Tom L. Phillips

1931–2018

BIOGRAPHICAL *Memoirs*

A Biographical Memoir by
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TOM L. **PHILLIPS**

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Elected to the NAS, 1999

By William A. DiMichele

Tommy Lee Phillips was a classically trained plant morphologist, evolutionary biologist, and, later, paleo-ecologist. His interests centered on plants of the late Paleozoic, Devonian through Permian, but also on modern pteridophytes—spore-dispersing vascular plants. Throughout most of his career he focused on plants of ancient so-called coal swamps, the large, peat-forming wetlands that characterized much of the tropical world during the Pennsylvanian and Permian "Coal Age" time periods. The plants and plant communities in which he was interested are preserved in concretions known as "coal balls," in which the structure of organic matter, primarily of plants, is preserved right down to the cellular level by being replaced over millennia by water-borne minerals. Through this process the original peat fabric of the coal and detailed information on the structure, reproductive biology, and even the physiology of the plants that lived in swamp landscapes more than 300 million years ago can be determined. Phillips availed himself of all possible avenues, botanical and geological, to understand Pennsylvanian coal swamps and their aspects.

His diverse interests included structural and evolutionary botany, community ecology, isotope geochemistry, coal geology, and paleoclimatic analysis. In the course of this work he amassed an enormous collection of coal balls from around the world. He led the way in re-introducing ancient climate as a major factor affecting patterns of peat/coal abundance and distribution and as a driver of ecosystem dynamics in the tropics of the long-ago world of the late Paleozoic.

Phillips began his higher education at Tennessee Western Junior College and enrolled in the University of Tennessee after graduation, where he received a bachelor's degree in science education. After two years in the Army, he, reenrolled at UT and earned another bachelor's, in botany. Moving to Washington University in St. Louis, he received an M.S. and a Ph.D. He then joined the faculty of the University of Illinois and remained there, teaching and researching, for his entire career.

Tommy Lee Phillips was born December 6, 1931, and raised in Kingsport, Tennessee, as part of a hard-working family. His father was a pressman at the Mead Paper Company plant, and his mother taught school and later worked as a proofreader for the Kingsport Press. It was the time of the Great Depression, and all members of the family had to contribute. Thus, as part of growing up, young Tommy was sent to live with relatives in Nashville, where he was put to work as a delivery boy for a local drugstore, delivering prescriptions on bikes without seats! This brought him into contact with the urban world and with other young men from diverse backgrounds among whom he had to prove his mettle by fighting his way into the pecking order. He also was intimately familiar with the outdoors, both as a hunter and as a budding naturalist. These youthful lessons served him well at various times in his life requiring courage of convictions, sacrifice, an unyielding sense of purpose, and the ability to shoot straight. (When in Army basic training, he "acquired" extra ammunition to use on the rifle range).

In Kingsport he was a 1949 graduate of Dobyns-Bennett High School. His undergraduate education took place in three stages. He began at Tennessee Wesleyan, then a two-year junior college, graduating in 1951 and subsequently enrolling at the University of Tennessee, from which he earned a degree in science education in 1953. Following two years in the army, he reenrolled at Tennessee, earning a B.S. in botany with a minor in geology in 1957.

Phillips' initiation into the world of evolutionary biology, always at the core of his professional identity, began in his second pass through the University of Tennessee. As recounted, he came home on break, having been introduced to the concepts of continental drift and evolution. Finding his mother at home, in her black wicker rocker, he told her about it, including with his hands, as was his wont. She gently rocked until he ran out of steam and then said, "Well, that's mighty fine, Tommy Lee, but don't you tell anyone." It must be remembered that, at that time, the State of Tennessee still banned the teaching of evolution in public schools.

Between completing his education degree and later his degree in botany and geology, Phillips served in the U.S. Army, entering the Counter Intelligence Corps during the latter part of the Korean War. He finished CIC training school at the top of his class and was named the Honor Graduate, with a personal letter of congratulations from the commanding general. As part of his CIC duties, he interviewed many prominent people, including Werner von Braun, and numerous high-ranking officers regarding matters of state security.

Leaving the Army and now sure of his interests, he was accepted into the graduate program at Washington University in St. Louis, where he studied with Professor Henry Andrews, an internationally prominent paleobotanist. He received an M.S. in 1959 and a Ph.D. in 1961. During the summer of 1959 he served as a physical science technician for Dr. James M. Schopf at the U.S. Geological Survey's Coal Geology Laboratory in Columbus, Ohio, an experience that led to a lifetime association with Dr. Schopf and a keen interest in coal geology.

