Memorial to Paul Albert Smith
1901–1978

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Paul Albert Smith had a long and productive career in public service. A native of Iowa, Smith was born on January 9, 1901. He received his professional education at the University of Michigan, earning the Bachelor of Science degree in engineering in 1924. It was there also that he met and married Sylvia Ralston in 1923. She and their two children, Paul Albert, Jr., and Kathryn Caroline (Mrs. Robert H. Gifford), are his survivors.

Following his graduation from the University of Michigan, Smith joined the U.S. Coast and Geodetic Survey where he served for twenty-two years as an engineer and commissioned officer with successive ranks from ensign to commander. From 1926 to 1939 he was a hydrographic and geodetic engineer, conducting surveys in several states, and in the coastal waters of the United States, the Philippine Islands, and Alaska. From 1939 to 1946 he was Chief of the Aeronautical Chart Branch of the Coast and Geodetic Survey, supervising the design and production of aeronautical charts for the United States and Allied forces. The standards thus established were subsequently adopted, with minor amendments, as the International Civil Aviation Organization (ICAO) World Aeronautical Charts.

In 1946 Smith was transferred to the State Department as Alternate U.S. Representative on the Interim Council of the newly established Provisional International Civil Aviation Agency. From 1947 to 1953, with the rank of Minister, and temporary rank of rear admiral, he was the U.S. Representative on the Council of the permanent International Civil Aviation Agency. In 1954 he returned to the Coast and Geodetic Survey from which he retired later that year with the rank of captain. Then, in 1955, by an act of Congress and Presidential appointment, he was re-commissioned Rear Admiral of the Coast and Geodetic Survey (on the retired list).

After his retirement from the Coast and Geodetic Survey, Smith continued his services to the government in various other capacities. From 1953 to 1958 he was a consultant to the Office of the Secretary of Defense for Research and Engineering, and in 1958 an assistant to the Director of the Advanced Research Projects Agency. From 1959 to 1966 he was an engineer, and from 1966, a consultant with the Rand Corporation.

Of principal present interest are the contributions of Paul A. Smith to geological science. During the 1930s, while doing oceanographic work in the Philippine Islands, the Aleutian archipelago, and the Atlantic coast of the northeastern United States, he became increasingly interested in the topography of the sea bottom in the regions bordering the continental shelves. This was augmented by some revolutionary developments that were being made during the decade of the thirties in the making of soundings.

Prior to that time the ship positions when out of sight of land had been determined by a combination of astronomical observations and dead reckoning, and depth soundings had been by means of weights lowered by rope or wire line. As was later determined when more precise locations were available, the errors of the positions of these soundings ranged from near zero to as much as seven miles. The new methods, developed during the 1930s (Veatch and Smith, 1939, p. 49–85), consisted of radio-acoustic ranging from ship to store stations, or to anchored sonic buoys located from an initial shore station by the taut-wire method. By this means, the position of a survey ship, out to the edge of the continental shelf a hundred miles or more from land, could be continuously monitored with an accuracy of within a few tens of feet while the ship was under way. The complementary development was that of acoustic depth determinations made either at discrete intervals of time and distance or by a continuous depth profile.

With these improvements it became possible for the first time in history to make detailed and accurate topographic maps of the sea floor in areas beyond the sight of land. During 1930 to 1932 the Coast and Geodetic Survey had found that the continental slope south of Georges Bank was incised by several steep V-shaped valleys. In 1933 it was found, by running more closely spaced survey lines, that similar features were present along the edge of the continental shelf off Maryland and Delaware.

The first officer of the Survey to appreciate the significance of these new discoveries, both for improved navigation and for geological purposes, was Paul A. Smith. A mutual interest in the geological aspects of these features led shortly afterward to a fruitful collaboration between Smith and a senior geologist of wide experience, A. C. Veatch. Veatch's early career had been with the U.S. Geological Survey. In 1904 he had published U.S. Geological Survey Professional Paper 44, dealing with underground water resources of Long Island and with the development of the main stream drainage systems of the North Atlantic coastal plain. From 1924 to 1930, while in charge of a geologic field party for an oil company, Veatch had made an extensive geological reconnaissance of equatorial west Africa; in 1935 he had published "The Evolution of the Congo Basin" (Geological Society of America Memoir 3, 161 p.).

