C. R. Palevol 1 (2002) 471–477

S1631068302000726/FLA

History of Sciences / Histoire des sciences

Frances Lawrence Parker (1906–2002), micropaleontologist and pioneer of paleoceanography

Wolfgang H. Berger

Scripps Institution of Oceanography, University of California at San Diego, La Jolla, California 92093–0524, USA

Received and accepted 7 November 2002

Written on invitation of the Editorial Board

Abstract – Frances L. Parker made important contributions to the knowledge of benthic and planktonic Foraminifera, both in respect to taxonomy and to biogeographic and stratigraphic distributions. Her work became part of the foundations of modern paleoceanography, which may be said to begin with the results of the Swedish Deep-Sea Expedition (R/V *Alabatross*, 1947–1948). Among her most significant works is a demonstration of warm-cold cycles in the Mediterranean, based on *Albatross* cores, a reorganization of the classification of recent planktonic foraminifers, and a study of lineages in planktonic foraminifers for the Late Cenozoic. ***To cite this article: W.H. Berger, C. R. Palevol 1 (2002) 471–477.*** © 2002 Académie des sciences / Éditions scientifiques et médicales Elsevier SAS

F.L. Parker / Foraminifera / Palaeoceanography

Résumé – Frances Lawrence Parker (1906–2002), micropaléontologue et pionnière de la paléocéanographie. Frances L. Parker a apporté une importante contribution à la connaissance des Foraminifères benthiques et planctoniques, à la fois en ce qui concerne la taxonomie et les répartitions biogéographiques et stratigraphiques. Son travail fait partie des fondements de la paléocéanographie moderne, dont on peut dire qu'elle tire son origine des résultats de la mission océanographique suédoise R/V *Alabatross* (1947–1948). Parmi ses travaux les plus significatifs figurent une démonstration des cycles chauds–froids en Méditerranée, basée sur l'étude des carottes de l'*Albatross*, une réorganisation de la classification des Foraminifères planctoniques du Cénozoïque récent. ***Pour citer cet article : W.H. Berger, C. R. Palevol 1 (2002) 471–477.*** © 2002 Académie des sciences / Éditions scientifiques et médicales Elsevier SAS

F.L. Parker / Foraminifères / paléocéanographie

1. Introduction

In the last fifty years, a new field of study in the Earth sciences emerged at the interfaces between oceanography, geochemistry and marine micropaleontology. It is called 'paleoceanography', a term that found wide acceptance in the 1970s [9]. A central issue in this field is the elucidation of the role of the ocean in orbitally forced climate variations over the last several million years. More generally, it is the reconstruction of all aspects of ocean history, including circulation, productivity and general biology. On the whole, the vital contributions of micropaleontology in providing the basic tools for the reconstruction of ocean history are well recognized, but a low degree of awareness regarding earlier contributions, even among prominent practitioners [25]. See, for example, in [25], the entry for Paleoceanography in a new comprehensive reference work on oceanography. On page 2078 one reads that "the recovery of oceanic sediments in cores started in earnest only in the 1950s" and that "cores collected by R/V *Vema* were the basis for seminal papers in pale-

E-mail address: wberger@ucsd.edu (W. Berger).

oceanography”. There is no mention of the earlier seminal contributions of W. Schott and O. Pratje of the *Meteor* Expedition (1925–1927) or, more importantly, the 299 cores recovered by the Swedish Deep-Sea Expedition (1947–1948), which delivered the first indication of cyclic sedimentation.

Long cores on a global scale were first raised by the *Albatross* during the world-encircling Swedish Deep-Sea Expedition, and the scientists working on these cores became the pioneers of paleoceanography: Gustaf O.S. Arrhenius, Cesare Emiliani, Eric Olausson, Fred B Phleger and Frances L. Parker. Two of these, Phleger and Parker, were micropaleontologists. Emiliani, as well, had training in paleontology. Earlier pioneering studies [24] were based on more limited material, but had already established the potential of deep-sea sediments as a record of climatic fluctuations. As far as the importance of foraminiferal studies in paleoecology in the 1950s, a review published in 1957 [4] cites studies by Natland and by Phleger, pointing out the potential for reconstruction of the paleoenvironment from benthic and planktonic foraminifers but emphasizing the lack of background knowledge in biogeography and species habitats for the purpose.

