

Sierra Nevada confirmed to be 40 million years old

Lisa M. Krieger, Inside Bay Area News, 12-14-15

A new Stanford study confirms that the northern Sierra Nevada are about 40 million years old, ending a contentious debate about the age of these beloved peaks.

While mere youngsters in geologic time -- the dinosaurs were already long gone and mammals were scampering about -- the Sierra are much older than some previous estimates of 3 million to 5 million years.

"We offer more robust evidence that they were as high as they are today about 40 million years ago," confirming an influential 2006 study, said Hari Mix, assistant professor of geology at Santa Clara University. He began the research as a graduate student at Stanford's School of Earth, Energy & Environmental Sciences.

The Sierra were born as volcanoes during a warm and wet time, called the Cretaceous, when the waves of an inland sea lapped up against the banks of today's "Gold Country." At the time, there were no polar ice caps. The Sacramento region was deep underwater. So was the Bay Area.

The average soil temperature in the northern Sierra was a balmy 73 degrees, about 18 to 27 degrees hotter than today, according to the Stanford team.

"The age of the Sierra is a fundamental question in geology," said Page Chamberlain, a professor of Earth system science at Stanford and co-author on the study, in a prepared statement. The research is available online in the journal GSA Bulletin.

"It's one of the largest mountain belts in the world, and it influences all western climate, so understanding the elevation history couples to all these different fields of research," he said.

Globally, it was a restless era, with mountains also emerging to create today's Himalayas, Rockies and Alps.

"The world was becoming more mountainous," Mix said.

The northern Sierra are younger than the Appalachians and the Urals, but older than the Tetons, Cascades, Wasatch and Alaska ranges.

The southern Sierra are less well understood. Scientists think they emerged more recently and more rapidly.

Because the Sierra is so jagged, "the earliest impressions were that they were very young. But as we bring more and more different lines of research, the northern Sierra are older than initially thought," Mix said.

Their findings were based on analysis of clay samples from the ancient Yuba and American rivers, whose wild and braided channels carved throughout what is now the Sierra.

The samples were collected in Ziploc bags at historic hydraulic mining sites, such as Malakoff Diggins State Historic Park in Nevada County, where clay minerals were exhumed and mined during the Gold Rush. They also took samples along Interstate 80, near the towns of Grass Valley, Auburn, Colfax and Alta.

Trapped in this clay are chemical traces of water -- oxygen and hydrogen -- left behind when raindrops fell long ago.

Based on the altitude of the mountain, the atoms of oxygen vary in their weight. At lower elevations, heavier oxygen isotopes are found, because they're the first to drop out of rainfall. At the high elevations, lighter oxygen isotopes are found.

By mapping the presence of these different oxygen isotopes, Mix and Chamberlain found that the Sierra had already uplifted 40 million years ago.

Earlier Stanford work, published in 2006, reached similar conclusions when studying the hydrogen isotopes in this ancestral water. But because oxygen isotopes are more resistant to change than hydrogen isotopes, the new dating of the Sierra Nevada is more definitive than the previous study, Mix said.

"The Sierra are important to the whole story of California," he said. "It contributes to our understanding of how the Earth works."