Coal-Ball Studies

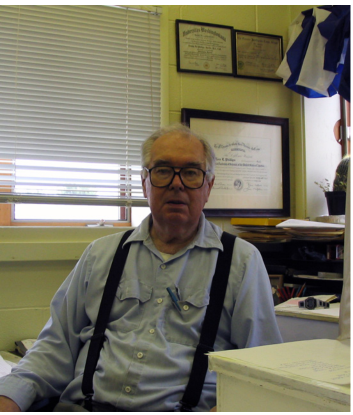
Upon receiving his doctorate, TLP, his signature sign off by which he would be known to his students, was offered a faculty position at the University of Illinois, focused on undergraduate teaching. Two paleobotanists were on staff at the time, Drs. Wilson Stewart, Botany Department head, and Theodore Delevoryas. Both were focusing on studies of plants anatomically preserved in coal balls. Consequently, the newly minted Dr. Phillips decided to refocus his research, and he began an investigation of Devonian-age plants. This work took him to a number of places—most notably, during the summers of 1962 and 1963, into the high Canadian Arctic, on Ellesmere Island, as part of expeditions led by Professor Andrews. As described in his 2006 National Academy of Sciences Memoir of Dr. Andrews, the field party not only searched for plant fossils, but also explored aspects of the Arctic landscape, with which Andrews in particular was fascinated.

Tom on Ellesmere Island. (Photo courtesy of Patricia Phillips.)

In 1962 the Botany Department moved into Morrill Hall. Phillips was part of the team of paleobotanists who designed a specialized laboratory in the basement, set up specifically for the analysis of coal balls. The windowless lab was fitted with broad double doors for bringing in carts loaded with specimens, specialized benches for coal-ball preparation and detailed study, areas for oil-lubricated diamond-blade saws, sinks equipped for cleaning cutting oil off specimens, and glass plates on which grinding and smoothing of coal-ball surfaces could be carried out using carborundum grit. The lab had two hoods, specialized microscope rooms, desk space for students and postdocs, and cabinets for storage of microscope-slide preparations. A fully equipped darkroom was present for many years, and all of Phillips' students learned darkroom technique, up through the emergence of digital technology.

During its heyday in the 1970s and early 1980s, when flush with NSF funding, there were at least four oil saws operating all day long, run by various undergraduate assistants, among whom was (now Dr.) Dan Guerra, an organizational genius who could work for hours and keep the whole operation plowing ahead at breakneck speed. This was necessitated by huge piles of bagged coal balls brought into the lab from numerous mine trips in which they were collected both from spoil piles and directly from the face of the coal bed. Most of these collections included complex spatial information that needed to be tracked and retained, so the work was far more complex than simply cutting, washing, and stacking the sliced specimens. Oil saws get dirty and need frequent cleaning. This is a dirty, oily job, and everyone pitched in, including Dr. Phillips; regardless of plastic aprons, goggles, and rubber gloves, one came away soaked to the skin with cutting oil.

Ultimately, so many coal balls were cut and processed, and so many acetate "peels" (thin sections) were made from them, that Phillips began searching for places on campus to store them all—the allocated space in Morrill Hall being inadequate. He managed, with the help of School of Life Sciences administrators, especially Paul Mortensen, to secure space in several basements or rooms in various university buildings. These spaces needed fitting out with steel shelving, all acquired secondhand and free, but requiring disassembling, hauling, and reassembling, virtually all done by Phillips and his team of students and assistants. Finally, even these spaces were filled to capacity, and their dispersed locations made managing and accessing specimens excessively complex and labor intensive. Thus began the quest for a specialized facility.



Dr. Phillips in his office at the coal-ball warehouse.

Working particularly with Mortenson and Botany Department Head Dr. Larry Vanderhoef, he devised a plan for a pole barn on the south campus near several other such facilities. A place was located, creative financing arranged, and the facility built in the early 1980s. Largely a warehouse, the "coal-ball barn" includes a processing lab and an office with space for microscopic examination of acetate peels, done on a double-headed microscope through which Phillips and a collaborator together could look at specimens. Ultimately the space was filled with more than 50,000 coal balls, and at least four times that many coal-ball slices, each labeled, bagged, and recorded in log books, as 1:1 outline sketches of each slice. By the early 2000s Dr. Phillips, working with Scott Elrick of the Illinois State Geological Survey, acquired a desktop computer with a gigantic screen. Although he used it for email (printing out the emails, writing responses by hand, which then were typed and sent by secretarial assistants), its main function was for viewing high-resolution scans of coal-ball peels, an innovation pioneered by Elrick and used to great effect. It also should be noted that Phillips saved the acetate peels of every coal ball processed in his lab, even though well over 75 percent of the coal balls themselves were discarded because of poor preservation or high pyrite content, which leads to short shelf life. The coal balls saved, therefore, represent only a fraction of the actual processing activity of the lab. The peels, like the coal balls themselves, were, and still are as of this writing, systematically organized, housed, and labeled.

