

Clues to Climate Change Reside in 300 Million-year-old Forest

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Penn **Professor of Earth and Environmental Science Hermann Pfefferkorn** and **Chinese Academy of Sciences Professor of Geology and Paleontology Jun Wang** made a discovery in 2003 that expanded our knowledge of Earth and its processes—and their discovery has the potential to significantly advance our understanding of climate change.

The story of how these two global experts in paleobotany came to work together begins in Berlin. Early paleobotanist Walther Gothan introduced an innovation in the field when he began applying botanical research methods to the study of fossil flora, yielding new insights about ecological and climatic conditions in the Paleozoic era, which ran from about 542 million to 251 million years ago.

Gothan's first graduate student, Sze Hsing-Chien, brought Gothan's "Berlin School" branch of paleobotany back to his native China, where he taught the approach to his protégé, Li Xingxue. Gothan's last graduate student, Winfried Remy, went on to mentor Pfefferkorn, who in turn came to the U.S., where he revived the study of late Paleozoic compression floras over the course of his career at Penn.

Connected by this shared academic heritage, Pfefferkorn and Li came to know each other well, and when Pfefferkorn sought a Chinese partner for a project some years later, Li could make the perfect match: his own protégé, Jun Wang.

The match couldn't have been more fruitful: Jun and Pfefferkorn went on to discover a tropical forest in northern China that had been preserved in volcanic ash for 298 million years.



Researchers Jun Wang (center) and Hermann Pfefferkorn (right) examine the preserved ash layer before excavating the site.

The discovery of this “vegetational Pompeii” was serendipitous. The pair literally stumbled over the fossils while walking through a region of extensive mining en route to a different place of paleobotanical interest. Pfefferkorn has returned to the site almost every year since, making a plethora of new discoveries.

“Just this summer,” he says, “we found several large new specimens—we’re talking entire plants, including the stems, fruits, and leaves, that are very early representatives of their group.”



298 million year old plant fossils in a volcanic tuff from Inner Mongolia, China

Now, about a century after Gothan discovered an innovative way to unearth cogent knowledge about our planet's Paleozoic past, two of his intellectual progeny have joined together in using their combined advancements to address one of the most urgent global issues in history: climate change of a potentially serious proportion.

Analyzing fossil plants are a critical part of Pfefferkorn's ongoing work to reconstruct the late Paleozoic climate system, which he believes was an icehouse world transitioning to a greenhouse world—a climate he says we may very well be experiencing right now. Pfefferkorn calls such climate

change “totally normal and to be expected” on a planet where change is the rule rather than the exception. However, he says human activity is augmenting if not catalyzing the change this time around—a difference that makes this particular transition anything but normal.

“We as humans have now become a geological agent. The amount of material that we move with earth-moving equipment each year is the same as what the Earth itself moves. The consequent changes to the environment are faster than at most times in earth history. Most times, changes were slow. But sometimes they were fast—and very unpleasant.”

— Professor of Earth and Environmental Science Hermann Pfefferkorn

Very few people are able to take this kind of multimillion-year perspective on the problem of global warming.

“I’ve taught Earth history and looked at it many different ways, so I’m always looking at the whole picture,” he says, noting that the “Berlin School” of paleobotany to which he ascribes—and which he has been teaching at Penn for the last 40 years—is one that integrates a range of other disciplines.

Pfefferkorn says that this work would have never been possible without his cross-cultural connections.

“In China, it’s very important to know people. If you want to work with a researcher or scholar, you need an introduction through someone who knows and respects you both.”



John Pfefferkorn with his wife and editor Barbara

At the close of his most recent trip to China, Pfefferkorn and his wife Barbara, who works with him as editor for publications, spent time at the new **Penn Wharton China Center** (PWCC), which opened in March 2015 to facilitate collaborations and partnerships such as these.

“PWCC loves to be able to facilitate our faculty research in China,” says **John Zhang**, the director of Penn Wharton China Center. “This is a great example of how our faculty benefits from the unique resources and expertise in China, and we hope more of our researchers will find their way here. PWCC stands ready to ease their way.”