

FRANCES LAWRENCE PARKER

1906 - 2002

BY W. H. BERGER

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Frances Lawrence (Franny) Parker came to Scripps in 1950 at the invitation of Fred B Phleger, who had just joined the faculty and knew Frances from earlier collaboration at Amherst and Woods Hole Oceanographic Institution. It turned out to be a crucial decision for the visibility and productivity of the newly founded "Marine Foraminifera Laboratory," which was launched with the support of the American Petroleum Institute. Her initial appointment was as "associate in marine geology," but she soon switched into the professional research series, advancing to "associate research geologist" in 1960, and to "research paleontologist" in 1967. She took retirement in 1973, but worked well into the 1980s. Parker was a full-time researcher. She spent most of her time at the microscope, identifying and describing foraminifers, drawing specimens, and counting the contents of sediment



Frances L. Parker at her microscope. Photo taken in 1980 by E. Vincent.

samples. Quite likely, she observed and counted more fossils than anyone, ever. The microfossils were spread out below the binocular microscope on a small black metal tray, each shell a speck of white the size of a pinhead. As she cheerfully and carefully sorted through the fossils, she would whistle softly. To prevent the fossils from flying off in the resulting puffs of air, she had thoughtfully attached a protective piece of cardboard to the microscope.

Parker's studies helped lay the foundations for the emerging field of paleoceanography, which is concerned with the reconstruction of ocean history. Phleger, who had briefly joined *Albatross* of the Swedish Deep-Sea Expedition (getting off in the Caribbean), had started to work on deep-sea samples of the expedition even before coming to Scripps. Parker had joined the effort as the expert on the taxonomy of the benthic and planktonic foraminifers. Publication of the appropriate Expedition Report (Phleger et al. 1953) established the members of the new laboratory (Phleger, Parker, and assistant Jean F. Peirson) as a world-class team at the cutting edge of foraminiferal research. The work on the *Albatross* material from the Atlantic was the first such study on long cores from the deep sea. It showed that the response of the ocean to ice-age fluctuations is reflected in a shift of biogeographic boundaries in the plankton (of the order of 10 degrees latitude) which suggested a significant change in the wind field (and hence the ocean's circulation). The report became a standard reference in regard to the taxonomy of planktonic and benthic foraminifers of the deep North Atlantic (Parker's chief responsibility in this work). It also represents the first attempt to recognize the sequence of warm and cold stages in long cores over a basin-wide region and to correlate these stages over considerable distances. This attempt was not successful because of the unequal sample spacing along the cores, but it pointed in the direction that was to bring fruit subsequently, when sample spacing was removed from subjective judgment.

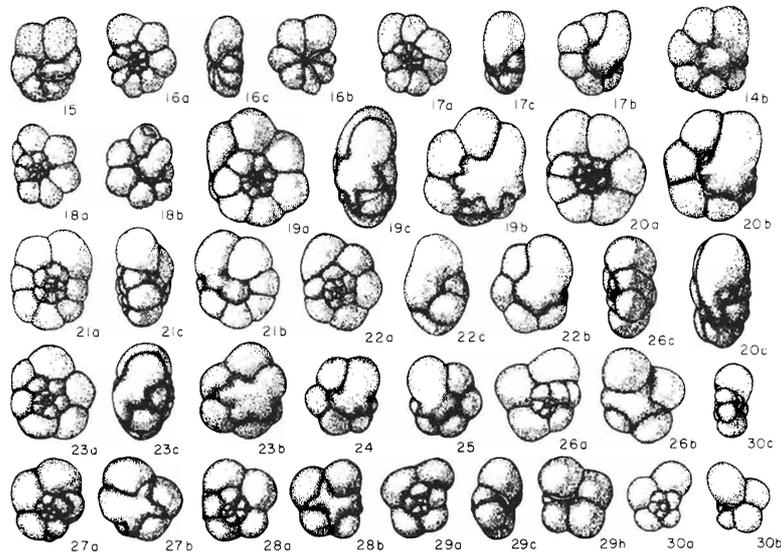
Parker's report on Mediterranean cores from the same expedition (published 1958) produced one of the classic pioneer papers of paleoceanography. The quantitative warm/cold index introduced in this study is still in use, in various modifications. An important finding was that quantitative warm/cold indices correlate well with oxygen isotopes. Parker did not completely abandon subjective judgment on what constitutes significant change, based on cursory examination of a sample: "The foraminiferal assemblages of all the core samples were examined but population counts were made only at approximately 50 cm intervals, including top and bottom samples, unless intervening ones showed faunal change by gross examination." (1958, p.223). Apparently, her gross examination was sufficiently thorough to detect significant change, because for many core sections she produced quite detailed stratigraphies.

