PREFACE, DEDICATION, AND ACKNOWLEDGMENTS

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The Mesozoic was a curious time. On the surface, it resembled today's world, but instead of large herbivores like elephants, there were sauropods; instead of large carnivores like lions, there were tyrannosaurs; instead of trees with flowers and broad leaves, there were pteridosperms and bennettitaleans with naked seeds and fernlike fronds. The Mesozoic was thus a wondrous time. It was an era of giant dinosaurs, flying reptiles, and crown-tufted plants. It also encompassed a huge amount of time, over 185 million years, making the existence of the Mesozoic fauna and flora on earth an incredibly long success story.

This is perhaps why there has been a huge resurgence in interest in the Mesozoic biota in the last few decades, although much less attention has been focused on the flora than on the fauna. Yet the Mesozoic plants were more than just stage props for the dinosaurs and their daily activities, as they formed and inhabited a world of their own making. In fact, they were the basic building blocks of landscapes that the world had never seen before and will likely never see again. To describe just a few uniquely Mesozoic plant communities, there were lush forests of ginkgoes, araucarias, stout-trunked bennettitaleans, and low-growing ferns and cycads; there were vast meadows of ferns with scattered groves of seed ferns and woody gymnosperms; there were fleshy-leaved cheirolepidiaceous conifer trees growing on saline soils; there were massive tree-forming ferns with delicate angiosperm vines twining around their trunks. We know all this and more through the efforts of decades of dedicated research by Mesozoic paleobotanists, one of whom—Ted Delevoryas—will be appearing again in this connection.

Although the all-encompassing term *Mesozoic flora* is being used here, the Mesozoic flora was by no means uniform in space or time. Like the modern-day flora, different plants preferred different habitats and had various growth habits, and there were many major plant groups in the Mesozoic that do not have any modern counterpart or living relatives today, such as the enigmatic seed ferns or the bennettitaleans. However, some taxa did survive to this day and can even be recognized to genus level. These living fossils include the sphenophyte *Equisetum*, the maidenhair tree *Ginkgo*, and the southern conifer *Araucaria*, just to name a few.

In regard to time, the Mesozoic flora was not static, but evolved and developed over the course of 185 million years. The Triassic, for instance, saw the advent of the Mesozoic flora, the shift from the fern- and lycopod-dominated Paleozoic to a largely arborescent assemblage of gymnosperms. The Jurassic was not only the Age of the Dinosaurs but

also the Age of the Cycadophytes. Indeed, the gymnosperms ruled the global flora for most of the Mesozoic, relinquishing their dominance only in the mid-Cretaceous when the radiation of the angiosperms tipped the scales in favor of plants with flowers.

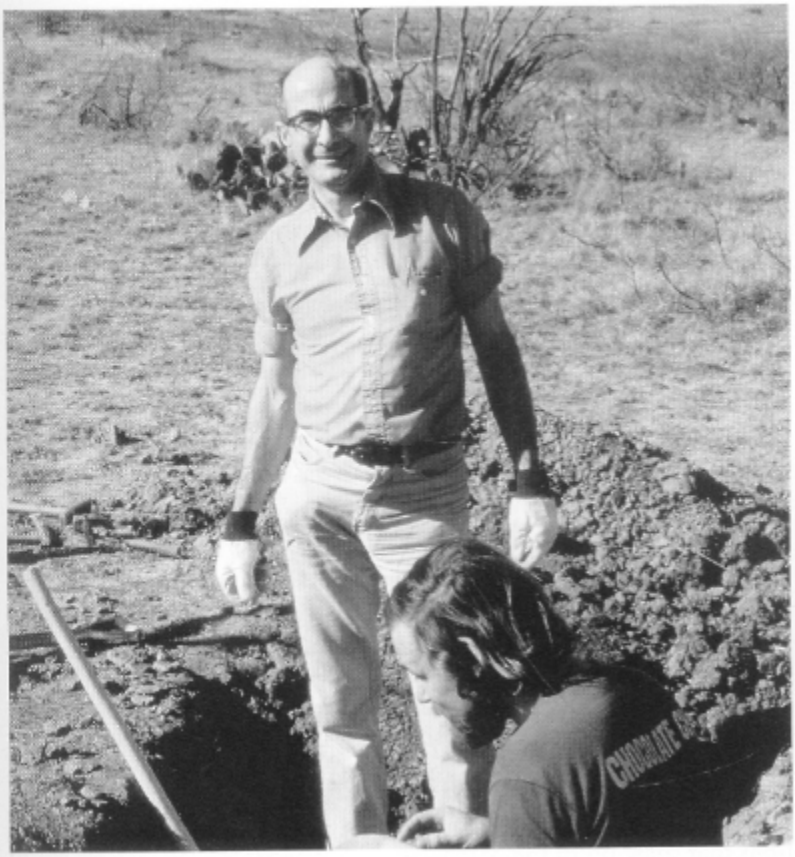
Despite being a large, diverse plant group, the gymnosperms had in common several major evolutionary advantages over the ferns and fern allies. One was the development of secondary tissues, such as wood, which enabled gymnosperms to grow into tall, solid trees. Another key innovation was that of the seed, a unit of reproduction and dispersal consisting of a plant embryo and food reserves in a protective seed coat—or, as Ted Delevoryas used to explain to his general botany students, a baby plant in a box with its lunch.

