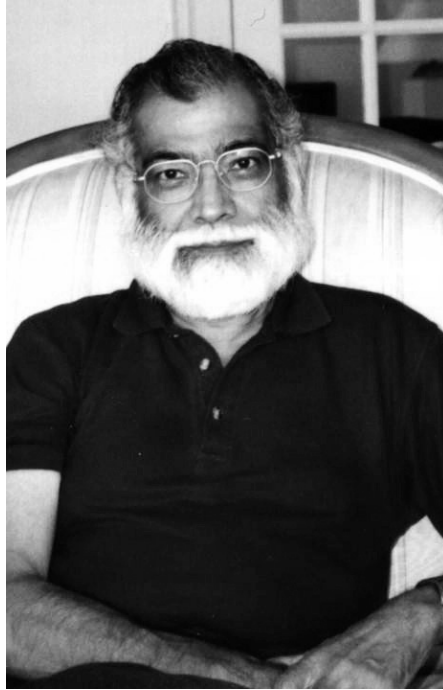


MEDAL FOR SCIENTIFIC EXCELLENCE

The American Association of Stratigraphic Palynologists
bestows upon

DR. SATISH K. SRIVASTAVA

The AASP Medal for Scientific Excellence for his Comprehensive Contributions in Taxonomy,
Paleoecology, Stratigraphic Palynology, and Continental Paleogeography



SATISH K. SRIVASTAVA

PRESENTATION BY SHARMA L. GAPONOFF

The town of Sitapur is located in the province of Uttar Pradesh in northern India. It is traversed by the Sarayan River and sits on a vast, gently sloping plain. Sitapur also is laced with numerous streams and ravines, and contains many ephemeral ponds and natural reservoirs. It was here in 1935 that Satish K. Srivastava was born to Hazari L. and Sheopyari Srivastava. As a young child, Satish displayed the gift of a photographic memory and an insatiable curiosity about the natural world which led him to a life-long fascination with the sciences. He pursued an interest in botany, chemistry and zoology, earning a multidisciplinary Bachelor of Science degree in these subjects in 1954 from the Agra University, India. At the age of 22 he began his professional scientific career as a Junior Technical Assistant in the palynology lab of India's Oil and Natural Gas Commission (ONGC). While in this position, Satish suc-

cessfully applied his knowledge of palynological slide preparation, microtomy and camera lucida techniques he had learned while working as an undergraduate at the Forest Research Institute in Dehradun, India, under two distinguished Indian paleobotanists, Drs. H.S. Rao and G.S. Puri.

In 1957 Satish published his first technical article and by the time he finished his Master of Science degree in 1965 in Geology from the University of Alberta, Edmonton, Canada, he had published 16 palynology papers ranging in subjects from morphology and taxonomy to chronostratigraphy and paleoclimates. These early publications spanned the geologic column from the Precambrian through the Jurassic, Cretaceous and Tertiary, and also included studies of selected modern angiosperm and gymnosperm pollen. Satish's master's thesis, *Palynology of Late Cretaceous*

Mammal-Beds, Scollard, Alberta, drew on his knowledge of geology, botany and zoology. Based on the palynology and analysis of corresponding microvertebrate mammalian fossils, Satish was able to characterize the Scollard mammal beds by providing a chronostratigraphic and paleoecologic interpretation of a succession of five Upper Cretaceous paleoecological zones where the climate shifted from humid tropical conditions to a series of warm subtropical and warm temperate climates.

While working on his M.S. and Ph.D. at the University of Alberta, Satish was awarded a Research Assistantship from 1964 to 1967 from the Geological Survey of Canada in its Biostratigraphy and Correlation of Western Canada Program, and a Dissertation Fellowship from 1967 to 1968 from the University of Alberta. To aid in the Geological Survey of Canada's efforts to provide accurate biostratigraphy and correlation of western Canada, Satish was able to solve the controversy of marine vs. non-marine interpretations of the Kneehills Tuff bed at the base of the Scollard Formation. This bed had been interpreted as marine, based on several siliceous "Globigerinid" microfossils recovered from the bentonite of the Kneehills Tuff. Satish examined these siliceous microfossils and recognized that they were not foraminifera but siliceous trilete megaspores of *Isoetes* ferns, and he was able to correctly interpret the Kneehills Tuff as non-marine. He coauthored these results in *Micro-paleontology* in 1968, and the Kneehills Tuff has been treated as non-marine since.