It is difficult to decide which of Parker's contributions have had the greatest impact, but there is no question that the 1962 paper on the taxonomy of planktonic foraminifers is a viable candidate for this status. The work on the Swedish material had brought the realization that planktonic foraminifers are crucially important for the study of deep-sea sediments and the clues to history within them. In these samples benthic foraminifers, which are dominant in shallow waters and highly diverse, constituted about one percent of the assemblage. Parker soon recognized that the prevailing classification of the planktonic forams was largely artificial. That is, many of the criteria used to define genera and species were useless in determining ancestry. Her desire to remedy this situation resulted in two major studies on taxonomy and ancestry. In the first of the two studies, published in 1963, she used the

criterion of the possession of spines to distinguish spinose and non-spinose forams. This overall division, which was subsequently confirmed by biochemical means, has stood the test of time. In the second study, published in 1967, she traced the ancestry of modern planktonic foraminifers back through the Neogene in the Indo-Pacific, illustrating several evolutionary sequences. Her chart of species ranges and evolutionary sequences of planktonic foraminifers in the late Tertiary shows a high abundance of last and first occurrences at the Miocene-Pliocene boundary, and also within the late Pliocene, the latter event presumably reflecting a faunal shift at the onset of Northern Hemisphere glaciations. A remarkable feature of the 1962 and 1967 publications is the quality of the artwork. Parker's hand-drawn illustrations are unsurpassed in clarity and sheer craftsmanship.

A second stratigraphic work for planktonic foraminifera, on samples from the Atlantic, appeared in 1973. In this study, Parker took advantage of the new availability of material from the Deep-Sea Drilling Project, which had recently been launched by several partnering oceanographic institutions

with Scripps in the leadership role. Parker, along with other Scripps scientists, had been involved in the preparatory phase, studying samples from the experimental Mohole drilling, near Guadalupe Island, Mexico (published in 1964). Franny's study of late Tertiary sequences in the Atlantic allowed her to make comparisons with the Indo-Pacific sequences that contributed materially to understanding the effects of closing the Panama Straits. She pointed out that the planktonic faunas of the Atlantic and Pacific regions started to differentiate considerably earlier than the final closure by a land bridge, a finding that has important ramifications for the origin of the modern Gulf Stream and associated heat transport. From her results, it appears that the marked change in the tropical planktonic fauna at the Miocene-Pliocene boundary, which she documented earlier, is closely related to the interruption of the ancient Tethys pathway between North and South America. Parker was much intrigued with the remaining communication of tropical Indo-Pacific and Atlantic plankton via the Agulhas leakage around the Cape of Good Hope, and pointed out that it was apparently effective for some species but not for others. The problem is still open.



Drawings of planktonic foraminifers. Two species are represented: *Globigerinita humilis* (Brady) and *Globigerinita iota* (Parker). A large number of specimens of *G. humilis* are shown, to capture the variability of the morphology, and also to show that *G. iota* is outside this variability.

