

Ancient Pollen Reveals Droughts between Sierra Nevada Glacier Surges

Boulder, CO, USA - Hidden below the surface of California's Central Valley are pollen grains from the Pleistocene that are providing scientists with clues to the severity of droughts that struck the region between glacial periods.

The Pleistocene -- the age of mammoths and mastodons -- occurred between 1.8 million and 11,500 years ago. For this new study, scientists dug up Pleistocene sediment samples containing buried pollen from the Central Valley. They found that pollen samples dated from interglacial periods -- years between surges in the mountain glaciers -- predominantly came from desert plants. The same sediments lacked pollen from plants of wetter climates.

"During the Ice Age there were lengthy periods of severe drought much drier than we are experiencing today," said Lanny Fisk, chief paleontologist with PaleoResource Consultants in Auburn, California. "It's the droughts that may have resulted in the extinction of large Pleistocene mammals like mammoths." Fisk will present evidence on Sunday, 1 November, at the Annual Meeting of the Geological Society of America, in Baltimore.

During the Pleistocene, glaciers formed in the Sierra Nevada, growing and shrinking numerous times throughout the epoch as the climate cooled and warmed. The layers of sediment in the valley are a record of these shifts in climate. During periods of melt, water swept sediments from the mountains into the valley, adding new layers with each cycle of glaciers, Fisk said.

While searching for fossils in the Central Valley during construction projects, Fisk noticed a mineral crust, called caliche, was often present between the layers of glacial sediment. Caliche only forms during extreme droughts, when evaporation draws water to the soil surface. When this water evaporates, it leaves behind layers of minerals.

Fisk and his colleagues focused on caliche layers formed during interglacial periods of the Pleistocene. They extracted organic particles, such as plant pollen and fungal spores, from the caliche and the sediment layers both above and below the caliche. The scientists hoped to gain a better understanding of the climate during Pleistocene interglacial periods by identifying the plants growing in the Central Valley at that time.

"Plants, unlike animals, don't have the luxury of moving when the climate changes," said Fisk. "The pollen and spores left behind [in the caliche] represent the type of ecosystem in place at that time."

The pollen and spores in the caliche included palms, yucca, Mormon tea, and cacti, but with very little grass, similar to the modern Colorado Desert in southeastern California. On the other hand, pollen and spores in the glacial sediment underneath the caliche came from conifers -- pine, fir, hemlock and spruce. The vegetation changed between a cool, damp coniferous forest and a dry desert as climate changed throughout the Pleistocene, said Fisk.

"The caliche samples did not contain pollen from the types of plants that grow in the Central Valley today nor the kinds that grow up in the Sierras," said Fisk. "The environment was desert-like, if not actual desert -- much drier than it is today even with our current drought."

A recent study published in the journal Science (<http://www.sciencemag.org/content/349/6248/602>) attributes the extinction of many of the giant mammals from the Pleistocene not to over-hunting, "over-kill," or harsh glacial temperatures, "over-chill," but to the periods of drought between glaciation events.

"Most people think of the Ice Age as cold and wet, but these cold and wet periods were interspersed with hot and dry periods," said Fisk.

That's not to say human hunting or other factors did not add to the extinction of the Pleistocene giants, but the sudden switch to a desert-like environment may have caused huge problems for these animals, said Fisk, who was surprised by how dry the region got during the interglacial periods.

In the future, Fisk hopes to study caliche with pollen from earlier Pleistocene droughts. With any luck, he can help answer questions about why the mammoths and mastodons survived a number of warm interglacial periods, but then disappeared during the last drought of the epoch.

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WHAT:**Records of Severe Drought in California during Pleistocene Interglacials**

Abstract Link: <https://gsa.confex.com/gsa/2015AM/webprogram/Paper269882.html>

Session No. 44, Booth #358

T146. Palynology (Posters)

WHEN & WHERE:

Sunday, 1 November 2015: 9:00 AM-5:30 PM

Baltimore Convention Center Exhibit Hall

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