It is against this background of a new awareness of the potential of foraminifers (and other microfossils) as indicators of past environments and the frustrating lack of information that would permit exploitation of this potential that the work of the pioneers in the field must be understood.

In this essay, we wish to commemorate the many important contributions of one of these pioneers: Frances L. Parker (Fig. 1). Her studies spanned the distribution of shallow-water and deep-water benthic foraminifers, and the taxonomy, ecology and biostratigraphy of planktonic foraminifers. For time spent at the microscope and for identifying and counting foraminiferal species, Frances Parker has few equals, perhaps none. It is quite likely that she examined more fossils than anyone, ever. An estimate of well over a million fossils would seem conservative. Parker tended to spend at least half of her time at the microscope. Her career spanned more than 50 years, or some 40 000 microscope hours. As much as half of this was spent examining the faunal content of samples. One identification per minute is on the slow side for this type of work when searching or counting. Yet, her work is referenced sparingly in the paleoceanographic literature; it is referred to with several citations in a review of paleoceanography in [1]. It is not mentioned in the two quadrennial reports that followed. The centennial review of paleoceanography for the Geological Society of America makes no mention of her work [1]. Of the

Fig. 1. Frances L. Parker.

Fig. 1. Frances L. Parker.

five pioneers who worked on the Swedish cores, only Arrhenius and Emiliani are cited in the review, the latter prominently.

Why should this be so? A combination of factors enter. Parker’s more important contributions were made before the early 1970s, that is, before paleoceanography expanded extremely rapidly, stimulated by the Deep-Sea Drilling Project and the CLIMAP Project [3]. By then, her work on the taxonomy of planktonic foraminifers and on their biogeography (which was crucial to paleoceanographic studies) was well known and had been incorporated into summaries by others. Also, Parker, while unfailingly helpful to colleagues coming for advice (and there were many in her days at Scripps) did not seek out meetings to discuss her work, or make much of an attempt to integrate her work into ongoing investigations by others. She was content to discover new information on the distribution, in space and in time, of the fossils that were her career, and to get the taxonomy right.

2. Career of a micropaleontologist

The career of Frances L. Parker began as an assistant of Joseph A. Cushman (1881–1949), the leading expert in foraminifers in the 1920s and 1930s. Cushman had a background in zoology (PhD Harvard, 1903) and had experience as museum director of the Boston Society of Natural History and as a geologist with the US Geological Survey [2]. In 1923, he had set up his own laboratory in Sharon near Boston, with funding from the USGS. His interest was in making an inventory of extant species of foraminifers and in their use, especially benthic species, 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 invited Parker to work at his laboratory after she had taken a course from him (offered at the lab to geology students). Parker left MIT with a M.S. in geology (in 1930) and became his research assistant. She became an assistant scientist with the U.S.G.S., which secured her salary. In 1932, Cushman and Parker visited laboratories and museums in central Europe to examine type specimens and meet colleagues [7]. Between 1930 and 1940 they published 16 papers together. Between 1936 and 1940, Parker spent summers at Woods Hole Oceanographic Institution, sharing a laboratory with Fred B Phleger. 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 started to shift 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. Because of Phleger's interest in deep-sea work, she began to work on deep-sea Foraminifera and on planktonic forms. When Phleger (who grew up in California) moved to Scripps Institution of Oceanography, in 1950, they were working on a number of projects and he asked her to follow. She accepted a position as 'associate in marine geology', and eventually entered the research career track. In 1967, she attained the status of 'research paleontologist', equivalent to full professor at UCSD [7].