Resolving the controversy of the paleoecological and depositional provenance of the Scollard Formation was Satish's segue into his Ph.D. research at the University of Alberta under the guidance of Professor C.R. Stelck. His dissertation, *Angiosperm Microflora of the Edmonton Formation, Alberta, Canada*, drew extensively on his multidisciplinary background incorporating palynology, planktonic foraminifera, sedimentology, invertebrate paleontology and the fossil remains of dinosaurs and early mammals.

Studying the relationships between tropical and temperate angiosperm pollen, Satish was the first scientist to use the ratio of tropical to temperate angiosperm pollen as paleoclimatic and paleoecological proxies to help interpret climate change in the Upper Maastrichtian of the Edmonton Formation in his dissertation research published in 1968.

Throughout his Ph.D. studies, Satish was also publishing on a range of topics including the paleoecological significance of Upper Cretaceous Ephedralean pollen; the significance of angiosperm microflora from the Edmonton Formation (resolving the marine vs. non-marine controversy); the identification of new Maastrichtian species; the identification of siliceous megaspores; and the paleoecological significance of Maastrichtian fungal elements. While completing his Ph.D., Satish also published more than 30 technical papers in journals such as *Pollen et Spores*,

Canadian Journal of Earth Sciences, Canadian Journal of Botany, Micropaleontology, Geological Society of America, Botanical Review, Palaeogeography, Palaeoclimatology, Palaeoecology, and in various proceedings of technical society conferences.

As a new Ph.D., Satish was awarded the Killam Postdoctoral Fellowship at the University of British Columbia, Vancouver, Canada from 1968 to 1970 and focused his Fellowship research on the geologically controversial Lower Cretaceous (Albian)–Eocene section in the Yukon Territory, Canada. In 1969 he presented lectures on palynology as a Visiting Research Scholar in Tucson at the Geochronology Laboratory, University of Arizona.

The late 1960s and early 1970s saw a major shift in our understanding of the positions and movements of the continents throughout earth's history. Many branches of physical and biological sciences were testing their assumptions and proposing new conclusions. It was during this time that both a controversial new theory of continental drift called plate tectonics was being published in the literature and dinoflagellates were being moved from Kingdom Animalia to Kingdom Plantae. Palynological literature on dinocysts was among the first to present fossil evidence in support of this new theory of continental drift. Satish was an avid reader of these publications and began to realize this new theory provided a mechanism for mapping and understanding paleophytogeographies.

It was during this exciting time of change in the prevailing understanding of the history of *Terra Firma* by geologists, paleontologists, and biologists that Satish left academia and went into industry palynology. In 1970 he joined Chevron Oil Field Research Company and began a distinguished career in applied research, mentoring and providing internal confidential technical reports. Much of the work Satish did at Chevron still provides that company with a competitive edge in oil-rich areas such as the Middle East, West Africa, North and South America, Asia and Europe. In tandem with his confidential industry work, Satish continued to provide the general palynological community with innovative and comprehensive publications.

Industry palynologists have the distinct advantage of seeing an enormous number of palynology samples from all over the world and from the entire geologic column. As the 1970s unfolded, more geologists were becoming comfortable with the theory of plate tectonics, Satish among them. Through his work at Chevron, analyzing and interpreting thousands of feet of section from almost every continent, he was beginning to see patterns of fossil palynomorph distributions that could not be explained without this theory. One beautiful and morphologically distinct palynomorph genus, *Aquilapollenites*, caught his attention. During a vacation in Scotland in 1971, he collected interbasaltic lignite in Mull with the hope of finding this genus preserved in these sediments. Published palynological literature of

the time described these pollen and suggested they only occurred in America and Siberia. However, Satish was successful in recovering *Aquilapollenites* from the Mull lignites. This occurrence plus those he observed while providing analyses and interpretations at Chevron convinced Satish of the extensive paleo-range of the genus. Thus, using plate tectonics theory to reconstruct the position of the continents during the Late Cretaceous, Satish was able to provide the Cretaceous phytogeoprovince of this genus and publish his results in *Palaeontographica* as “Maastrichtian Microspore Assemblages from the Interbasaltic Lignites of Mull, Scotland.” He explained the mechanism of the *Aquilapollenites* phytogeoprovince by a series of paleocontinental maps, paving the way for these types of analyses and interpretations that incorporated plate tectonics.