Ted Delevoryas is today professor emeritus at the University of Texas at Austin and is considered one of the leading paleobotanists in America. Ted began his career in 1954, when he graduated with a Ph.D. in botany at the University of Illinois at Urbana-Champaign. Afterward, he took on a postdoctoral position at the Museum of Paleontology, University of Michigan, for one year. His first real job, as an assistant professor of botany at Michigan State University, followed in 1955. Ted then taught at Yale University from 1956–1972, except for two years, 1960–1962, at Illnois, before finally moving on to U.T. Austin in the 1970s.

Most of Ted's work has focused on the morphology and evolution of plants in two general areas: first, Paleozoic ferns and seed ferns such as *Psaronius, Medullosa,* and *Glossopteris,* and second, Triassic and Jurassic cycads and bennettitaleans, such as *Leptocycas, Cycadeoidea,* and *Williamsonia.* In actuality, though, Ted is a morphologist par excellence of the entire plant kingdom. With regard to research, Ted is meticulous and scholarly, and his enthusiasm for all plants—both fossil and living—is boundless. His groundbreaking work in paleobotany not only formed a solid foundation for further studies (including chapters in this volume by Osborn and Taylor [chapter 3], Rothwell and Stockey [chapter 4], and Crepet and Stevenson [chapter 10]), but also served as an inspiration to others in other areas of paleobotany.

Ted is also a highly skilled draftsman and used his talent to reconstruct beautiful and detailed images of whole-body fossil plants, some of which adorn the cover of this book. Anyone who was lucky enough to have had a class with him will certainly remember his spectacular, synchronous, two-handed chalkboard drawings of an apical meristem.

Ted was my doctoral advisor, or, as we called it, my major professor, at U.T. Austin in the 1980s. However, here in Germany, where I now live and work, a Ph.D. supervisor is called a *Doktorvater.* Although this may strike some as too familial a term for what should be a strictly professional relationship between mentor and student, I find that it is quite an apt designation in many cases. For it is the *Doktorvater,* or *Doktormutter* for that matter, who takes responsibility for the academic development of the young scientist—advising, encouraging, and guiding—and imbues the fledging scientist with his or her vision of science, research, and



Preface Figure 1. Ted Delevoryas digging for Early Permian plants in north-central Texas on an unusually warm day in January 1982, here with Chuck Daghlian in the foreground. Ted loves prospecting and collecting in the field and is good at it. *Photo by Carole T. Gee.*

academic life. As my *Doktorvater*, Ted was easygoing but watchful over my scholarly development, and he always had a kind and encouraging word for me. Through his teaching and scientific work, he passed on to me his passion for plant morphology and anatomy. And like a good academic parent, he introduced me to his world, taking me along like a tag-along kid on a number of field trips and collecting trips throughout Texas (Preface Fig. 1). On these trips, I got to see and appreciate paleobotany through his eyes.

Most importantly, Ted taught me to understand that plant fossils are not just patterns in the rock record—objects like postage stamps to be collected and sorted and labeled—but parts of once growing, photosynthesizing, transpiring, reproducing living beings. This is perhaps the most precious inheritance from my academic dad: the realization and appreciation that paleobotanical fossils simply represent plants that lived in the very distant past. To look at them in that way is to be able to visualize them with deep respect as actual trees, shrubs, herbs, and vines that grew and greened the earth hundreds of millions of years ago.