Parker liked to work at the microscope and was quite content that Phleger would look after the running and funding of the 'Marine Foraminifera Laboratory', which they founded on arrival at Scripps. Fred B Phleger (1909–1993) had degrees from CalTech and Harvard (PhD, 1936); his early interests were in the paleontology of large cats, before he moved into micropaleontology for his research at Woods Hole. He also had a civilian appointment with the Navy, as an instructor teaching oceanography. After nine years on the faculty at Amherst College, he moved to Scripps to pursue research in foraminiferal ecology and (paleo-) oceanography [7].

Parker had a very productive career at Scripps till her retirement and well beyond. She pursued a wide range of topics, including taxonomy, ecology, biogeography, stratigraphy, and aspects of preservation, publishing more than 30 papers as sole author and in collaboration with Phleger and others at the Scripps laboratory. Many of these papers made important contributions and now considered classics. If one were to choose just one of these, it would be "Planktonic foraminiferal species in Pacific sediments", published in 1962, which changed the way modern planktonic foraminifers are classified on the genus level and higher [14]. This work prepared the ground for a follow-up paper on the evolution of planktonic foraminifers in the Late Tertiary [16]. In an earlier study, made on cores of the Swedish Deep-Sea Expedition (R/V *Albatross*, 1947–1948) she demonstrated, in 1958, how planktonic foraminifers could be used to detect warm-cold cycles in surface waters [13]. Such cycles, not just in the Mediterranean (where Parker discovered their presence), but also in all parts of the ocean, have been a chief object of study in paleoceanographic work since the 1970s [10].

3. Studies and contributions

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 d'Orbigny carried out 100 years earlier. In fact, Cushman and Parker explicitly make reference to the need to verify and extend the surveys made by d'Orbigny [5]. From the introduction: "D'Orbigny's memoir on the Foraminifera of his voyage around South America, published in 1839, contained figures and descriptions of many new species that have not been recorded or referred to since that date. Very little has been added to the knowledge of the foraminiferal fauna of the South American coast, including the Falkland Islands. [...] Our stations from off Brazil, especially the harbor of Rio de Janeiro, show that the fauna at that point is essentially a West Indian one, and most of the species are to be found in d'Orbigny's work of 1839 on the West Indies, or in more recent works on the fauna of the same region. The stations to the south along the coast of Argentina and the shallow water of the Falklands give a cold-water fauna, which is not closely related to that of Brazil, but which has numerous species recorded by d'Orbigny in

1839 from this same region, and others evidently extending around Cape Horn. These are identical with species described by d'Orbigny from the west coast. The faunas of the two sides of South America are, however, for the most part quite different".

A special focus of Parker's work with Cushman 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 [6]. The running head proclaims "shorter contributions to general geology, 1946" – the original price for purchase from the US Government Printing Office is given as 15 cents, that is, eight pages per cent. Almost 100 species, previously assigned to *Bulimina*, are reassigned to other genera, which is clearly a major effort to make the genus into a meaningful and well-defined taxon.

At Woods Hole, Parker studied Foraminifera from the shelf of the East Coast, from New Hampshire to Cape Hatteras. The three substantial papers that resulted from this work are remarkable for the high quality of the illustrations [11]. Also, the first of these articles (published in 1948) lays out a systematic method for reporting sample content in a way that is useful for ecologic analysis. Parker writes (1948, p. 217): "An attempt has been made to give the facts concerning the occurrence of Foraminifera in a manner which will easily lend itself to analysis and interpretation. [...] The different species have been counted and their relative abundance determined on a percentage basis. [...] Species occurring with a percentage of less than 0.1% have been omitted from the tables [...] it has been possible to cut down the working fauna from about 300 species to about 150. The danger of drawing conclusions from spotty occurrences of species in small numbers also has been eliminated". And further (p. 219): "In working out the percentages the planktonic forms were separated from the benthonic. This has not been done by most authors, but it seems necessary in view of the fact that at least two different environments are represented and a mixture of these elements would give an untrue picture of the facts, biologically, and lead to a false interpretation".

