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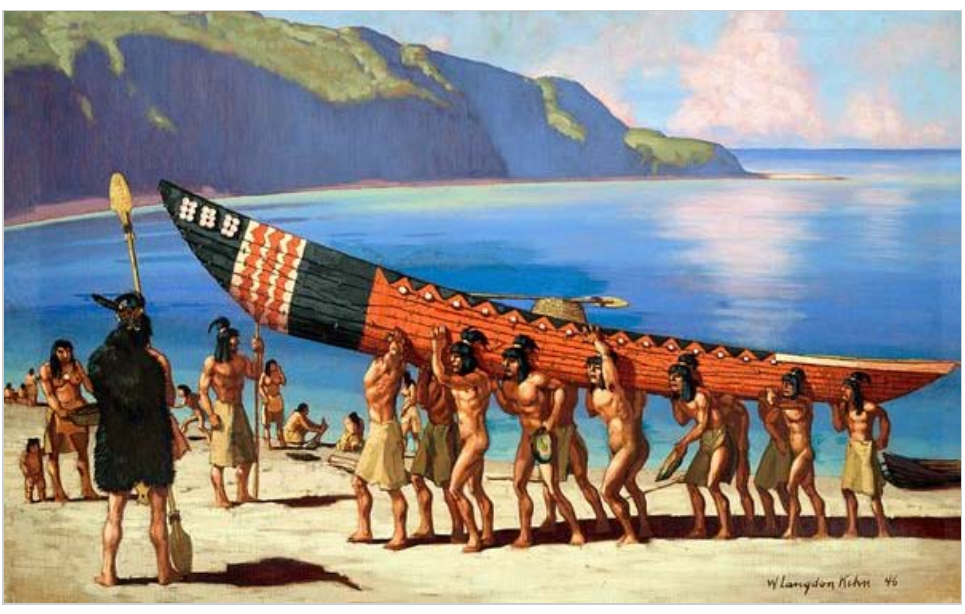
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Tar Shrank Heads of Prehistoric Californians Over Time?

Toxic substance caused health decline in Chumash Indians, study suggests.




The Chumash used tar to fill gaps in their plank-based canoes (artist's conception).
 Illustration by W. Langdon Kihn, National Geographic

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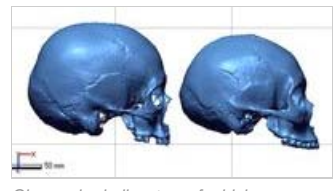
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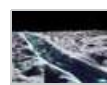


Christine Dell'Amore
 National Geographic News
 Published October 6, 2011

A long-term health decline—including a gradual shrinking—among prehistoric Indians in California may be linked to their everyday use of tar,



Chumash skulls—two of which are depicted in 3-D models above—shrank over generations. Diagram courtesy Sabrina Sholts, UC Santa Barbara.

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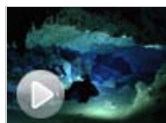
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which served as "superglue," waterproofing, and even chewing gum, scientists say.

Naturally occurring polycyclic aromatic hydrocarbons (PAHs) in bitumen tar could at least partially explain a decrease in skull size over a period of about 7,500 years in the Chumash people, a recent study proposes. Decreased head size usually reflects decreased stature, which is a biological indicator of a population's declining health.

The Chumash lived in dense villages of up to 20,000 people in the Channel Islands (see map) and used shell beads as currency. The hunter-gatherers collected tar from the plentiful natural seeps on the islands and used the gummy substance for everything from building canoes to casting broken bones to making chewing gum.

Though the PAHs in bitumen are known toxins, "this is a health risk that no one has brought up" in the context of the Chumash, said study co-author Sabrina Sholts, an anthropologist at the University of California, Berkeley.

The decline "we're talking about is a very gradual process over thousands of years, and it could have been the chemicals, these carcinogens [the Chumash were] exposed to everyday—the equivalent of smoking and breathing polluted air."

Though the results are still preliminary, the idea that tar exposure caused the Indians' health problems is a "reasonable" one, said Ronald Kendall, an environmental toxicologist at Texas Tech University, who wasn't part of the project.

(See "Prehistoric Dice Boards Found—Oldest Games in Americas?")

Toxic Tar

In the modern world, PAHs are widespread as byproducts of fossil fuel combustion, cigarette smoking, road paving, and roofing. (Read more about air pollution.)

Previous research has shown the chemicals are easily taken up by the human body through breathing, ingestion, or skin contact—and can be distributed to organs, tissues, and fetuses.

Major health problems—including cancer, altered hormone levels, and damage to internal organs—have been connected to PAH exposure.

While analyzing skeletons of 269 Chumash males and females from various periods, the team found a marked decrease in skull size over time, according to the research, published in May in the journal *Environmental Health Perspectives*.

To find out if PAHs in tar were possible contributors to the shrinkage, the researchers tested modern tar from seeps in ancestral Chumash territory. The tar turned out to have high levels of toxic PAHs.

Next, the team examined previous studies about how PAHs enter the human body and realized that the Chumash's use of bitumen would have allowed the toxins to enter the Native Americans' bodies in multiple ways, from direct ingestion to inhalation.

