

Genetic study of prehistoric girl: Dating and DNA show Paleoamerican-Native American connection

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Cave diver Alexandro Alvarez inspects the newly-discovered skull of Naia, the 12,000-13,000 year-old human skeleton discovered in a submerged cave on the Yucatan peninsula of Mexico. An international team of researchers detailed their analysis of what is the oldest most complete, genetically intact human skeleton in the New World in a paper published today in the journal *Science*. Credit: Photo by Daniel Riordan Araujo

Eastern Asia, Western Asia, Japan, Beringia and even Europe have all been suggested origination points for the earliest humans to enter the Americas because of apparent differences in cranial form between today's Native Americans and the earliest known Paleoamerican skeletons.

Now an international team of researchers has identified a nearly complete Paleoamerican skeleton with Native American DNA that dates close to the time that people first entered the New World.

"Individuals from 9,000 or more years ago have morphological attributes—physical form and structure—distinctive from later Native American peoples," said Douglas Kennett, professor of environmental archaeology, Penn State. "What we have here is the unique combination of an adolescent Paleoamerican skeleton with a Native American DNA haplotype."

The skeleton of a teenage girl was found in Hoyo Negro, a deeply submerged chamber in the Sac Actun cave system in the eastern Yucatan Peninsula, Mexico. Alberto Nava Blank and a team of science divers discovered the skeleton along with many extinct animal remains deep inside this inundated cave in 2007. The divers named the girl Naia. The Hoyo Negro project is led by Pilar Luna and the Instituto Nacional de Antropología e Historia of Mexico, Nava and James Chatters, owner of Applied Paleoscience, with funding from the National Geographic Society.

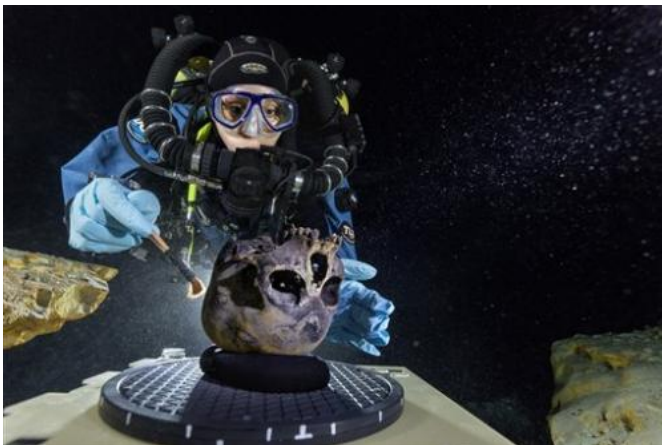
This collaborative interdisciplinary research effort is reported in today's (May 16) issue of *Science*.



New genetic evidence supports the hypothesis that the first people in the Americas all came from northeast Asia by crossing a land bridge known as Beringia. When sea levels rose after the last ice age the land bridge disappeared. Credit: Julie McMahon

Kennett and Brendan J. Culleton, postdoctoral fellow in anthropology, Penn State, were originally asked to directly date the skeleton. After traditional and well accepted direct-dating methods failed because the bones were mineralized from long emersion in warm salty water within this limestone cave system, they worked closely with colleagues to build a geochronological framework for Naia using a unique combination of techniques to constrain the age of the skeleton to the end of the ice age.

To build the case for a late Pleistocene age they collaborated with Yemane Asmerom and Victor Polyak from the University of New Mexico using global [sea level](#) rise data to determine when the cave system, which at the time Naia and the extinct animals entered was dry, filled with water. The site where Naia lies is now 130 feet below sea level and sea level rise would have raised the groundwater level in the cave system and submerged everything between 9,700 and 10,200 years ago. So initial estimates of the latest that animals and humans could have walked into the cave system was 9,700 years ago.



In this June 2013 photo provided by National Geographic, diver Susan Bird, working at the bottom of Hoyo Negro, a large dome-shaped underwater cave in Mexico's Yucatan Peninsula, brushes a human skull found at the site while her team members take detailed photographs. Thousands of years ago, a teenage girl fell into this deep hole and died. Now, her skeleton and her DNA are helping scientists study the origins of the first Americans. An analysis of her remains was released Thursday, May 15, 2014 by the journal Science. Her DNA links her to an ancient land bridge connecting Asia and North America, and suggests she shares ancestors with the modern native peoples of the Americas. Credit: National Geographic, Paul Nicklen

At the same time, the researchers experimented with uranium thorium dating the skeleton directly. Asmerom and Polyak tried to directly date Naia's teeth using this method, but that also did not work well.

The bones were found deep below today's ground surface in a collapsed chamber connected to the surface via a web of now flooded tunnels that Naia once walked along to fall to her untimely death. Because the caves are limestone, mineral deposits continued to form while the cave was largely dry. Working with Patricia Beddows, Northwestern University, Chatters noticed accumulations of calcium carbonate—tiny rosettes of calcite deposited by water dripping off the cave roof—which could be accurately dated using the uranium thorium method. Because these drip water deposits formed on top of Naia's bones, their date must occur after she fell in the cave. The oldest one dated so far is 12,000 years old.

Naia's tooth enamel was also radiocarbon dated to 12,900 years ago by Kennett's lab.

"Unfortunately, we can't rule out that the tooth enamel is contaminated with secondary carbonates from the cave system, but we removed potential contaminants using standard techniques and Tom Stafford, Stafford Research Laboratories, produced a comparable age," said Kennett. "We consider this a maximum age and when combined with the uranium thorium dates from the adhering

speleothems, we argue that the [skeleton](#) dates between 12,000 and 13,000 years ago. Well placed as a Paleoamerican."

Morphologically, Naia does not look like a contemporary Native American, but mitochondrial DNA testing—maternally inherited DNA—carried out by Brian Kemp, Washington State University, and his collaborators shows that she has a D1 haplotype. This is consistent with the hypothesis that her ancestors' origins were in Beringia, a now partially submerged landmass including parts of Siberia, Alaska and the Yukon. Early humans moved into this area from elsewhere in Asia and remained there for quite some time. During that time they developed a unique haplotype that persists today in Native Americans. Genetically, Paleoamericans have similar attributes as modern Native Americans even if their morphology appears different.

"More work is needed," said Kennett. " There are still carbonate deposits on the bones of Naia and other animal bones in the cave. The Instituto Nacional de Antropología e Historia and the scientific diving community have nicely preserved the site so the next step will be to date additional samples to constrain the age of Naia and associated extinct animals further." Also working on this project were Eduard Reinhardt, McMaster University, Ontario; Joaquin Arroyo-Cabrales, INAH; Deborah A. Bolnick, University of Texas at Austin; Ripan S. Malhi, University of Illinois; Dominique Rissolo, Waitt Institute; and Shanti Morell-Hart, Stanford University.

More information: "Late Pleistocene Human Skeleton and mtDNA Link Paleoamericans and Modern Native Americans," by J.C. Chatters et al. *Science* 2014. www.sciencemag.org/lookup/doi/10.1126/science.1252619

Provided by Pennsylvania State University

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