Parker also introduced a micro-splitter, to split 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 [21] and subsequently at Scripps. A percentage count had previously been introduced by W. Schott of the *Meteor* Expedition [23], but it is likely that Parker was unaware of it, since there is no reference to Schott's work. The separate consideration of benthic and planktonic foraminifers, as representing entirely different environments, seems obvious now. Parker found four major faunal zones between Cape Cod and Cape Hattera, tied to depth and running parallel to the shore. She considered temperature and food supply as possible factors responsible for the zonation. She also found a regular change in the ratio of planktonic forms to benthic ones, with high numbers at the shelf break (80% of the total fauna) and rapidly decreasing toward the shore, with very small numbers near 50-m depth. The finding established that such ratios may be useful in determining the direction of sea-level rise and fall in shelf sequences.

In her first years at Scripps, Parker worked within the American Petroleum Institute Project 51, which supported the new Marine Foraminifera Laboratory, along with the Office of Naval Research. API Project 51 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 [20] – Jean F. Peirson was in charge of preparing samples and counting foraminifers, largely trained and mentored by Parker – established the concept of environmental biofacies (somewhat reminiscent of the sand and mud facies recognized earlier by Phleger [21]). They distinguished 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 E.L. Hamilton, on the age of foraminifers from Mid-Pacific flat-topped seamounts is listed as one of the early contributions of the Marine Foraminifera Laboratory [8]. The results reported by Hamilton (the first such report), based on the dredging of seamounts in the Mid-Pacific Mountains, are arguably the most important ones to come out of the Mid-Pac Expedition. The age of corals and rudists on top of the seamounts demonstrated that large regions of the sea floor had subsided in this area by roughly a mile, within the last 100 million years or less. The Foraminifera could be used to verify the age estimates based on corals, molluscs and rudists. Thus, correct identification of the foraminifers was of crucial importance to this surprising story. Hamilton writes: "The Foraminifera date the truncation of one guyot as pre-Upper Cretaceous and two others as pre-Paleocene-Eocene, which generally supports the evidence provided by the 'middle' Cretaceous reef coral rudistid fauna dredged from these guyots". He 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. It was the problem that invariably interested her, not the credit.

With the collaborative landmark study on Atlantic deep-sea Foraminifera [22], Parker entered the deep-sea environment in a serious way, and soon concentrated her efforts on planktonic foraminifers [12]. The work on the Atlantic cores from the Swedish *Albatross* Expedition was the first foraminiferal study of long cores in 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^{o} of latitude) which suggested a significant change in the wind field (and hence the circulation). The report became a standard reference in regard to the taxonomy of planktonic and benthic foraminifers of the deep North Atlantic (Parker's 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 into the direction that was to bring fruit in later studies, when sample spacing was removed from subjective judgment – the original spacing of samples, 10 cm, was in fact adequate for the purpose, but because of the great effort necessary for a full count of samples it was decided to skip the counting for samples that were 'indistinguishable' from previous samples, based on visual examination (F.B Phleger, pers. comm. to W.H.B.). This method can perhaps work in some parts of the ocean, where the contrast between cold-water and warm-water faunas is large. It is bound to fail in the subtropics and tropical regions, where changes between the phases of the ice ages are subtle. Parker's report on Mediterranean cores from the same expedition [13] subsequently produced one of the classic pioneer papers of paleoceanography. Important results include the demonstration that quantitative warm/cold indices correlate well with oxygen isotopes. Parker adopted the method introduced previously [22], as explained above. She writes [13 (p. 223)]: "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". Apparently, her gross examination was sufficiently thorough to detect much change, because for many core sections she produced quite detailed stratigraphies. The quantitative warm/cold index introduced in this study is still in use, in various modifications.

