Pleistocene Podcast Final

Cameron McLeod and Jackson Wetherill

Mammoths: Melting or Muder?

[Calming Electronic Music and Wind Noises]
Jack Ridge: So the two main theories about their extinction is that the climate change. At the end of the last ice age was abrupt enough to cause this to happen. But then you also have humans appearing on the scene, and you have hundreds of these organisms.
Jackson: Hey, Cam,
Cam: Hey Jackson.
Jackson: So what are we talking about today?
Cam: Today we're discussing a paper written by Jack Broughton and Elic Weitzel. The paper is called Population reconstructions for humans and megafauna suggest mixed causes for the North American Pleistocene extinctions.
Jackson: Yeah, thanks, Cam. So today, we're going to be discussing these competing theories about the role of humans in the Pleistocene megafauna extinction. We're going to explain the research and methodology of the paper. And in the second half of the podcast, we're going to be joined by an esteemed scholar in the field, Jack ridge. So Cam, transport us back to the Pleistocene. What, what was it like?
[Wind Noises]
Cam: The Pleistocene began around 2.6 million years ago, and it's characterized by glacial interglacial cycles, constantly shifting the world in and out of ice ages. The final Glacial Maximum around 23,000 years ago, corresponds with the Late Pleistocene, where North America is inhabited by a variety of prehistoric mammals known as megafauna. Mammoths, mastodons, giant sloths, and saber toothed cats roamed the significantly colder continent until the arrival of humans. Their migration from Siberia, along with major climatic changes would result in what we know as the Late Pleistocene megafauna extinction.
Jackson: Yeah, and these cycles are caused by changes in patterns related to Earth's orbit around the sun. Basically, Earth's orbit around the sun will change over long timescales. We're talking about 10s of 1000s of years here. So there's no worry, no fear to worry about anything related to our lifetimes. But these changes are quite notable over these 1000s of years timescales and prehistoric humans definitely had to deal with that.
[Piano music]
Jackson: So cam, what were humans doing in the world at this time?
Cam: Well, humans were traveling around the continent. The paper focuses simultaneously on populations of megafauna and humans in North America. We have existing archaeological records of humans hunting megafauna during this time range.

Jackson: That's right, the paper references what are called Clovis sites, which are cultural sites from this time ranch in North America that are characterized by the presence of flute stone spears. These Clovis sites are what we recognize as evidence for human civilization at this time.

Cam:Exactly. Specifically, there have been a handful of sites that contain both mammoth remains and these Clovis points, which indicate that humans killed these megafauna. These sites have led scientists to question the role humans played in the extinction of mammoths and other megafauna at the time.

Jackson: And based on this theory, one would anticipate a negative correlation between the mammoth populations and the human populations. Intuitively, humans would have benefited from the influx of new food from hunting these large megafauna. So their populations, the humans, would have risen when the populations of the Mammoths would have declined.

Yes. And to add to that the other hypothesis relevant to this debate concerns megafauna and climate megafaunal decline coincided with climatic and environmental changes known to impact these animals negatively.

Jackson: And this transition would be from the Pleistocene to Holocene. Right.

Cam: Yeah. And that's the crux of the issue. We have these two trends that both make sense. Both theories are certainly compelling. And that's what the paper is trying to distinguish. So to answer some of our questions concerning the paper, and to get some expert advice on what the earth was like, during this period of time, we decided to consult Tufts professor of quaternary geology Jack Ridge. Professor Ridge is a scholar in the field concerning glacial geology, and he's published a lot of work on the most recent glaciation and the end of the Ice Age. Jack, thanks for joining us today. Can you maybe elaborate on why the climatic changes would have been particularly effective at creating an extinction event for mastodons, mammoths and saber toothed cats?

Jack: Yes. So there's a couple of things that we have to understand, and one is that you can talk about different parts of the US for instance, and where these things went extinct. We're not dealing with the same animals everywhere. So especially, this is especially true with mammals. There are two main species of mammoths in North America. One is a Columbian mammoth, which does not live in an ice age climate, it lives in a temperate or a warmer climate. And so they would have been living in California and Mexico and places like that, and across the southern United States, and then there's also wooly mammoths, which lived next to the ice sheet, and both of those organisms have different types of food, and everything. So they both went extinct at the end of the last ice age, so we may be dealing with a situation where there's different reasons for those different species, and the climate is certainly changing, but it might not just be temperature, it might be that the area where they live becomes a lot drier, or I can't imagine that wetness would necessarily influence that extinction too much. But certainly conditions getting drier might be a factor. In the case of saber toothed cats, they're predators. And a lot of times the things that they're eating are challenged or they go extinct, and their numbers get low. And so the