Parker's comprehensive knowledge of modern and late Tertiary planktonic foraminifers allowed her to spot new species rather readily, and she described them with great care. Among the planktonic forams, the following carry her name as author: *Globigerina calida*, *Globigerina praedigitata*, *Globigerinita iota*, *Globigerinoides tenellus*, *Globoquadrina pseudofoliata*, *Globorotalia anfracta*, *Globorotalia* (or *Globanomalina*) *pumilio*, *Globanomalina* (?) *praepumilio*, and *Pulleniatina spectabilis*. Similarly, she described a large number of new benthic species throughout her career, by herself or with Joseph Cushman and with Phleger. Like the other pioneers of paleoceanography who worked on the Swedish cores – Gustaf Arrhenius, Cesare Emiliani, Eric Olausson, Fred Phleger – she was keenly aware of the potential of foraminifers as carriers of information of ocean and climate history. However, like no other, she focused on tackling the lack of background knowledge in taxonomy and biogeography that prevented this information from emerging.

As a woman in a man's world, in the period spanning much of her career, Parker was content to stay out of the limelight. She published in the specialty literature and she avoided making presentations of any kind. She was, however, generous in spending time mentoring Phleger's graduate students. As the world's expert in modern and late Tertiary planktonic foraminifers, Franny had a steady stream of visitors who came to the Marine Foraminifera Laboratory to consult with her. To them also, she freely gave of her time and expertise. Especially her stratigraphic studies, beginning with the article "Foraminifera from the experimental Mohole drilling near Guadalupe Island, Mexico" (published in 1964) and continuing with the 1967 and 1973 works on late Cenozoic sediments in the Pacific and Atlantic, respectively, had made her an important source of information in the context of the new Deep Sea Drilling Program hosted at Scripps. In pursuing these studies, she had the active advice of her colleagues M. N. Bramlette and W. R. Riedel, who worked on nanofossils and radiolarians respectively. Together, this triumvirate of Cenozoic experts made Scripps the leading institution in deep-sea stratigraphy at a crucial time.

Her life-time achievements were recognized in 1981 by her colleagues on the board of directors of the Cushman Foundation, with the Joseph A. Cushman Award for Outstanding Achievement in Foraminiferal Research. Cushman, the American pioneer of foraminiferal studies, had brought her into the field in the first place, and she was pleased with the recognition. However, Franny knew her worth. Of the papers co-authored with Cushman on benthic foraminifers, she said that she did the work, and he looked at it. Authorship was determined by status, European style.

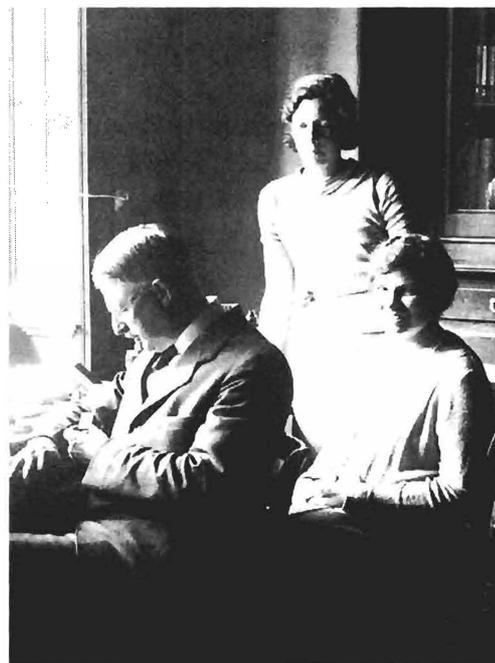
At Scripps, Parker greatly appreciated the hassle-free environment that Fred Phleger provided. He put together the proposals that brought in the funding and he took care of administration. "Fred was the boss of the lab," she said in an interview, "but he wasn't my boss. He didn't tell me what to do." In turn, Phleger greatly appreciated Parker, and fully realized the importance of her contributions. He called Parker his "distinguished colleague" and he meant it. (On one occasion he used the term disapprovingly, when she barked at a dog someone brought to the lab, saying just loud enough for her to hear: "My distinguished colleague Frances Parker is making a fool of herself.") Half in earnest, half jokingly, he advised the new Assistant Professor whom he had chosen as his successor (me): "I have made my reputation collaborating with Frances Parker, now you can do the same." Indeed,

Parker's mentoring and stern insistence on getting things right made a big difference in my own career and set an example for everyone at the lab.