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. With the new focus on planktonic foraminifers, following the API studies, Parker soon realized that the prevailing classification of this group was largely artificial. That is, many of the criteria used to define taxa were useless in determining ancestry. Her desire to remedy this situation resulted in the aforementioned major studies on taxonomy and ancestry [14, 16]. In the first of the two studies, she used the criterion of the possession of spines to distinguish spinose and non-spinose forms. This overall division, which was subsequently confirmed by biochemical means, has stood the test of time. A remarkable feature of the 1962 and 1967 publications [14, 16] is the quality of the artwork. Parker's hand-drawn illustrations are unsurpassed in clarity and sheer craftsmanship. In the second study, 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 Neogene [16 (p. 121)] shows a concentration of last and first occurrences at the Miocene–Pliocene boundary, and also within the Late Pliocene, at the base of zone N21. Presumably, the latter is a faunal shift reflecting the onset of northern hemisphere glaciations.

A second biostratigraphic work, on the Atlantic, appeared in 1973 [18]. 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 oceanographic institutions, with Scripps in the leadership role – the first leg of the *Glomar Challenger* set out in 1968, to the Gulf of Mexico, with Maurice Ewing in charge. Parker, along with other Scripps scientists, had been involved in the preparatory phase, studying samples from the experimental Mohole drilling, near Guadalupe Island, Mexico [15]. The idea of drilling to the 'Moho' (the Mohorovicic discontinuity) was abandoned, but the success with dynamic positioning and with the recovery of sediment pointed in the direction to be pursued. Other Scripps scientists working on these materials were M.N. Bramlette and W.R. Riedel.

The study of Neogene sequences in the Atlantic [18] allowed Parker to make comparisons with the Indo-

Pacific sequences. She writes [18 (p. 265)]: "Late Neogene faunas of the Atlantic and Pacific regions started to differentiate in Latest Miocene and Earliest Pliocene time. This time of beginning provincialism is probably considerably before the final closing of the opening through the Isthmus of Panama. [...] The earliest known planktonic foraminiferal species which did not migrate after its development in the Pacific was *Pulleniatina spectabilis* (Earliest Pliocene); the earliest Atlantic species, *Globorotalia puncticulata* (near earliest Pliocene)". From these results, it appears that the marked change in the tropical planktonic fauna at the Miocene-Pliocene boundary, which she documented earlier [16], is closely related to the final interruption of the Tethys pathway. This suggested that the effect of the Panama Isthmus was felt well before it became a land bridge. 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 but not for other species.

During this period of stratigraphic work (middle 1960s and early 1970s) she continued her work on the biogeography of modern planktonic foraminifers, as seen on the sea floor and in plankton samples [17]. One of the PhD students she mentored during this period was W.H. Berger, who was interested in pursuing the question of patterns of preservation in planktonic foraminifers in space and time. Parker had a rich store of experience regarding these matters, largely through her work on the Swedish cores [13, 22]. Her extensive dataset on the distribution of planktonic Foraminifera on the sea floor in the Pacific readily lent itself to statistical analysis and the mapping of both faunal and preservation patterns [19].

Parker's comprehensive knowledge of modern and Late Neogene planktonic Foraminifera allowed her to spot undescribed species rather readily, and she described new species with great care. Among the planktonic forms, 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 Cushman and with Phleger.

4. Epitaph

Parker was well recognized among her peers in the micropaleontology community for her contributions. In 1981, she received the Cushman Award for Outstanding Achievements in Foraminiferal Research, by the Board of Directors of the Cusman Foundation. By this time, she was officially retired, but remained active, not only on the microscope, but also keeping her unique library and reference collection up to date [26]. As pointed out by Edith Vincent (p. 94 of [26]): "This collection, carefully accumulated through the last five decades, is invaluable to all of us near her (especially those of us who have messy filing systems). It was not difficult to fall short, when comparing one's own filing system with Parker's.