Throughout the 1970s, Satish maintained an interest in this genus, as did the palynology community, and many papers were subsequently written. By the end of the decade, there was enough global Cretaceous palynology literature to provide Satish with several data points of newly published occurrences of *Aquilapollenites*, enabling him to distill the information into an organized and intuitive summary documenting the paleo-range of this genus. By combining these published occurrences with discussions on plate tectonics, Satish was able to reconstruct several paleocontinental and paleogeographic maps showing the land connections necessary for the distribution of the plants producing these palynomorphs. He showed that biogeoprovinces maintain their integrity as long as they are separated by large bodies of water and that during major regression phases, plants intermix. He emphasized that the Indian plate was in contact with the African plate in the Senonian, and as more palynological literature became available, improved these biogeoprovincial maps.

Satish produced a total of 28 additional publications in the 1970s, including more of his extraordinary monographs. These publications include “Pollen Biostratigraphy and Paleocology of the Edmonton Formation (Maestrichtian), Alberta, Canada,” published in *Palaeogeography, Palaeoclimatology, Palaeoecology*. During this time, Satish routinely applied the then new technique of SEM (scanning electron microscopy) photomicrography to spores and pollen, and as such these publications have become classic references. In 1972 his comprehensive study of spores from the Edmonton Formation was published in *Palaeontographica*, and the recovery, analysis, interpretation and photomicroscopy of the Paleocene spores and pollen from the Oak Hill Member of the Naheola Formation of Alabama was published in the *Review of Palaeobotany and Palynology*. In 1977 he produced an additional monograph titled “Microspores from the Fredericksburg Group (Albian) of the Southern United States” published in *Paleobiologie Continentale*.

Satish published several papers that illustrate how the interpretation of fossil history in the context of plate tectonics can be used to reconstruct the migration path of disjunct plant distributions. Additionally these interpretations helped to identify regressive sequences, especially those in which no other fossils save palynomorphs were preserved. This work was culminated with Satish’s 1978 publication of *Cretaceous Spore-Pollen Floras: A Global Evaluation*.

As an industry palynologist, one has the ability to view the entire palynological assemblage, both marine- and terrestrially sourced elements. In 1981 and 1982 Satish studied dinocysts under Professor W.R. Evitt at Stanford University, thus expanding his knowledge of palynology to include these marine-through-fresh-water palynomorphs. During these years he was fortunate to attend Bill Evitt’s short course and three-day seminar. The short course consisted of two-weeks “total immersion” on theoretical and practical aspects of dinoflagellates used in biostratigraphic, oceanographic and paleoecologic applications in oil exploration of coastal and marine sediments. The three-day seminar focused on the morphology, classification, evolution and use of fossil dinocysts in biostratigraphy. Satish’s photographic memory and insatiable thirst for knowledge gave him an advantage in learning and understanding the world of fossil dinocysts and their application in stratigraphic interpretations.

In 1984 Satish published a monograph titled ‘Barremian Dinoflagellate Cysts from Southeastern France in *Cahiers de Micropaléontologie*. This publication contains spectacular SEM and LM (light microscopy) photomicrographs of dinoflagellate cysts which were the only microfossils recovered from these sediments. This was Satish’s first publication focusing solely on dinoflagellate cyst taxonomy and biostratigraphy. In keeping with the standard of excellence he set for himself with his pollen and spore monographs, this publication has also become a classic reference. In 1992 Satish published another dinocyst monograph, “Dinocyst Biostratigraphy of Cenomanian–Coniacian Formations of the Western Gulf Coastal Plain, Southern United States” which appeared in the *Palaeobotanist* journal. This investigation was based on 63 samples from 9 stratigraphic outcrop sections exposed in 7 Texas counties in a north–south trend from the Dallas area to Del Rio. Satish then published a follow-up monograph “Dinocyst Biostratigraphy of Santonian–Maastrichtian Formations of the Western Gulf Coastal Plain, Southern United States” in the same journal in 1995. That investigation consisted of an examination of 82 outcrop samples from 19 stratigraphic sections in 9 counties in a north–south trend from the Dallas area to Kinney and thus provided comprehensive coverage of dinocyst biostratigraphy of the Late Cretaceous of this region.

