

Discovery of American salamander in Korea tells 100 million-year-old tale

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Imagine discovering pandas in California or kangaroos in Argentina.

For David Wake, one of the world's leading experts on amphibians and a professor of integrative biology at the University of California, Berkeley, an equivalent surprise was the recent discovery in Korea of a type of salamander that comprises the majority of species in the world, but is totally unknown in Asia and rare outside the Americas.

Image: Karsenia koreana is a lungless salamander that spends its entire life on land, living in limestone crevices in its native Korea. (Photo by Rafe Brown/University of Kansas)

"I've discovered and named nearly 50 species of salamanders - more than 10 percent of the total in the world. I've discovered new genera in Guatemala and Cost Rica. But this tops everything I've ever found by a long ways," Wake said. "For me, this is the most stunning discovery in the field of herpetology during my lifetime. It's so utterly unexpected, so completely unexpected."

The discovery of a lungless salamander from the family Plethodontidae was made two years ago by Stephen J. Karsen, a biologist from Illinois who teaches in the Taejon Christian International School in Chungcheongnam-do province midway down the western edge of the Korean peninsula. Wake, the world's top expert on lungless salamanders, and colleagues in South Korea and Illinois report the discovery and their analysis of the new species, which they named *Karsenia koreana*, in the May 5 issue of *Nature*.

The find suggests that the lungless salamanders are more widespread than people thought, and some 60 to 100 million years ago may have had a worldwide range, from the Americas through Europe and Asia. Since then, as the world's climate cooled, salamanders in the Americas flourished while those elsewhere somehow suffered extinction.

"It's really huge," said Robert Kaplan, a professor of biology at Reed College in Portland, Ore., and an expert on Korean frogs and salamanders, who heard about the find a few weeks ago. "The closest relative to the critter they are reporting for the first time is probably here in the Pacific Northwest. So, you have a major biogeographical question: How in the world could it have gotten there? Previously unknown but still living vertebrate species like this can provide us with key information on the history of life on earth."

Karsen made the discovery in April 2003 while looking for salamanders in a wooded Korean upland as he would in his native Illinois - by turning

over rocks. The plethodontids were probably overlooked, Wake said, because the newly discovered salamanders are fully terrestrial, whereas all other Asian salamanders breed in water. Korean biologists, though actively studying other salamanders and finding other new species, they did not expect to find a family of salamanders never before seen in Asia.

"People have gone on expeditions looking for terrestrial salamanders, in places like Kazakhstan and other Central Asian republics," said Wake. "They didn't bother with northern China or Korea or Japan because we thought we knew everything that was there. And so here (in Korea) they show up, and in the most surprising way, when some guy who's a high school teacher from Illinois goes out with his class and says, 'Let's look for salamanders, let's see what we can find when we turn over rocks and logs.'"

To date, the salamander has been found in 16 locations in three Korean provinces, and Wake and his colleagues have established that it differs significantly from all other lungless salamanders, which make up 70 percent of the known 535 salamander species in the world. Wake and his colleagues placed the species in a new genus of plethodontids, *Karsenia*. The animal's common name will be the Korean crevice salamander, for its preferred abode, limestone crevices.

As the name implies, lungless salamanders from the family Plethodontidae have no lungs and breathe through moist skin. Because these nocturnal animals live, breed and lay their eggs on land, they typically are found in areas with abundant rainfall, such as the eastern United States. They are most abundant in North and South America, with one lone outpost in Italy and Sardinia. The Korean crevice salamander is the only lungless salamander between Italy and British Columbia, Wake said, and it split off from the aquatic salamanders common in Korea at least 175 million years ago.

"In the past, we have seen this one group that occurs in Sardinia and Italy as being somehow a special case, an enigmatic case," he said. "Now all of a sudden, we realize that if they're in Korea and they're in Italy, they must have been in between as well. There were probably plethodontid salamanders across Asia in the past, and they've largely gone extinct."

That doesn't mean that biologists won't find more lungless salamanders in wet areas of Europe and Asia. Wake himself is eager to go to Korea and to the nearby Shandong area of China to look for more. He continues to be amazed at the new amphibian species being discovered - an increase of 40 percent in the number of known species in the last 20 years. Just recently, some 50 new frogs were discovered in heavily populated Sri Lanka.

"It's a very paradoxical situation. On the one hand, amphibians are declining, and they are in terrible difficulty, and on the other, we are discovering new species," said Wake. "I think there still are a lot of surprises to come in, especially with respect to nocturnal organisms that do not have breeding congregations, where they don't come together en masse ever in their lives."

He noted that numerous plants and animals in Asia and eastern North America share an evolutionary connection, suggesting some past geographic link between Asia and North America when the world's climate was much warmer, before about 60 million years ago. The closest relative of the Japanese and Chinese giant salamanders is the hellbender of the eastern U.S., for example, while Chinese alligators are related to the American alligator. About 65 genera of flowering plants in Asia also have close relatives in the eastern U.S.

After Karsen found the salamander and was unable to identify it, he approached amphibian specialists M. S. Min of Seoul National University and S. Y. Yang of Inha University in Incheon, as well as his

former college professor, Richard A. Brandon of Southern Illinois University. Brandon recognized the salamander as a plethodontid and drew it to the attention of Wake. Wake and post-doctoral fellows David R. Vieites and Ronald M. Bonett of UC Berkeley's Museum of Vertebrate Zoology and Department of Integrative Biology performed anatomical comparisons and a molecular phylogenetic analysis to determine the relationship between the new salamander and other plethodontids.

All these researches are coauthors of the current Nature paper, though Karsen elected not to join them in order to accept their offer to name it after him.

To date, Wake and his American colleagues have seen only one live specimen and a few preserved specimens, though Vieites is scheduled to travel to Korea in May to scout the area, which is heavily populated and in the past has been nearly deforested.

"The Korean people, already well sensitized to the importance of their natural heritage and the symbolic value of their previously known and beloved clawed salamander, will be and should be extremely proud of such a new unique animal," Kaplan noted. "The boost to environmental awareness and education in the region will be invaluable to such a rapidly developing and highly educated country."

Source: UC Berkeley

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