For instance, the Chumash would have literally drunk PAHs, since bitumen was used to waterproof tightly woven fiber baskets that served as water bottles.

The Indians also heated the tar to make it more malleable, producing fumes that could have easily been inhaled.

Tar Was Chumash "Superglue"

The Chumash not only used the tar regularly, they used it more and more as the years went by, based on increasing levels of bitumen found in artifacts.

For one thing, the Chumash began building canoes with multiple wooden planks about 1,500 to 2,000 years ago, noted archaeologist Lynn Gamble. Tar was used to seal any spaces where the planks met and to plug holes, as well as as

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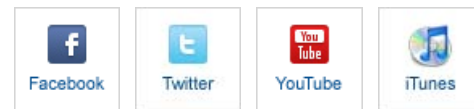
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an adhesive in a canoe's body and paddles, said Gamble, of the University of California, Santa Barbara.

Tar was also used as an adhesive in bone whistles, flutes, shell containers, abalone dishes, pipe mouthpieces, and musical rattles.

"It's really the superglue of the Chumash," said Gamble, who wasn't part of the research.

Bitumen even factored into the culture's dress, she said, as women wore grass skirts weighted with bits of tar.

(See "[Sixteen Indian Innovations: From Popcorn to Parkas.](#)")

In general, the study presents "an intriguing idea—it certainly deserves more research," Gamble said.

Europeans Still Top Health Threat

Despite the bitumen evidence, study co-author Sholts said, "the most significant health impact experienced by the population was contact with Europeans."

Beginning in the 1700s, the new arrivals moved many Indians into Spanish missions on the mainland. There, many Chumash died from diseases and mistreatment.

Today, many of the Indians live on a [reservation near Santa Barbara](#).

Sholts also emphasized that there's no established way to test for hydrocarbons in ancient bones.

The link between PAHs and bone change is "somewhat speculative—there can be numerous factors contributing to this skeletal change," she said. "To actually target PAHs more specifically, we need to do a biochemical analysis of bone."

Study leader Sebastian Wärmländer and colleagues intend to develop a skeletal PAH-detection technique as part of their next research effort, she noted.

(Also see "[Egypt Mummy Pictures: Scans Show Ancient Heart Disease.](#)")

Texas Tech's Kendall emphasized that "there's no methodology that's available for us to validate a potential connection between" Chumash PAH use and skeletal shrinkage.

"At the same time," he said, "I think the theory is plausible."

Modern PAH Toxicity Still Not Understood

The Chumash tar-use study is more than a history lesson. Examining PAH exposure's long-term effects in a past population can help scientists understand the chemical's toxicity today, study co-leader Sholts said.

"Currently the effects of modern PAH exposure—most significantly from major accidents such as the [Gulf oil spill](#)—are not fully understood," she said.

"This is a great example of how studies of ancient human remains can shed light on contemporary problems."

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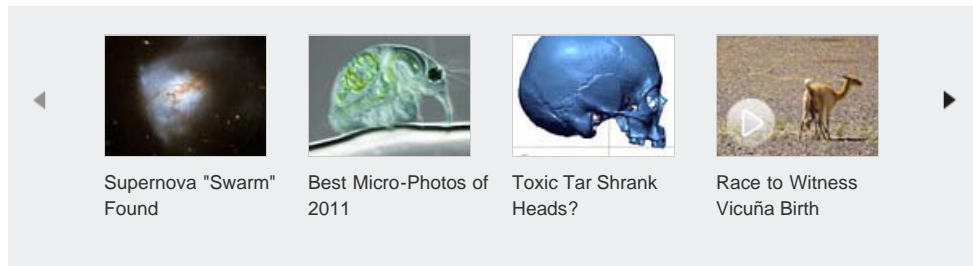




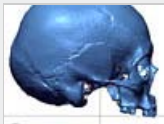

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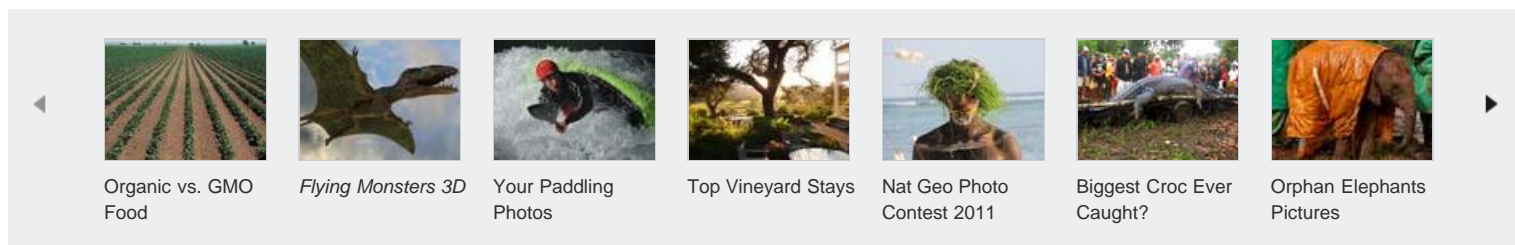
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