Dr. Phillips in his lab at the coal-ball processing facility. (Photo credit William A. Dimichele)

Inventing Coal-Ball Paleoecology

Fieldwork is the unseen part of coal-ball studies, and collecting coal balls can be an arduous task. In its simplest form, one goes to a non-working part of a coal mine or to the tipple area (with permission, of course), looks for coal balls in the piles of discarded rock, fills canvas or cotton bags (old seed bags were plentiful and worked well), and returns to the lab. But collecting from natural outcrops or from the coal face is a different story. Here, pickaxes, sledge hammers, crack hammers, chisels with handles welded onto them, pry bars, and even explosives in exceptional circumstances, are necessary. TLP was a field guy and loved the work, feeling at home with coal miners, happy in a hardhat and decked out in mine gear, whether on the surface or underground. He was a big man, 6 feet tall, and strong, one of the few people who could swing the 16-pound hammer effectively (another was Matt Avcin, one of his collaborators, who could swing the big hammer from the end, and once bent a 1½ inch-diameter hardened-steel chisel).

There are many stories about collecting coal balls. In only one instance, however, did I see Dr. Phillips under strain. We were collecting in “low” coal, a seam about 3½ feet thick, they get thinner than that, requiring crawling); moving around required so-called duck walking. This was not too difficult for shorter among us, but it was difficult for a big person. Nonetheless, Phillips staggered around, hauling coal balls back to the transport vehicles, while his students discussed whether we could get him out in case of emergency. We had similar discussions at other times. For example, on an exceptionally hot, cloudless summer day in an abandoned, remote part of a southern-Indiana surface mine, Phillips was pounding on a large mass of coal balls with a big sledge hammer, situated in such a way that, in an emergency, there was no way out except over several ridges and valleys of spoil piles. He was in his mid-40s at the time, and we several graduate students, 15-20 years younger, were sure he was at risk. Clearly, our fears were unfounded, and if he detected our concerns, he never let on.

Perhaps the most important field trip of his career was to a mine in the Herrin Coal near Shawneetown, Illinois. As Phillips described it, the coal balls were in place, and he realized he could take them out in layers and record the succession of changes in peat composition through the thickness of the coal bed. However, he had none of the necessary collecting equipment for digging specimens directly out of the seam, and no way to mark or label the coal balls as they were extracted. After that trip, in the late 1960s, he never again went into the field without digging equipment, spray paint, sacks, and bag tags. And, as usual with nearly everything in his scientific life, these necessary items were systematically organized, and stored in one place for quick loading. All tools were painted reflective yellow to allow them to be seen, particularly underground, and the bags, tags, and spray paint were modularized, stored in milk cartons to facilitate stacking in a fleet vehicle (Chevy Suburban), and transferred to designated frame backpacks. Bag tags were pre-coded with colors. Consequently, the important work of keeping things straight started before anyone left the lab. This penchant for organization was a hallmark of a Tom-Phillips operation at all phases and in all places.

The Shawneetown fieldtrip was of great scientific significance, as well as important to future logistics. The realization that coal balls could be extracted in layers, and that such information, if preserved, could provide insights into coal composition and coal-swamp plant ecology, was a crucial turning point in Phillips' career. From that moment, he expanded his pursuits from plant morphology and systematics to coal geology and paleoecology, areas in which some of his most original, important, and high-impact research was carried out. Palynologists—scientists who study pollen, spores, and microscopic plankton—had for some time sampled sediments, peat, and coal by collecting "profiles" or "vertical sections." Thus, there was already a model for this kind of sampling and for the kinds of plant-compositional data that might be extracted. But no one among the many students of coal-ball paleobotany, extending back to the mid-1800s, had ever done such collecting for plants preserved in permineralized (fossilized through accretion of water-borne minerals) peat, possibly because of difficulty of access to in situ specimens.