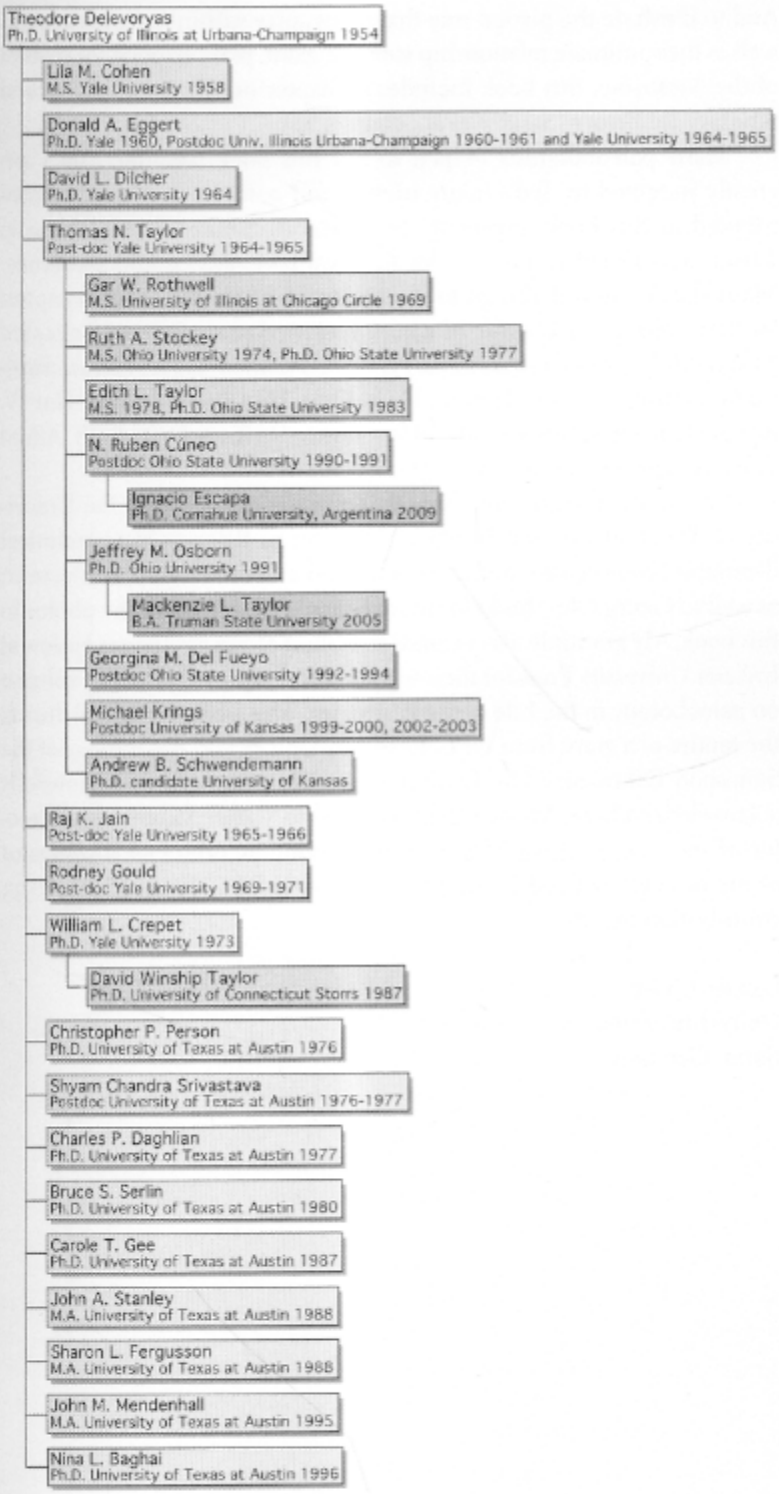
During my doctoral work, I was in the lucky position of being able to give new names to several species, but I was too embarrassed then to name any of this scrappy material after my major professor. Now, however, some 20 years later, I have the opportunity of naming another fossil

plant—this time, a Late Jurassic *Araucaria* complete with seed cones, cone scales, seeds, pollen cones, leaves, twigs, and branches (see Gee and Tidwell, chapter 5 in this volume), a once-living, thriving, whole plant—after my *Doktorvater* in this Festschrift on the happy occasion of his eightieth birthday in July 2009.