In the late 1970s and early 1980s, the first technical papers began emerging regarding the “asteroid theory” or

“impact event theory” resulting from the discovery of an iridium anomaly at the Cretaceous–Tertiary boundary (KTB) in Italy and elsewhere around the globe. This theory suggested there was an extraterrestrial impact caused by an enormous asteroid hitting the earth and creating the bowl-shaped depression that formed the eastern coastline of southern Mexico and the Yucatan Peninsula. The theory states that the impact event was large and violent enough to form a dense cloud of asteroid and crustal debris in the atmosphere which blanketed the earth for an unspecified length of time, throwing the planet into instant winter conditions and causing the catastrophic extinction of dinosaurs. The theory postulates that the anomalously high levels of iridium are explained by this extraterrestrial source because the asteroid would have been pulverized upon impact and formed a major component of the debris cloud that eventually settled out and formed the sediments containing the iridium anomaly.

To test the catastrophic climate change portion of this popular theory, Satish meticulously examined palynological evidence from a Scollard section at the KTB in Alberta, Canada. The palynomorphs recovered indicate there was progressive cooling from a subtropical to a temperate climate rather than a catastrophic cooling event. Satish presented his preliminary findings as “Palynological Nature of the Cretaceous–Tertiary Boundary in Alberta, Canada” in the Sixth International Palynological Conference, Calgary, Canada (1984). Later he published his findings in detail as “Palynology of the Cretaceous–Tertiary Boundary in the Scollard Formation of Alberta, Canada, and Global KTB Events” in *Review of Palaeobotany and Palynology* (1994). In a publication prior to this, Satish was able to demonstrate that by Maastrichtian times, the climate and resulting freshwater lakes in the dinosaur-rich area of the Canadian Foreland Basin contained frigid waters, lending credence to the theory that at the end of the Cretaceous, climate in this area was indeed much colder than it had been six million years earlier at the beginning of the Maastrichtian. Satish coauthored these results in a paper entitled “Siliceous and Silicified Microfossils from the Maastrichtian Battle Formation of Southern Alberta, Canada” in *Paleobiologie Continentale* (1984). The paper describes chrysomonads, sponge spicules, silicified fungal spores, spores, pollen and wood fragments. These fossils were key to interpreting frigid water conditions in this foreland basin Maastrichtian lake.

Satish’s investigation of the palynomorphs of the Scollard section and his coauthored study of the siliceous microfossils recovered from the Battle Formation are two of several bodies of evidence suggesting a gradual rather than a catastrophic climate shift. Although the impact theory remains popular today, many paleontologists and geologists now consider that there were several factors contributing to the ultimate demise of the dinosaurs, catastrophic

events among them, leaving perhaps today’s birds as the only surviving descendants.

As the controversial impact theory was being hotly debated by paleontologists and geologists, Satish continued his industrial palynological career as well as his publishing career and was recognized by his fellow palynologists as a world-class taxonomist, paleoecologist, stratigraphic palynologist and an emerging authority on continental paleogeography. As a result, Satish was elected and served in high-level positions of several technical palynological associations in the 1980s. This list includes a Fellow of the Linnean Society of London in 1980; a Fellow of the Indian Association of Palynostratigraphers in 1985; President of the Indian Association of Palynostratigraphers in 1984, reelected in 1985; Councilor of the Indian Association of Palynostratigraphers in 1979, 1980 and 1983; and President-Elect of the Southern California Palynological Society in 1991.