But this was also the case because the then-intense focus among researchers on plant anatomy and the insights it provided to plant life was remarkably different from foci of today, those being the priority and the reason why most students of coal balls were not ecologically minded. In fact, it took colleagues some time to recognize the importance of such work. Phillips related a story about the first time he presented a quantitative study at a national Botanical Society of America meeting, where a senior colleague first congratulated him and then asked, “But why are you bothering with this? There are so many new plants to describe.” But he stayed the course, and revolutionized the field.

The collection of coal-ball profiles specifically for the analysis of peat composition adds another dimension, which might be called “litter floristics.” To make sense of the peat, Phillips needed to be able to identify nearly every scrap of plant material, both to taxonomic group and organ type, based on anatomical features. Fortunately, the several dominant plant groups in Pennsylvanian wetlands differed widely from each other in anatomical structure, allowing even small pieces of degraded material to be identified by the trained observer. Nonetheless, this necessitated knowledge of the entire Pennsylvanian coal-swamp flora, to be gained from a spectrum of preservation ranging from excellent to miserable. Phillips became an expert at this, and, through their involvement, many of his students also became expert fossil-plant-litter specialists.

The collection of coal-ball profiles began with the Herrin Coal, the main coal resource in Illinois, at the time being extracted in numerous mines throughout the state. Coal balls occur relatively abundantly, and frequently, in the Herrin, providing many opportunities to make oriented, measured collections directly from the coal face. In order to turn this process into more than a descriptive exercise, Phillips had to devise means to analyze peat composition quantitatively and then to compile the data in a meaningful manner. The first step was a counting method, for which he created a cm^2 grid of clear acetate to which a cellulose-acetate peel of a cut coal-ball surface could be attached. Each square on the grid was numbered. Accompanying this was development of a shorthand system for identifying the plant remains, first to taxonomic affinity, and then to organ type, while simultaneously recording aspects of preservation, such as charcoal or the presence of siliciclastics (carbon-free silica sediments). Identification data was recorded for each cm^2 on a paper copy of the grid, on which an outline of the coal-ball face was drawn, labeled by collecting layer (zone) and coal-ball number.

Several additional steps were necessary. How many slices of each coal ball were needed—how much cross-sectional surface area was enough to allow a reliable determination of the plant composition of a coal-ball zone/layer? How were data to be compiled, given multiple coal balls in any given zone? How was that data going to be analyzed? In a quest to answer these questions, Phillips joined with two scientists from the Physics Department at Illinois, A. Barry Kunz and Daniel J. Mickish. Together they worked out the sampling and analysis protocols, published in the first modern quantitative study of coal-ball paleoecology (Phillips, Kunz, and Mickish, 1977). Unseen in the final result were the hours Phillips spent transferring data from paper scoring sheets to Fortran data sheets, which were used by keypunchers to enter the data onto cards, which were run through the computers at the Illinois State Geological Survey. These analyses resulted in reams of fan-fold, dot-matrix computer printouts, from which various forms of data were extracted and compiled.

Application of these methods and procedures to numerous coal-ball collections, both "random samples" collected from spoils and oriented vertical sections, led ultimately to quantitative data on peat composition from numerous coal beds in the United States and Western Europe; 26 of these coals became basis of further synthetic analyses. Additional quantitative data were compiled from coals in Eastern Europe, China, and Australia. The most intensively sampled coal beds are the Herrin and Springfield of the Illinois basin. From these, numerous profiles and random samples were collected, including 23 vertical profiles from the Herrin Coal, supplemented by 9 random samples, amounting to 358,324 cm^2, and 12 vertical profiles from the Springfield Coal, supplemented by 6 random samples, 67,824 cm^2 of surface area. It must be remembered that each cm^2 is an individual decision about taxonomic affinity and organ type of a piece of plant litter. When samples from all the coal beds analyzed were compiled, approximately 1,000,000 such determinations were made, mostly by Phillips himself, sometimes in collaboration with several of his students or collaborators, most of whom started their graduate studies after the coal-ball quantitative work had begun.

Nineteen papers resulted from these intensive analyses, including the first quantitative community-ecology study of a peat-swamp flora (Phillips and DiMichele, 1981), and a major integrative study combining coal balls and palynology, including an artistically significant landscape reconstruction by artist Mary Parrish, which was the final site-specific analysis of Phillips' career (Willard, et al., 2007). There are additional papers by his students or by others who used or adapted his methods.