Assisted by a research grant from the Geological Society of America, the collaboration between Smith and Veatch culminated in their publication in September 1939 of Geological Society of America Special Paper 7, "Atlantic Submarine Valleys of the United States and the Congo Submarine Valley." As the paper was nearing completion, Veatch, during his terminal illness, wrote a preface dated November 18, 1938. His death on December 25, 1938, came just before the meeting of the Geological Society of America in New York, where the paper was presented by Smith, who had completed it for final publication.

In this paper the results of the Coast and Geodetic survey mapping of the submarine valleys along the continental shelf from Cape Hatteras to Georges Bank were presented in great detail, both in the text and in charts. Two charts each for five separate areas were included. In each case, one chart gave only the survey lines and the depth data of the soundings; the second chart showed the topographic interpretation of the data by contours. The chart presenting only the soundings was provided in order that anyone who might be interested in doing so could make his own alternative interpretation.

Nine major, and numerous smaller, submarine valleys indenting the edge of the continental shelf were mapped from Cape Hatteras to Georges Bank. Some of these, notably the Hudson, connected with present rivers on land. Others had no such connection. They were simply V-shaped valleys extending up to a few tens of miles into the flat continental shelf from its seaward edge, the continental slope. The seaward edge of the continental shelf is at a depth of about 100 fathoms (600 feet). From there, down the slope the depth increases abruptly, dropping off to ocean depths of more than 1,000 fathoms within a few miles.

A companion study was presented of the Congo submarine valley on the west coast of Africa. This valley, it was shown, extends for 130 miles across the continental shelf from the present shore line. At places it is 8 miles wide and is entrenched 5,000 feet into the shelf sediments, and at its extreme end it reaches a depth beneath present sea level of 10,000 feet. According to Veatch's work, the Congo originally discharged into the Atlantic a few hundred miles north of its present course. The original course had been blocked by faulting, a lake was formed, and the river cut its present outlet only about 10,000 years ago. The interpretation given for the subsequent events was that sea level receded rather rapidly by an ultimate amount of 10,000 feet; during that recession the present valley was eroded subaerially. Then sea level rose fairly rapidly to about 60 fathoms below present sea level, and then slowly to the present level.

This Congo interpretation was used as a precedent for that which authors Veatch and Smith developed for the submarine valleys off the Atlantic coast of the United States. Here also, the interpretation was made that since the last glaciation the sea level had dropped to about 10,000 feet below present level. Veatch and Smith suggested that during that process the present submarine valleys were eroded by subaerial streams, and that the sea then rose to its present level.

In his completion of Special Paper 7 after Veatch's death, Smith (p. 48) concluded, "It appears to the junior author that the evidence is overwhelminingly in favor of subaerial, stream erosion for the origin of the topography of the North American Atlantic Continental Slope to depths of at least 1200 fathoms."

This bold hypothesis that the level of the Atlantic ocean since the last glaciation dropped on the order of 10,000 feet during which the present submarine valleys were formed, and then returned to its present level, unavoidably evoked a great deal of critical discussion. The most serious difficulty is naturally the question of what could have become of all that water. If the level of the Atlantic dropped 10,000 feet, so must that of other oceans. In fact, Smith had found a similar feature around Bogoslof Island in the Aleutian chain where a submarine valley entrenches the continental shelf at a present depth of 400 fathoms, and extends to a depth of at least 1,300 fathoms.

According to Smith's notes on contemporary discussions at the time this interpretation was presented, one critic, J. B. Mertie, Jr., of the U.S. Geological Survey, pointed out the following difficulties:

> The removal of a volume of sea water for glacial storage that would cause a change in the absolute sea level of thousands of feet is absurd, because this would probably have been adequate to cover the entire land surface of the world with ice fields thicker than the Pleistocene ice caps are known to have been. On the other hand, if the change of strand-line is to be attributed to local deformation, where are the intensely folded Tertiary deposits along our Atlantic coast?

During the forty years since the Veatch and Smith paper was published, the problem of the mode of origin of the features described still has not been entirely resolved. At present, the difficulties with the subaerial hypothesis are too formidable to cope with, and the principal alternative appears to be submarine density currents, about which more is known now than was the case forty years ago. Whatever may be the final interpretation of these features, it will have to be compatible with the very solid base of factual evidence painstakingly assembled by Smith during the Coast and Geodetic Survey mapping of the 1930s. Whether or not the Veatch and Smith interpretation may be permanently sustained, their data will stand as a lasting monument.

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