Satish also served on several editorial boards and advisory committees. For example, he is a Member of the Editorial Advisory committee of *Palaeobotanist* which is an international journal of paleobotany, and has served in this capacity continuously since 1986. From 1989 to present, Satish has been a member of the Editorial Board of *Review of Palaeobotany and Palynology*, which is an international journal published by Elsevier, and as coeditor, published a Festschrift volume for Drs. Helen Tappan and Alfred R. Loeblich, Jr., in *Review of Palaeobotany and Palynology* (vol. 98 [1–2], 1997); and from 1989 to 1991 served on the Earth Sciences Advisory Committee, Museum of Natural History and Science, Newport Beach, California. In the 1980s and 1990s Satish actively participated in palynological conferences around the world, and gave numerous technical presentations. In 1992 he was invited to present the keynote lecture for the Paleofloristic and Paleoclimatic Changes in Cretaceous and Tertiary Times Symposium at the Eighth International Palynological Congress in Aix-en-Provence, France. Another noteworthy presentation was in 1998 entitled “Evolution of Early Cretaceous Phytogeoprovinces in Euro-American-North African Areas” in the Pollen and Spores: Morphology and Biology Conference held at the Royal Botanic Gardens, Kew, England.

While working as a palynologist at Chevron, Satish never lost sight of the importance of providing palynological guidance to university students and became an external advisor and examiner for many universities, thus helping ensure a succession of qualified students available to industry for its next generation of palynologists. In addition, Satish was sought after for lectures and seminars at these universities. In 1981 Satish gave a lecture seminar on “Global Evolution of Cretaceous Flora and Their Climates” at the University of Arizona in Tucson, and in 1986 gave a graduate lecture seminar on “Application of Organic

Microfossils in Stratigraphy and Paleoecology” at California State University, Los Angeles.

Satish left Chevron in 1986 and continued to balance his scientific career between industry and academia. He established himself as an independent consulting geologist, which he continues to do today and remains available as a university lecturer. Furthermore, from 1989 to 1995 Satish was awarded an Adjunct Full Professorship in the Department of Earth Sciences at the University of Southern California and through his work as a consulting geologist, was hired to train PETROCI (Petroleum Company of Ivory Coast) professionals in applied oil exploration palynology from 1994 through 1998.

Throughout the remainder of the 1990s and into the twenty-first century, Satish continues his legacy of insightful scientific analyses and interpretations through publications that vary in topics from stratigraphy, sequence stratigraphy, depositional history, oceanic fertilization and oil shale, to dinocysts, spores, pollen, phytogeoprovinces, paleoclimates, paleoecology, hydrostratigraphy, paleobotany and evolution, and archaeology. Currently, Satish is coauthor of his most recent monograph, “High Resolution Palynological and Palynofacial Sequence Stratigraphy of an Aptian–Albian Core from Northern Arabian Gulf” (97 plates, 5 tables) in *Savitrjana* vol. 2 which is in press. In this study, a palynological analysis of 126 samples from a 365.8m (1200 ft) core from the northern Arabian Gulf revealed six terrestrial palynomorph zones and seven marine dinocyst zones. In reconciling these two types of zones, five biostratigraphic zones are recognized within an Aptian

to late Albian interval of this core. Palynofacies analysis was used to help determine these paleoecological zones.

Today, Satish is a recognized and widely respected world expert with extensive cross-discipline experience as a palynologist, geologist, botanist, paleontologist and biostratigrapher. His contributions to our science span both academic and industrial research programs applied to worldwide geological, paleobiological, paleoenvironmental and evolutionary problems. He has shared his extensive experience in Phanerozoic marine and terrestrial palynomorph biostratigraphy through his publications in professional journals worldwide and as an instructor, external advisor and examiner for many universities.

Throughout his career, Satish has had a positive and lasting impact on our science with his keen insights, research contributions and his mentoring of future generations of palynologists. He will always be remembered for his standards of excellence, his thorough and meticulous research and his cross-discipline assimilation of thoughts and ideas. Satish remains a generous scientist, making his expertise available to anyone who seeks it. His distinguished career, which has spanned over half a century, has provided the scientific community with 143 publications encompassing the Phanerozoic as well as the globe. The palynological community looks forward to many more years of contributions from him, and as such, it is an honor to bestow upon Dr. Satish K. Srivastava the AASP Medal of Scientific Excellence, 2006, for his comprehensive contributions in taxonomy, paleoecology, stratigraphic palynology and continental paleogeography.