Phillips's most influential paleoecological contributions were based on compilations of the data generated in the more detailed analyses. Two of these stand out: Phillips and

Peppers (1984) and Phillips, et al. (1985). In the first, the authors correlated patterns of vegetational change across the breadth of European and American coal basins, proposing climate as the principal control on tropical peat-swamp dominance-diversity patterns through time. The 1985 paper details the quantitative composition of peat swamps through time and space. It became the standard work documenting changes in Pennsylvanian coal-swamp wetland vegetation through time, and strengthens the climate interpretations. The outgrowth of these papers was the recognition that long-past ecosystems could contribute significantly to our understanding of the relationship between environmental and ecological change, and that the study of such systems could involve numerical analyses that transcended descriptive studies.

In parallel with the coal-ball quantitative studies, Phillips and his collaborators, particularly Russel A. Peppers of the Illinois State Geological Survey, began studying species origin and extinction in peat-forming wetlands. Dr. Peppers amassed a large, stratigraphically referenced database of palynomorphs from Illinois Basin coals. A team of Phillips, Peppers, and graduate students Matthew Avcin and Penelope Laughnan identified a major turnover at the Middle-Late Pennsylvanian boundary, described in a highly influential paper in *Science* magazine (Phillips, et al., 1974). The paper has since become a milestone, and represents the first quantitative step in the recognition of significant vegetational turnover events, and of climate change as a likely driver, in late Paleozoic tropical ecosystems.

From this point forward, Phillips began a search for a fuller understanding of the relationship between vegetational structure, changes, and climate factors, turning to compilations of coal-resource abundance and assessment of the quantitative differences in plant composition of coals through time. In combination with the development of quantitative analysis methods, this search for evidence of vegetational changes through time, and their causes, motivated his intention to generate and compile quantitative data on every coal bed known to have coal balls, a search that took him across the modern north temperate zone, in search of the late Paleozoic tropics.

One of his colleagues, C. Blaine Cecil, of the U.S. Geological Survey, who himself has made important contributions to understanding the relationships between peat/coal formation and climate, credits a paper presented by Phillips in 1981, at the Geological Society of America meeting, with reintroducing the relationship between coal and climate, which had long been more-or-less taken for granted as “wet.” Cecil offered this perspective: “…it was in the 1981 ‘Origin of Coal’ Symposium in Cincinnati, convened by Jim Cobb and me, that I first heard Tom's invited seminal paper on paleoclimate and coal resources, [and] the light bulbs came on. After considerable subsequent discussions, it was in 1983 that Tom and I convened the paleoclimate symposium in Indianapolis, which served as the basis for the 1985 *IJCG [International Journal of Coal Geology]* Special Issue." The linkage between climate and coal occurrence, thickness, and quality patterns provided the needed framework to move what might have been interesting studies of a past world into more general examinations of how tropical wetland ecosystems respond to major changes in climate. Phillips addressed this topic in several subsequent papers, which stimulated others to study the relationship between late Paleozoic vegetation and climate change.

Other Long-Term Interests and New Areas

Even as he moved into coal geology and paleoecology, Phillips continued his interest in the morphology and evolution of pteridophytes—non-seed-bearing vascular plants. He first made a brief foray into the sphenopsids with his 1959 master's thesis, a study of *Sphenophyllum constrictum*—his first paleobotanical publication. He then took on the ferns in his 1961 Ph.D. dissertation study of the genus *Botryopteris*—subsequently published in a series of journal articles (including Phillips, 1970) and the first of a long-term collaboration with his colleague Jean Galtier (Galtier and Phillips, 1977). Later he would delve into the lycopsids, beginning with a study of the small, *Selaginella*-like plant, *Paurodendron*, then expanding into studies of the structural and ecological aspects of the large lepidodendrid forms. He collaborated with many students and colleagues in these pursuits.

His most influential contributions to understanding lepidodendrid biology are studies and reviews of their reproductive biology, and their overall growth, architecture, and inferred physiology. In the first of these, an examination of lepidodendrid reproductive biology (Phillips, 1979), he introduced the "aquacarp" concept and provided a detailed analysis of convergences between lepidodendrid megasporangiate organs and seeds. The second reviews the structure of the main tree forms, with inferences about their physiology, including the idea of CO_2 sequestration by their root systems (Phillips and DiMichele, 1992). Phillips' thinking about these unique plants continued up to the time of his death. An unpublished idea, still to be explored, is his thought that stigmarian rooting organs may have extended into open water areas of swamps, where their balloon-like lateral appendages may have buoyed up the main axes, nucleating organic debris, contributing to development of floating peat mats.

