problems left in the office. He was particularly enthusiastic about *Camellia sasanqua* and he planted many of the shrubs in his garden. Bill and Ethelwyn enjoyed entertaining guests in their lovely home, where Bill presided over the carving of the roast and extolled the virtues of the red wine that he had just discovered in one of the many liquor stores in Washington, D.C.

In 1973, a 6000-foot ridge in the Bearpaw Mountains was named Pecora Ridge in honor of Bill. The ridge extends southwest about two miles from the 6916-foot top of Baldy Mountain and forms the divide between Eagle Creek and the headwaters of Birch and Little Birch creeks. In the summer of 1973, William Carter Pecora carried the ashes of his father and those of Esper S. Larsen 3d, Bill's close friend since Harvard days, to the top of Baldy Mountain. This was an appropriate mission as Bill dearly loved the Bearpaw Mountains.

On July 21, 1972, at the auditorium of the Department of the Interior, U.S. Geological Survey Director V. E. McKelvey delivered a eulogy for Bill: "It is hard for any of us here to believe that Bill Pecora—our loved one, friend, colleague, leader—is no longer with us. We have suffered a loss that we are only

beginning to fathom but it is a loss we know we cannot replace. There will be no replacement for Bill's smile and hearty chuckle, his intellect, his uncanny ability to perceive the solution to seemingly unsolvable problems, his cool in the midst of crisis, his verve in approaching a difficult situation, his contagious excitement over a new idea, his ability to inspire, to bring out our best efforts, to lead us to accomplishments that we never dreamed were possible. We know too that our loss as loved ones, friends, and colleagues is not ours alone. It is the Nation's loss and the world's, for Bill Pecora's talents were being effectively applied to the solution of problems of great national and international significance."

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KEY TO ABBREVIATIONS

Am. Assoc. Pet. Geol. Bull. = American Association of Petroleum Geologists Bulletin
Am. Mineral. = American Mineralogist
Braz. Div. Fom. Prod. Miner. Avulso = Brazil, Divisão de Fomento da Producção Mineral Avulso
Geol. Soc. Am. Bull. = Geological Society of America Bulletin
Min. Congr. J. = Mining Congress Journal
U.S. Geol. Surv. Bull. = U.S. Geological Survey Bulletin
U.S. Geol. Surv. Misc. Geol. Invest. Map = U.S. Geological Survey Miscellaneous Geologic Investigations Map

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