

# UC Davis researchers find evidence of past mega-droughts

Mark Grossi, Fresno Bee, 11-24-09

While Californians worry about the three-year drought dragging on another season, researchers say climate change soon could create much longer dry spells – lasting decades or even centuries.

Scientists from UC Davis announced the first proof of such mega-droughts this month after studying mineral formations in caves along the Sierra Nevada.

Just as important: The big droughts seem connected to rapid warming, especially in the Arctic. The dry spells occurred during a climate warm-up that started about 15,000 years ago after the last ice age, says Davis geochemist Isabel Montañez.

Scientists fear climate warming this century might similarly trigger mega-droughts that would devastate agriculture, increase wildfires and cut water supply in the nation's most populous state.

"We don't know why warming in the polar region creates drought here," Montañez said. "But it does happen. And some estimates show the warming will make Arctic sea ice disappear during summer months by 2020."

The three-year study on cave minerals by Montañez and doctoral student Jessica Oster was published Nov. 5 in the journal *Earth and Planetary Science Letters*.

Researchers took microscopic core samples at more than a dozen caves, including Moaning Cavern in Calaveras County in the central Sierra and Bear Den Cave in Sequoia National Park. Analysis of changes in trace minerals established the age of the formations and the lengths of droughts.

The idea of longer droughts is not far-fetched, says climatologist Mike Anderson of the state Department of Water Resources, which did not participate in the study. California is known for sporadic droughts throughout the last century.

"There's evidence of a 140-year drought around the year 1100," he said. "So, it actually does sound possible for mega-droughts to happen again."

Such a lengthy drought would herald drastic changes in the Sierra, one of the state's biggest natural assets with millions of forested acres. Some animals and vegetation would move to higher elevations. Some might not survive.

The Sierra probably would be more prone to large, intense fires, said Anthony Westerling, a University of California, Merced, researcher who has studied Sierra wildfires.

"There could be a sudden and dramatic shift," he said. "Areas that will burn in the Sierra would expand."

Montañez and Oster found proof of past mega-droughts in the mineral formations that grew over thousands of years after the last ice age. The formations were created by water seeping into caves during storms.

The water leaves trace chemicals – such as uranium – that it picks up as it passes through the air and soil. The

caves are chemically suited to capture these chemicals in a mineral record because they occur in layers of marble – fossilized tropical reefs from perhaps 300 million years ago in the ancestral Pacific Ocean.

In such formations, a mineral, such as calcium carbonate, is drawn out of the marble as water drips from the cave ceiling and hits the floor. As the water dries, the mineral hardens into a stalactite, an eerie cone hanging from the ceiling.

The drips, carrying more of the mineral, also hit the cave floor and form rounded or conelike stalagmites.

In the stalactites and stalagmites, the trace minerals from the rain are deposited in distinct layers, representing up to a decade of time.

Generally, layers with higher levels of trace chemicals signify dry times, because it means less rain water entered the cave at the time.

"It's almost like tree rings," Montañez said. "We can't quantify the amount of precipitation, but we can see the shifts from wet to dry. Some dry times lasted for centuries."