The lycopsids are the group about which, as an evolutionary biologist, Phillips was most curious, due to many parallelisms with seed plants. His first love as a classical botanist, however, was the ferns, and it is there that most of his systematic and morphological work continued (e.g., Phillips, 1974). His primary interest was in the smaller, scrambling or climbing forms, now attributed to the Filicales and Zygopteridales (resulting on more than 16 published papers, some of the final papers of his life, produced with Jean Galtier, e.g., Phillips and Galtier, 2011; Galtier and Phillips, 2014). His study of the small ferns was complemented by studies of marattialean tree-fern morphology and paleoecology (Stidd and Phillips, 1968; Ehret and Phillips, 1977). His love of ferns extended to extant forms, and he grew many ferns in his gardens at home. There they were permitted to survive as best they might, without much fuss, side-by-side with a variety of flowering plants—I still grow columbines in my own garden, descended from seed he gave to me in the 1970s.

Phillips expanded outward from his botanical core interests into many other areas, due to the breadth of his curiosity in both the biological and geological sciences, to happenstance career opportunities, to his philosophy of encouraging his students to seek and develop their own interests and professional paths, and to years of teaching structural botany and paleobotany. Much of this was done in collaboration with others, something he encouraged and greatly enjoyed. Among the many publications resulting from, and reflecting the breadth of, this work are many on seed ferns (primitive seed plants with fern-like, leaves: e.g., Phillips, 1981), early non-vascular plants (e.g., Phillips, et al., 1972), plant-insect interactions (e.g., Labandeira, et al., 1997), various aspects of coal-ball studies, from techniques (e.g., Phillips, et al., 1976), to the origin of coal balls and peat formation (e.g., Siewers and Phillips, 2015), to the history of coal ball studies (e.g., Phillips and Cross, 1995). At the time of his death, he was working on parts of a large book on coal-ball peat taphonomy (the processes leading to fossilization), which several of his students and colleagues hope to bring to completion in the near future.

Reconstructing the Past

Phillips was strongly committed to visual reconstruction of past plants and ecosystems. He attributed this to his thesis advisor, Professor Andrews, who believed that anatomical sections alone could not bring extinct plants to life for readers of research papers. Rather, Andrews believed in using detailed studies as the basis for reconstructing the plants as they may have appeared in life. Phillips followed this advice and recommended that his students do the same. As a result, during his career, he developed excellent working relationships with several artists, particularly Alice Prickett and Carol Kubitz at the

University of Illinois, and Mary Parrish at the National Museum of Natural History. He was exacting in this work and would ask the artists to go through many iterations in pursuit of his "vision" of the plant or landscape in question. Two of these landscapes are widely reproduced, one of a Middle Pennsylvanian-age peat swamp, drawn and painted by Alice Prickett (published in Cross and Phillips, 1990), and the other of a Late Pennsylvanian-age swamp, by Mary Parrish (published in Willard, et al., 2007), the latter a winner of awards for scientific illustration and art.

The importance of visualizing the past must not be overlooked or underappreciated. In the course of detailed study, a paleontologist learns much about a past organism and often about the world that organism inhabited. Plus, the study of whole ecosystems, in geological context, forces the investigator to integrate many lines of inquiry—the picture, indeed, is there in the mind, and getting it out, onto paper, forces a confrontation with reality, between fact and fancy. Working with scientific illustrators, especially artists, brought Phillips and his students into a world of questions—color, angle of leaves, spacing of plants on a land surface, etc., which led to further scientific research and revised thinking. The scientist-artist collaborations were, without question, some of the most important and, for Phillips, most enjoyable aspects of his work.

Many awards and acts of recognition came his way over the course of his career, including a Guggenheim fellowship (1975), the Gilbert Cady Award from the Geological Society of America for excellence in coal-geology research (1992), and recognition as distinguished alumnus of Tennessee Wesleyan University. Phillips was elected to the National Academy of Sciences in 1999. Each of these honors came as a complete surprise to him, reflecting a philosophy he held deeply: Do not strive for awards and recognition, over which you have no control, but, rather, aim to do the work you love and believe to be important. If rewards and awards appear, be thankful, and get back to work. In that spirit, these awards never influenced the subsequent decisions he made regarding career objectives or research pursuits.