Parker's presence and generous disposition was a great asset to all working in micropaleontology at Scripps. She 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. A topographic high on the Louisiana shelf in the Gulf of Mexico has been named the Parker Bank in her honor in 1976, by the US Geological Survey (with the Phleger Bank nearby). In 1999, she established the Frances Parker Program in Public Education in the Earth Sciences at SIO with a significant gift to the Geosciences Research Division.

Frances L. Parker was born in Brookline (near Boston) in 1906, the youngest of four siblings. She took up geology in Vassar College and decided to stay with it. After graduating she went to MIT and obtained a Master's degree. When joining Cushman's laboratory, she was launched on her distinguished career in the study of foraminifers, which culminated in a series of milestone contributions at Scripps Institution of Oceanography, where she worked from 1950 till well after her retirement. She died in La Jolla (California) in 2002, a few days short of her 96th birthday. She was lucid and content to the end of her days.

References

[1] W.H. Berger, P.H. Roth, Oceanic micropaleontology: progress and prospect, Rev. Geophys. Space Phys. 13 (3) (1975) 561–585, 624-635; W.W. Hay, Paleoceanography: a review for the GSA Centennial, Bull. GSA 100 (1988) 1934–1956.

[2] J. Cattell, American Men of Science, a biographical directory, 8th ed., The Science Press, Lancaster, PA, USA, 1949.

[3] CLIMAP Project Members, The surface of the ice-age Earth, Science 191 (1976) 1131–1137.

[4] W.S. Cole, Foraminifera of the Cenozoic, in: H.S. Ladd (Ed.), Treatise on Marine Ecology and Paleoecology, Vol 2 (Paleoecology), Geol. Soc. Am. Mem. 67 (1957) 757–762.

[5] J.A. Cushman, F.L. Parker, Recent Foraminifera from the Atlantic Coast of South America, Proc. US Nat. Museum 80 (3) (1931) 1–24 pls.1-4 Smithsonian Institution, Washington DC, USA.

[6] J.A. Cushman, F.L. Parker, Bulimina and related foraminiferal genera, US Geol. Survey Prof. Pap. 210-D (1947) 55–176.

[7] D.C. Day, Frances Lawrence Parker, Research Geologist, SIO, UCSD Interviews, SIO Centennial Oral History Project, SIO Reference Series No. 00–12 (2000) 1–36.

[8] E.L. Hamilton, Upper Cretaceous, Tertiary, and Recent planktonic Foraminifera from Mid-Pacific flat-topped seamounts, J. Paleontol. 27 (2) (1953) 204–237 4 plates (Marine Foraminifera Laboratory Contribution No. 12).

[9] W.W. Hay (Ed.), Studies in Paleo-oceanography, Soc. Econ. Paleont. Mineral. Spec. Publ. 20 (1974) 1–218; Van Andel, Tj.H., G.R. Heath, T.C. Moore, Jr., Cenozoic history and paleoceanography of the central equatorial Pacific Ocean, Geol. Soc. Am. Mem. 143 (1975) 1–134.

[10] J. Imbrie, J. van Donk, N.G. Kipp, Paleoclimatic investigation of a Late Pleistocene Caribbean deep-sea core: comparison of isotopic and faunal methods, Quat. Res. 3 (1973) 10–38; W.H. Berger, J.V. Gardner, On the determination of Pleistocene temperatures from planktonic Foraminifera, J. Foraminfer. Res. 5102-113 5 (1975) 102–113.

[11] F.L. Parker, Foraminifera of the continental shelf from the Gulf of Maine to Maryland, Bull. Mus. Comp. Zool., Harvard 100 (2) (1948) 213–241, 10 tables, 7 plates; F.L. Parker, Foraminifera species off Portsmouth, New Hampshire, Bull. Mus. Comp. Zool., Harvard 106 (9) (1952) 391–423, 6 plates; F.L. Parker, Foraminiferal distribution in the Long Island Sound-Buzzards Bay area, Bull. Mus. Comp. Zool., Harvard. 106 (10) (1952) 427–473 (including 6 tables), 5 plates.