predators numbers are gonna get low. They're basically controlled by what they eat. So that's also true for the, you know, the mammoths as well. As far as mastodons are concerned, mastodons were very abundant here in the northeastern United States. So especially in the Hudson River Valley, there are many, many sites where, you know, people have dug up Mastodon bones, from the bottoms of ponds and bogs and things like that. There's even a site in Western New York, where they find butchered, mastodons wrapped in skins, and preserved in the bottom of a pond. And what people were doing is they were putting that meat in very cold water to try and preserve it. And they would eventually come back and get it, which they never did. So, you know, that type of thing is going on in Western New York. So they do overlap with people, which then begs the question, well, are people involved in this? So the two main theories about their extinction is that the climate change at the end of the last ice age it was abrupt enough to cause this to happen. But then you also have humans appearing on the scene, and you have hunting of these organisms. And that's a difficult thing to prove. If you find a point, like this, I guess spearpoint stuck in a mammoth bone. Great, that doesn't really mean anything, because that's one individual. And, you know, think about this, think about if you're one of those, you know, early Americans, and you have the choice of hunting a deer or a mammoth, you know, and hunting a mammoth has got to be a dangerous thing. You know, there's a big organism out there. So we know they did hunt mammoths. And this is especially true in Siberia. I mean, they made shelters, out of the tusks in the bones of mammoths, some of those bones may have actually been found in the tundra, they were fossil sites that were already they were already dead, you know, and they were using the bones to do these types of things.

Jackson: So Jack, could you explain a bit more about what it would look like to reconstruct one of these population declines? And what it's like to actually find these mammoth and Mastodon remains.

Jack: The problem is that you're dealing with relatively small numbers of individuals for those big organisms as compared to, you know, other organisms. And it's, it's hard to say we definitively have the date where something went extinct. So you also have, in the case of big organisms, sometimes separated populations, and they don't all go extinct at the same time. Good example, a great example is Mammoths. So mammoths are thought to have gone extinct somewhere between, you know, 11 and 13,000 years ago, and that seems to be the case with, you know, fossil bone sites for mammoths from the Midwest and California and places like that here in the East. But mammoths survived till 4000 years ago on Wrangel Island in Alaska and also on the Channel Islands off the coast of California. And I don't even want to get into how they got out to the Channel Islands, because they would have had to swim across 15 miles of ocean water to get out to these islands and, and they lived out there for a long time there. That group actually became dwarfed as a result of living on those islands, maybe limited food sources, but they survived till about 4000 years ago. And, you know, that populations very small. And that's about the time that humans arrive. on those islands, so they may have been done in by human hunters, it's less clear whether that was the case simply from the fossil record and in other places like across the whole continent.

[Nature founds and mammoth-like noises]
Jackson: So what these scientists tried to do is use radiocarbon dates from samples to model population trends during the Pleistocene Holocene extinction event.
Cam: That's right, scientists use radiocarbon, a source of radioactive carbon that stays in the remains of dead organic matter, to date things in the relatively recent past. Scientists compare the rate of decay of this carbon to that of carbon that doesn't decay over time. Using this ratio, scientists can determine the age of anything with organic matter in it that's about 40,000 years old or younger.
Jackson: That's right. So they gathered a bunch of samples from North American sites and aggregated this data with other past research to make the largest dataset on megafauna populations in the Pleistocene of its kind.
Cam: Yep. And like we mentioned earlier, they include data on dire wolves, giant bears, mastodons, and of course, the mammoth.
Jackson: So Cam, what were the trends the scientists were looking for?
Cam: It varied a bit by animal. What's important here is to understand animals that were hunted with decrease in population, and animals that were not hunted would have a limited change in population. Conversely, if climate is the main culprit, all animals should have about the same trend in population.
Jackson: And I'm assuming these scientists did some statistical work to determine these tangible effects, right?
Cam: Yes, they compare the correlations and found statistically significant negative correlations between the two datasets. This is what we would expect when examining the human megafauna interplay.
[Upbeat piano music]
Jackson: So what did the paper find in the end?
Cam:Something interesting, as we discussed earlier, if humans were the main cause of megafaunal extinction, then we would expect a strong correlation between human populations and megafaunal populations in the record in the contiguous United States, mammoths, horses, and saber toothed cats experience a population drop right around the Clovis period.
Jackson: So, if there is a strong negative correlation between humans and these three animals, we could probably conclude that human activity is certainly a main driver in their extinction.
Cam: That's right. Based on this data, we can assume that humans had a nonzero role in the extinction events of these animals.
Jackson: But there's a catch, there's always a catch.
Cam: There is always a catch. And they found that some animals like the Shasta ground sloth and the mastodon don't experience population drop offs until well after the Clovis period has ended. So this leads us to have some conflicting data.
Jackson:So with these two animals, we can't attribute their extinction to human hunting.
Cam: Nope, which leaves us with different conclusions based on the different animals we're talking about..