Phillips did have his moment in the public eye in the four-part 1989 BBC-TV series called "Lost Worlds, Vanished Lives—Magic in the Rocks," in which he appears with Sir David Attenborough in a Southern Illinois coal mine and later demonstrates how to make a cellulose-acetate peel of a coal ball, with a view of the results through a microscope. As his wife, Pat, relates, "Tom was about 17 minutes into the 1st episode. It's online if you want a small dose of Tom Phillips explaining in American so Attenborough can restate in British."

Phillips took several sabbatical leaves during his tenure at Illinois. These were not always uneventful, and a few of his more interesting experiences, as related by him, deserve mention. During the 1975-1976 academic year he serially visited and worked with colleagues at the British Museum in London, the University of Montpellier in France, and the Komarov Botanical Institute in Moscow. He was, at the time, working on a large manuscript detailing the anatomy and developmental biology of the arborescent lycopsid that produced *Lepidocarpon*, a seed-like, reproductive structure he'd dubbed an "aquacarp" for its specialized aquatic fertilization and dispersal attributes.

This manuscript included a number of photographic plates illustrating anatomical features. At the time, such plates were made by gluing black-and-white photographs onto mounting board; this was a time- and labor-intensive process, starting with preparation of the anatomical sections, photographing them with large-format 5x7 inch sheet film, preparing prints using darkroom facilities, then cutting the photos to size (razor blade and straightedge), and mounting them on heavy poster board with rubber cement. In order to reduce bulky luggage between Montpellier and Moscow, he sent the manuscript, with its many plates, to the Soviet Union by diplomatic pouch—thus entirely within the sphere of the U.S. Foreign Service. The manuscript never arrived. No explanation was offered, aside from the observation that the package was "lost." More than a decade later he received a letter from the State Department telling him that they had a package belonging to him and that it would be sent to him forthwith. It never arrived, and has not reappeared to this day. One can only imagine an intelligence expert examining coal-ball anatomical sections, envisioning them to be aerial photographs, but from where and of what?! Perhaps someday this package will reappear and reach the hands of someone who can finish the work.

Once Phillips arrived in the Soviet Union, all went well for a while. It appears that his former position in the Army's Counter Intelligence Corps had not been detected during the evaluation of his visa application. During his visit he was able to examine coal-ball specimens from Donets Basin mines and work closely with Russian colleagues. Among various outings, he visited Josef Stalin's former translator, a woman he described as senior, elegant, and sophisticated, and conversant on many topics. He also traveled into the countryside around Moscow and reported on the beauty of the landscape. At some point, however, he acquired a "tail," who was stationed in the apartment next to his. An avid reader of spy novels, Phillips employed various techniques he'd absorbed, first to affirm his suspicions, and then to avoid being followed, by employment of various subterfuges. He reports that there even were some concerns that he might not be permitted to leave…

but all worked out with the help of colleagues and friends, a large group of whom walked him to his final departure gate and waited there until the plane departed.

During his 1982 sabbatical to the China Institute of Mining in Beijing, he found numerous specimens of uncut coal balls from Permian age coals in China. The lab at the institute did not have facilities to cut these in a time frame that would have permitted him to examine anatomical sections. So, after casting about, and with some help from his hosts, he found a local jade factory where, thanks to several transactions, including the sharing of American cigarettes, sufficed to get the work got done. The chance to see Chinese coal balls completed his long pursuit of these specimens throughout the world. With that visit he likely was the only living person ever to examine coal balls from virtually every place on earth where they were known to occur at the time. The visit, however, had health consequences, serious disruption of his digestion, that lingered for the rest of his life.

Phillips retired in 2005. His retirement was a memorable event, a multiday affair, with several distinguished speakers, a banquet, and overnight facilities for out-of-town guests. Retirement was by no means the end of his career, however. He continued to work on aspects of coal-swamp paleoecology, small-fern morphology and systematics, and the origin of coal balls. As noted, he was deeply engaged for nearly a decade in the preparation of a book focused on patterns of peat formation in Pennsylvanian swamps, which will appear posthumously.

Dr. Phillips (center) and many of his students and post-docs, at his retirement.L-R: James Mahaffy, Ben Stidd, Alicia Lesnikowska, Joan Courvoisier, Richard Leary, Karl Niklas (bottom to top in center), Hermann Pfefferkorn, Debra Willard, Lisa Pratt, Conrad Labandeira, Bill DiMichele.