This volume is thus dedicated to Ted Delevoryas as a tribute to his manifold and valuable contributions to our knowledge of the Mesozoic flora. The 14 chapters in this book, Ted's biography, and this preface are offered here with gratitude, respect, and affection for Ted from his academic offspring and his extended family of colleagues—over 30 of them in this book alone—botanists, paleobotanists, paleontologists. During his 40-plus years in academia, Ted has sired several generations of paleobotanists, producing a robust academic family tree (Preface Fig. 2).

Although Ted was equally at home in the Paleozoic, we are focusing here in this volume on his greatest interest in later years, the Mesozoic flora. In view of the excellent textbooks on paleobotany available these days, we decided not to duplicate their efforts, but to complement these general works by showcasing scholarly paleobotanical research on the Mesozoic. Each chapter thus highlights the latest research on a particular plant, plant group, or topic. This is reflected as state-of-the-art reviews on plant groups such as the Late Triassic ginkgoleans of North America (Ash, chapter 8), and the Mesozoic cycadophytes (Cúneo et al., chapter 9) and Early Cretaceous conifers (Archangelsky and Del Fueyo, chapter 11) of Argentina. There are also several chapters elucidating key innovations that show up in the Mesozoic flora, namely in the leaf crowns of Mesozoic forests (Sussex et al., chapter 1), sphenophytes (Schwendemann et al., chapter 2), bennettitaleans (Osborn and M. Taylor, chapter 3; Rothwell and Stockey, chapter 4), conifers (Gee and Tidwell, chapter 5), and flowering plants (Dilcher, chapter 6; D. Taylor, chapter 7). One chapter applies phylogenetic methods to the recurrent burning issue of bennettitalean and angiosperm relationships (Crepet and Stevenson, chapter 10). Even studies on evolutionary developmental biology ("evo-devo") are no longer the sole domain of those working on living organisms, because fossils can, surprisingly, reveal quite a bit about how development and evolution interact (Sussex and Kerk, chapter 1; D. Taylor; chapter 7).

Most of the topics on this book involve gymnosperms, but also included here are in-depth studies on other Mesozoic plant groups such as the sphenophytes (Schwendemann et al., chapter 2) and angiosperms (Dilcher, chapter 6; D. Taylor, chapter 7; Tidwell et al., chapter 12), including the first woody dicot vine known from the fossil record (Tidwell et al., chapter 12). From a geographic point of view, paleobotanical research on the Western Interior of North America remains as active as ever—for example, on the Late Triassic Chinle Formation (Ash, chapter 8), the Late Jurassic Morrison Formation (Gee and Tidwell, chapter 5; Tidwell et al., chapter 12; Hotton and Baghai-Riding, chapter 13; Sander et al., chapter 14) and the Cretaceous Cedar Mountain, Burro Canyon, Mojado, and Dakota Sandstone Formations (Tidwell et al., chapter 12).



Preface Figure 2. Genealogy of Ted Delevoryas's academic family. The F_1 generation is shown in its entirety; members of the F_2 and F_3 generations are listed only if they are authors in this volume. For clarity, the family tree is depicted here as a linear series of academic relationships, although in reality it is an intricate, close-knit, weblike network.

And to illustrate the pivotal role that plants play within an ecosystem, as well as their intimate relationship with the giant, plant-dependent reptiles of the Mesozoic, this book includes a chapter on Mesozoic plants and dinosaur herbivory (Sander et al., chapter 14).

Many paleobotanists helped to put this book together, and I am greatly indebted to Ted's many friends and colleagues who have contributed to this book, especially to P. Martin Sander, David Winship Taylor, and David L. Dilcher for their valuable advice and assistance. Many thanks should also go to the reviewers of the individual chapters for their selfless work, some of whom reviewed more than one chapter. This includes Nan Crystal Arens, N. Rúben Cúneo, James Farlow, Patricia G. Gensel, Carol L. Hotton, Hans Kerp, Harufumi Nishida, Gar W. Rothwell, Ruth A. Stockey, David W. Taylor, William D. Tidwell, Alfred Traverse, and Zhiyan Zhou.

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