Frances Parker was born in Brookline near Boston, on March 28, 1906, the youngest child of four of Philip Stanley Parker, a judge, and Eleanor Payson Parker. As a teenager, Frances took an interest in books and in the outdoors (her family owned an island at Cape Cod). At Vassar College she majored in geology and decided that, instead of becoming a librarian, she would become a geologist. She took an A.B. in geology in 1928, with a minor in chemistry, and subsequently entered MIT to work on a Ph.D. in mineralogy. During this period, she took a course from Joseph A. Cushman (1881-1949), who had set up a private laboratory near Boston.

Cushman, the leading expert in foraminifers in the 1920s and 1930s, promptly offered her a job. Parker abandoned her plan to get a Ph.D. in mineralogy, took a master's degree from MIT, and joined Cushman's laboratory. Thus began her career, washing samples in a poorly lit lab smelling of tetrachloride. Cushman's interest was in making an inventory of extant species of foraminifers, especially benthic species, and in their use for stratigraphic purposes in the quest for petroleum. He gained great prominence as one who made micropaleontology economically useful, and was well recognized within several professional societies (Society of Economic Paleontologists and Mineralogists, President 1930; Paleontological Society, President 1937; Geological Society, Vice-President 1938).

Cushman's lab had been set up with funding from the U.S. Geological Survey, and Parker became an assistant scientist with the agency, thereby securing her salary. In 1932, Cushman and Parker visited laboratories and museums in central Europe to examine type specimens and meet colleagues. Between 1930 and 1940 they published 16 papers together. The bulk of the work with Cushman was of a taxonomic nature and concerned the occurrence of benthic species on shelves and margins in various regions of the world. In this respect it differed little from the type of studies that Alcide d'Orbigny carried out 100 years earlier. A special focus of Parker's work at that time was the genus *Bulimina* and the related genera *Buliminella* and *Robertina*. A substantial monograph of 121 pages describes and illustrates the species belonging to these genera, as well as a few others, less diverse. Almost 100 species, previously assigned to *Bulimina* are reassigned to other genera in a major effort to make the genus into a meaningful and well-defined taxon. In other circumstances, this would have been a Ph.D. dissertation.



Frances L. Parker in Joseph Cushman's office, 1930s.

Between 1936 and 1940, Parker spent summers at Woods Hole, sharing a laboratory with Fred Phleger. At Woods Hole, Parker studied foraminifers from the continental shelf of the east coast, from New Hampshire to Cape Hatteras. The first of the resulting articles (published in 1948) lays out a systematic method for reporting sample content in a way that is useful for ecologic analysis, in a table with species percentages. Rare forms are omitted, because of "the danger of drawing conclusions from spotty occurrences of species in small numbers ..." She strictly separated benthic and planktonic forms, which had not been done previously by most authors, "but seems necessary in view of the fact that at least two different environments are represented ..." Today, her statement simply reflects common sense. Parker also introduced a micro-splitter, to divide samples down to counting size through repeated halving. The statistical methods described by Parker became the standard procedure of treating this type of information, at Woods Hole and subsequently at Scripps.

Parker found four major faunal zones between Cape Cod and Cape Hatteras, tied to depth and running parallel to the shore. She considered temperature and food supply as the possible factors responsible for the zonation. She also found a regular shift in the ratio of planktonic forams to benthic ones, with high numbers at the shelf break (80 percent of the total fauna) and rapidly decreasing toward the shore, with very small numbers near 50 m depth. The finding established that such ratios are useful in determining the direction of sea level rise and fall in shelf sequences. It was subsequently widely used by petroleum geologists and others interested in such sequences.