Jackson: So we're presented with the fact that mammoths, horses and saber toothed cats all declined with the onset of humans, along with clear evidence that they were being hunted. We also have two different animals that do not show the same trend. The Mastadon and sloth showed no notable decline around the Clovis points in history.
Cam: Yeah, and that's kind of tough. One way we might be able to reconcile this data is that perhaps humans had a preference for hunting these three animals. Perhaps humans then would have more influence over their populations than mastodons or sloths.
Jackson: Yeah, that's some compelling logic. An additional facet of the argument presented is that human selection for specific species could have had effects down the food chain. For example, the researchers outline that humans might not have had a direct impact on the saber toothed cats via killing them, but rather their effects on other organisms, notably, the food of the saber toothed cats, could have created a trophic cascade. In other words, humans could have been either eating or hunting the typical food of saber toothed cats, and not could have been the main culprit of their extinction. After all, the idea of killing a saber toothed cat is well, it's really scary. I certainly want nothing to do with that.
Cam: Yeah, and this provides an interesting alternative to the direct killing hypothesis for the saber toothed cat. But unfortunately, that logic can't really be extended to all of our other animals, because humans would have been less able to disrupt the food chain that exists for herbivores.
Jackson: It's also interesting that mastodons did not see a population change and mammoths did. Cam, what do you make of this?
Cam: Perhaps this could have been explained by differences in the geographic location of mastodons and mammoths. Another explanation is the animals could have been better or worse and moving around human populations. Perhaps mastodons were simply better at avoiding hunting. Unfortunately, I'm not super compelled by this logic, when it comes to sloths, it's hard to believe a giant sloth would be able to effectively avoid humans.
Jackson: Yeah, that makes sense. I actually believe the paper attempts to address some of these outlying concerns. What if we look at a more local level?
[Nature sounds and Mammoth-like noises]
Cam: Well, in the Great Lakes, we actually see a positive correlation between human, Mammoth, and Mastodon populations. The population drop offs for the animals are more consistent with extinction due to climate change.
Jackson: So human hunting can't be a cause there, can it?
Cam: Nope. But in the southwest, we see data consistent with both extinction due to human hunting and extinction due to climate change.
Jackson: So it appears that both human hunting and climate change must have been drivers in the extinction. And the degree to which each factor caused extinction varied based on the location of the species.

Cam: Exactly. We actually find that the megafauna which have survived today, including bison, moose and elk, are the species able to more efficiently use nutrients in short growing seasons, likely allowing them to survive a changing climate.
Jackson: So, now that we've discussed the results and findings of this paper, what do we make of them?
Cam: Obviously, there's a lot going on here. With the results, we can see that there are still compelling reasons to believe both theories, as outlined, they say it is plausible for both climate change and hunting to have played significant roles in the decline of megafauna populations, as typical of science, we are left with the classic answer. It depends
Cam: Exactly, it depends.
Jackson: So is there an implication to us today, Cam?
Cam: I'd say the most obvious implication is that these two behaviors of the past hunting and climate change are known culprits to cause extinction. Humans have clearly been up to no good when it comes to extinction events for over 10,000 years now.
Jackson: Yeah, it's very interesting to me that this paper outlines these two competing theories of extinction. But today, many, many 1000 years later, we're still dealing with them. Arguably, these two factors now, hunting and climate change are much bigger and badder than they were in the past. So we've got to be careful about how we continue to influence the climate and hunt animals. History tells us that when we do either of these things, we create problems for the biosphere.
Jackson: Well, that's all we've got on the podcast today.
Jackson: My name is Jackson.
Cam: And my name is Cam.
Jackson: And thanks for listening.
[Calming Electronic Music and Wind fades out]

Bibliography

Brannen, P. (2017). *The Ends of the World: Volcanic Apocalypses, Lethal Oceans, and Our Quest to Understand Earth's Past Mass Extinctions*. HarperCollins Publishers.

Broughton, J.M., Weitzel, E.M. Population reconstructions for humans and megafauna suggest mixed causes for North American Pleistocene extinctions. *Nature Communications 9, 5441 (2018). https://doi.org/10.1038/s41467-018-07897-1*.

Sound Documentation

Tundra Atmosphere - Very strong wind through willows, occasional calls from Snow Geese, frogs in background with several closer calls.
https://sound-effects.bbcrewind.co.uk/search?q=NHU05101042
bbc.co.uk – © copyright [1989] BBC

Animals: Elephants - Indian elephant growling, no background
https://sound-effects.bbcrewind.co.uk/search?q=07062088
bbc.co.uk – © copyright [2024] BBC

Weather: Wind - Wind on tundra - cold rolling wilderness sound.
https://sound-effects.bbcrewind.co.uk/search?q=07061039
bbc.co.uk – © copyright [2024] BBC

Music

Title: Roboduck
Creator: Airtone
http://dig.ccmixter.org/files/airtone/66098
CC by 4.0 Deed

Title: First Snow
Creator: HoliznaCC0
https://freemusicarchive.org/music/holiznacc0/winter-lofi/first-snowmp3/
CC0 1.0 Universal License