RESPONSE BY DR. SATISH K. SRIVASTAVA

I am honored and humbled to receive AASP’s *Medal for Scientific Excellence*. At the outset, I would like to thank Sharma Gaponoff for nominating me, and David Jarzen, Rolf Mathewes, Sheldon Nelson, and Reed Wicander for supporting my nomination. I thank Paul Strother (Chair of the AASP Awards Committee), Owen Davis, Len Eames, and Barbara Whitney (Members of the Awards Committee) for selecting me. For the approval of my name to receive this award, I thank Bob Cushman and other members of the AASP Board.

Few people think of an award at the outset of their career. Most jobs are taken to earn a living or further one’s career. However, if peer appreciation of one’s work is expressed in the form of an award, then one feels tremendously gratified. I do. I enjoyed research that I did for the last 52 years with

a humble beginning as a Research Assistant. In the course of my career, I was well compensated in terms of my satisfaction doing research. Today, receiving this award elates me as it shows the approval of my peers for the work I did. In my journey of the last 52 years, I have learned something or the other from those with whom I worked. I would like to mention those who modified or impacted my way of thinking.

I started working in 1954 in the cytology section of the Botany Branch in the Forest Research Institute, Dehradun, India. In that laboratory I first encountered pollen grains of various plants under investigation for their chromosome numbers. Dr. H. S. Rao was in charge of the laboratory - he had a PhD in paleobotany, then due to the dearth of paleobotany jobs in those days in India, he studied for a

PhD in cytology from the University of Minnesota. Thus, I have a dubious honor of starting my career with a paleobotanist. However, I am thankful to Dr. Rao for motivating me to do research with integrity.

Soon I was moved to assist Dr. G. S. Puri in writing his book "Forest Ecology of India". Puri had a PhD in Quaternary leaf paleobotany then he took a PhD in forest ecology from University College of London. When I joined him, Puri had already published more than 200 papers. The side effect of collecting data for his book was that I learned a lot from geological, pedological, botanical, and environmental literature. Puri gave me an ambition to publish.

Three years after starting my career (1957), I joined the Palynology Laboratory of the Oil & Natural Gas Commission of India in Dehradun. Professor A. K. Ghosh was in charge of the Laboratory. I published several papers while working with him – some co-authored and others as a sole author. Ghosh gave me the freedom to publish independently.

I came to the University of Alberta, Edmonton, Canada, in September 1964. Traveling for the first time outside India, I was lost in the Canadian vastness. Professor Charles Stelck rescued me with his benevolent encouragement to learn my newly adopted subject of geology. He trained me in field geology, and helped me to collect samples for my MSc and PhD studies. Without Dr. Stelck's encouragement, guidance and help, I would have been lost forever.

After getting my PhD in 1968, unfortunately I had no job prospect in North America so had to return to India. Professor Glenn Rouse of the University of British Columbia, Vancouver, recommended me for the Killam Postdoctoral Fellowship at the University of British Columbia. There, I learned how to operate a Cambridge Stereoscan. Using those SEM photomicrographs, Rouse and I published a paper on *Pistillipollenites* in the *Canadian Journal of Botany* in 1970.

My stay at the University of British Columbia for two and half years gave me an opportunity to meet Dr. Alfred R. Loeblich, Jr., at Chevron Oil Field Research Company in

La Habra, California. He was familiar with my publications and hired me to work for Chevron, on the basis of my work. Al remained my friend and supporter all his life.

It is generally believed that oil companies don't encourage anyone to publish, but fortunately it was not true in my experience. I am thankful to Chevron, where I always received excellent support towards my ambition to publish.

Since I met Rosalind in 1965, she supported my academic persuasions and helped me to fulfill my dreams. We were married in 1970 and visited Rosalind's parents in Scotland in November 1971. Rosalind's father asked me one day what I wished to do in Scotland while on vacation. I said "Nothing particular, I am alright". Rosalind interrupted, "I know what he would like to do. He would like to collect Simpson's locality in Mull". Thus, we went to the University of Dundee, found relevant references, and got a detailed map of Mull. The samples collected in that vacation resulted in my 1975 paper on Mull lignites published in *Palaeontographica*. Rosalind's continued interest and dedication in my work throughout our 41 years together has facilitated and made my research career more enjoyable.

Thank you all.

Satish K. Srivastava

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