In 1943, she took a position as senior paleontologist with Shell Oil Company in Houston. There, working with a diverse group of geologists, her interests shifted even more strongly from a focus on taxonomy to a broader view including environmental reconstruction. In 1945, Parker became ill with tuberculosis, and she left Shell to recuperate in Boston. In 1947 Phleger invited her to join his laboratory. He was on the faculty of Amherst College at the time, doing summer research at Woods Hole. When Phleger (who grew up in California) moved to Scripps Institution of Oceanography in 1950, he asked her to follow. She did, and there they founded the "Marine Foraminifera Laboratory." Fred B Phleger (1909-1993) had a Ph.D. from Harvard (1936); his early interests were in the paleontology of large Pleistocene cats, before he moved into micropaleontology for his research at Woods Hole. After nine years on the faculty at Amherst College he moved to Scripps to pursue research in foraminiferal ecology and (paleo-) oceanography. At Scripps, as mentioned, in the protected environment he provided, Parker pursued a wide range of topics, including taxonomy, ecology, biogeography, stratigraphy, and aspects of preservation, publishing more than 30 papers as sole author or in collaboration with Phleger and others at the Scripps laboratory. Many of these papers are now considered classics.

In her first years at Scripps, Parker worked within the American Petroleum Institute Project 51, which along with the Office of Naval Research, supported the new Marine Foraminifera Laboratory. API Project 51, led by Francis P. Shepard, involved a number of Scripps geologists. They focused on a detailed study of the patterns of sedimentation in the Gulf of Mexico, to gather knowledge useful in interpreting stratigraphic sequences in the region. The study of foraminifers was an important part of the effort. Parker and colleagues established the concept of environmental biofacies, distinguishing open gulf, bay, marsh, and river biofacies. Salinity and the variability in salinity were identified as important factors.

A substantial portion of Parker's time was spent in helping to train and mentor others, including students and visitors of the Marine Foraminifera Laboratory. For example, an important paper by Edwin L. Hamilton, on the age of foraminifers from Central Pacific flat-topped seamounts (guyots) is listed as one of the early contributions of the Marine Foraminifera Laboratory. The results published by Hamilton (the first such report), based on the dredging of guyots in the Mid-Pacific Mountains, are arguably the most important ones to come out of the 1950 Midpac Expedition. The age of reef corals and rudists from the seamounts' summits demonstrated that large regions of the seafloor in this area had subsided by roughly a mile, within the last 100 million years or less. The foraminifers could be used to verify the estimated ages of the associated corals, mollusks, and rudists. Thus, correct identification of the foraminifers was of crucial importance to this surprising story. In his report (published in 1953, in the *Journal of Paleontology*, 27 (2)) Hamilton credits Parker with assisting significantly: "At the Marine Foraminifera Laboratory, Scripps Institution of Oceanography, the writer was materially aided in the study of the faunas and in preparation of the plates by Miss F. L. Parker, and by the facilities of the laboratory, which were generously opened to him." Parker genuinely enjoyed helping others with their problems concerning the identification of foraminifers. Invariably it was the problem that interested her, not the credit.

Parker contributed importantly to the productivity of the Marine Foraminifera Laboratory by maintaining a unique library and reference collection. Edith Vincent, who joined the laboratory in the 1970s (with a Ph.D. from the University of Southern California), made great use of these resources. Vincent gratefully commented on the efficiency of Parker's filing systems and collections. Indeed, Parker's presence and her generous disposition were great assets to all working in micropaleontology at Scripps.

Franny was editor for the Contributions and Special Publications of the Cushman Foundation for Foraminiferal Research for nine years, and an Honorary Director and Fellow of the Foundation. Her name is attached to a topographic high on the shelf off Louisiana in the Gulf of Mexico, the "Parker Bank," so designated in her honor in 1976, by the U.S. Geological Survey (with the Phleger Bank nearby). In 1999 she established the Frances Parker Program in Public Education in the Earth Sciences at Scripps with a significant gift to the Geosciences Research Division. Frances Parker died in La Jolla in 2002, a few days short of her 96th birthday. She was lucid and content to the end of her days.

■ Acknowledgments

In assembling this short biography I made use of interviews conducted by Deborah Cozort Day, in 2000 (SIO Ref. 00-12) and of a laudatio by Edith Vincent, on the occasion of the Cushman Award to Frances Parker (E. Vincent, 1982. *Journal of Foraminiferal Research* 12 (2)). Much of the material is taken from an article in the Alcide d'Orbigny memorial volume recently published by the *Académie des Sciences* (W. H. Berger, 2002, C.R. Palevol 1, 471-477).

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