Personal Life

Tom Phillips was married for 51 years to Patricia Paden, herself a paleopalynologist who worked for their mutual friend, Charles Felix. They met at an American Institute of Biological Sciences meeting when Tom, on crutches from a leg injury, asked Pat for ride. For most of their married life, Tom and Pat Phillips lived in Champaign, in a home surrounded by gardens. They had three children, Mary, Thomas, and Andrew. Although Dr. Phillips was born and reared in the mountains, he came to love the Midwest and its rolling farmlands and vast sky, quoting his brother, Haynes', characterization of the Midwest as "a place where the sky meets the ground."

A Phillips hallmark was his passion for organization. He stored things in notebooks, including compilations of scientific papers on specific topics; coal-ball data, peels, grid-sheets, and analyses, including the original Fortran sheets; photographs; and correspondence from friends and colleagues. By the end, there were more than a thousand notebooks, most with tables of contents, and several dozen indexing the others and their specific contents. He had duplicates of everything, reflecting a "stand on your own two feet" mentality—hundreds of pens, an old ammunition box filled with paper clips (essential for clipping peels to 4 x 6 file cards, data sheets, and manila envelopes), microscopes from across the decades, and more than 20 chairs in his lab and office. This extended to his home life and included several tape decks for playing cassette tapes of books, which kept him company while doing many of his routine tasks.

Further insight into the man is provided by comments of his junior colleagues, many of whom wrote, after his passing, to express affection for him. Bob Hook, coal geologist and paleontologist, University of Texas, related, "Tom was a lot more than a paleobotanist to his friends in the coal realm. He was a real guy who was more comfortable in coveralls with 'common folk' than with the professors of academia. He was data centric, loved underground work, smoked like a chimney, and was a true gentleman. He was masterful at connecting with people, even those with whom he disagreed: you have your views, I have mine, let's move on." Hans Kerp, University of Münster, himself a pillar of Paleozoic paleobotany, recalled talking with Dr. Phillips for the first time in 1989 at a Botanical Society meeting. "I vividly remember the afternoon we spent in a bar in Toronto. He invited me for a beer (in fact it was a couple), because he felt that discussing matters was more interesting and more important than listening to talks. I remember him as a man wearing a plaid shirt with suspenders, drinking a beer, smoking a cigarette, and talking about his passion. The paleobotany presentations were still going on. He said: 'Let them talk, we better talk to each other.'" And Ge Sun, a student when Phillips visited China in 1982 and now a professor at Jilin University, remembered Dr. Phillips "as an old friend of Chinese paleobotanists. His erudite, kind-hearted, noble character and friendship with the Chinese people still remain in our memory."

Phillips also took the time to help his younger colleagues in Illinois' Botany (later Plant Biology) Department adjust to the new demands placed on them as untenured faculty members. The comments of two, from among several, written to him at the time of his retirement, summed it up nicely: "My first semester here was a lonely one, both intellectually and socially. A major highlight of that semester was that you took me to your warehouse to have lunch together and showed me your numerous fascinating samples. It really meant a lot to me!...I've kept your cards on my desk to remind myself that there are caring colleagues around me." And, "When I started as an assistant professor, I was extremely apprehensive about teaching. I spoke with many senior faculty but came away with only a vague sense of what to do. However, when we discussed teaching what impressed me most about our conversation was the idea that I should be conveying what I'm passionate about to students as much as any specific factoid I might have them learn...Hopefully my enthusiasm is as obvious and contagious to colleagues and students as yours was to me." Phillips had a capacity to see things differently from others, to come up with unanticipated perspectives, to break the mold. This innovativeness characterized his thinking up to the very end of his life. He strove to know everything, from every perspective, about plants and wetland ecosystems of the Pennsylvanian "Coal Age," and by the end he probably knew more about that complex subject than any living human being, contemporary or predecessor. He used that knowledge to mentor his many students, and others who sought his advice, including students at other universities or in other programs at Illinois, and did his best to pass on his experience to many of his junior colleagues. He loved the University of Illinois and always urged us to be proud of our relationship to it and to the paleobotanical program there, one with a long history from which many prominent leaders in the field emerged. He was more than a man of his times, more than a pioneer in the field of quantitative plant paleoecology, and more than a mentor and teacher. His work, and his vision, continue to generate new ideas and inspire students of a new generation.

Although he had experienced a long series of illnesses, Dr. Phillips remained actively engaged in his work until the final days of his life. He passed away quietly at home, in the early morning hours of July 14th, 2018, in the company of his wife, Pat. On July 21st, in a misty rain, his ashes were interred in the churchyard of the First Presbyterian Church of Champaign, Illinois.

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