[12] F.L. Parker, Distribution of planktonic Foraminifera in some Mediterranean sediments, Pap. Mar. Biol. Oceanogr., Deep-Sea Research, 3 (suppl.) (1955) 204–211; F.L. Parker, Eastern Mediterranean Foraminifera, Rep. Swedish Deep-Sea Exped.1947–1948 7 (1) (1958) 3–122; F.L. Parker, Living planktonic Foraminifera from the equatorial and southeast Pacific, Vol.71-82, Sci. Rep.. Tohoku Univ. (2) (Geology), Spec. 4 (1960) 71–82.

[13] F.L. Parker, Eastern Mediterranean Foraminifera, Rep. Swedish Deep-Sea Exped. 7 (1) (1947–1948) 3–122.

[14] F.L. Parker, Planktonic foraminiferal species in Pacific sediments, Micropaleontology 8 (2) (1962) 219–254.

[15] F.L. Parker, Foraminifera from the experimental Mohole drilling, near Guadalupe Island, Mexico, J. Paleontol. 38 (1964) 617–636 6 plates.

[16] F.L. Parker, Late Tertiary biostratigraphy (planktonic foraminifera) of tropical Indo-Pacific deep-sea cores, Bull. Amer. Paleontol. 52 (235) (1967) 114–208.

[17] F.L. Parker, Distribution of planktonic Foraminifera in Recent deep-sea sediments, in: B.M. Funnell, W.R. Riedel (Eds.), The Micropaleontology of Oceans, Cambridge Univ. Press, Cambridge, pp. 289–307; F.L. Parker, Living planktonic Foraminifera from the Gulf of California, J. Foraminifer. Res. 3 (2) (1973) 70–77.

[18] F.L. Parker, Late Cenozoic biostratigraphy (planktonic foraminifera) of tropical Atlantic deep-sea sections, Rev. Esp. Micropaleontol. 5 (2) (1973) 253–289.

[19] F.L. Parker, W.H. Berger, Faunal and solution patterns of planktonic Foraminifera in surface sediments of the South Pacific, Deep-Sea Res. 18 (1971) 73–107.

[20] F.L. Parker, F.B. Phleger, J.F. Peirson, Ecology of Foraminifera from San Antonio Bay and environs, Southwest Texas, Cushman Found. Foraminifer. Res., Spec. Publ. 2 (1953) 1–75; F.L. Parker, Distribution of Foraminifera in the northeastern Gulf of Mexico, Bull. Mus. Comp. Zool., Harvard 3 (10) (1954) 453–588.

[21] F.B. Phleger, Foraminifera ecology off Portsmouth, New Hampshire, Bull. Mus. Comp. Zool., Harvard 106 (8) (1952) 317–390 18 tables.

[22] F.B. Phleger, F.L. Parker, J.F. Peirson, North Atlantic Foraminifera, Rep. Swedish Deep-Sea Exped. 7 (1) (1947–1948) 3–122.

[23] W. Schott, Die Foraminiferen in dem äquatorialen Teil des Atlantischen Ozeans, Wiss. Ergebn., Deut. Atlant. Exped. Meteor 1925–1927, 3 (1935) 43–134.

[24] W. Schott, Die Foraminiferen in dem äquatorialen Teil des Atlantischen Ozeans, Wiss. Ergebn., Deut. Atlant. Exped. Meteor, 1925–1927, 3 (1935) 43–134; M.N. Bramlette, W.H. Bradley, J.A. Cushman, L.G. Henbest, Geology and biology of North Atlantic deep-sea cores, (1940)1-50, US Geol. Survey Prof. Pap. 196-A (1940) 1–50.

[25] J.H. Steele, S.A. Thorpe, K.K. Turekian (Eds.), Encyclopedia of Ocean Sciences, Vol. 6, Academic Press, San Diego, 3399 p.

[26] E. Vincent, The 1981 Joseph A. Cushman Award Frances L. Parker, J. Foraminifer. Res. 12 (2) (1982) 93–95.