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Vole Fossils Elucidate Evolutionary Changes

Remains Shed Light on Climate and Geology Effects

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Incredibly preserved vole fossils discovered in a Colorado cave sealed up for up to a million years has allowed UC Berkeley scientists to study the impact of climatic and geological changes on species evolution.

By comparing old vole fossils to modern-day voles, the scientists were able to observe how climate and geological changes produced morphological changes in populations over time. Voles do not seem to have changed significantly since the last ice age.

"If you looked at them, you'd think they died yesterday," said UC Berkeley paleontologist and integrative biology professor Anthony Barnosky. "We had no idea they were that old until we started analyzing them."

The remains of approximately 120 animal species have been found in Porcupine Cave since bones were first discovered there in 1981 by oil geologist Don Rasmussen and his son.

70 of these fossil sets were from mammals, most abundantly voles.

Voles are small mouse-like rodents commonly found in the wild. They grow to be three to four inches long and mainly eat plants and seeds. They are frequent prey for large birds such as owls which were responsible for many of the remains later deposited in the cave by pack rats.

"There were a lot of fossils of that particular species and it allowed us to trace how that particular species changed over time," said Barnosky, who has worked at the site since 1985.

Barnosky worked with University of Texas at Austin geological sciences professor Chris Bell, a former graduate student of his at UC Berkeley, comparing the vole remains from Porcupine cave to those from more modern populations.

Data and materials from UC Berkeley's Museum of Vertebrate Zoology and Museum of Paleontology were used in their comparisons.

They followed populations of voles from the middle Pleistocene to the present, a time period spanning hundreds of thousands of years.

Barnosky and Bell found that the teeth of more modern vole specimens had edges more suited for cutting, a morphological change that would have been advantegous for eating plants during a drier climate.

Their research indicated that although climatic changes and glacial to interglacial transitions did stimulate morphological changes in the species over time, such environmental changes weren't enough to produce a new species.

"What we discovered is that if you look at the species on the modern landscape today, it's easy to draw a boundary around it," said Barnosky. "If you go back in time the boundary of the species is very fuzzy."

Their findings were published in an article this October by the Royal Society.

According to Barnosky and Bell, morphological changes seen in specimens from current vole populations were probably initated during an unusually dry and warm interglacial period which may have been caused by the shift from 41,000-year glacial-interglacial cycles to 100,000-year period cycles.

"We were able to see what effect major climate changes have on stimulating evolution and what we found is that most transitions from an ice age into a non-ice age don't have much effect," Barnosky said.

Barnosky and Bell estimate the amount of time for the early form of the species to change into what we recognize as the modern species at approximately 800,000 years, with earlier vole populations co-existing and possibly even interbreeding with the evolving populations now seen today.

"Dramatic transitions do stimulate evolution a little bit but not enough to get new species to arrive, just enough to get species to change their characteristics a little bit, as with the vole," Barnosky said.