Palaeontology

Woolly rhino genome holds clues to its demise

James Woodford

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A GENOME reconstructed from a tiny piece of flesh found in the stomach of a wolf pup that died 14,400 years ago suggests that woolly rhinos were still genetically healthy even as they faced imminent extinction.

No one will ever know how a young female wolf pup died at a site near what is now the town of Tumat in northern Siberia, Russia. But it is most likely that she and her sister had just been fed the meat of a woolly rhinoceros (*Coelodonta antiquitatis*) by their mother when their den collapsed, entombing the siblings in permafrost.

The first of the puppies was found at the site in 2011 and the second in 2015. A dissection of the stomach contents of one of the puppies yielded a piece of woolly rhino flesh.

Edana Lord at Stockholm University in Sweden, a member of the team that studied the fragment, says it looked "like a piece of jerky with a bit of fluff".

From that, Lord and her colleagues were able to reconstruct the woolly rhino's genome and determined that it was a female with no signs of inbreeding in the DNA (*Genome Biology and Evolution*, doi.org/qm2w).

What caused the extinction of the woolly rhino has long been a source of debate

This finding is very important, she says, because this is the first time that scientists have recovered genetic material from a woolly rhino so close to the date it vanished, just a few centuries later.

It has long been debated what led to the extinction of the woolly rhino – human hunting pressure, climate change or simply that inbreeding meant that the species was no longer thriving.

Another member of the team, Love Dalén, says they compared this woolly rhino genome with two others – one around 18,000 years old and the other at least 49,000 years old – and found no change in genetic diversity or inbreeding levels through time.

"If there had been a population decline, we would have seen lower diversity and higher inbreeding in the 'stomach rhino'," says Dalén.

Instead, the team says the most likely cause of extinction was a rapid period of climatic warming between 14,700 and 12,900 years ago called the Bølling-Allerød interstadial, which would have led to dramatic changes in the woolly rhino's habitat. ▮

Space

Earliest known supernova sheds light on first stars

Alex Wilkins

ASTRONOMERS have caught a massive star exploding just moments after the universe emerged from the cosmic dark ages, illuminating how the first stars were born and died.

When stars run out of fuel and explode, they produce a burst of powerful light called a supernova. Supernovae can look extremely bright in our local universe, but the light from a star exploding in the early universe can take billions of years to reach Earth, by which time it has dimmed.

Because of this, astronomers can typically only see very distant supernovae in special cases, such as type Ic supernovae, which are stellar cores that have lost their outer gas and produce an exceptionally bright burst of gamma rays. Type II supernovae, which are the most common stellar explosions we see in our galaxy and occur when a massive star runs out of fuel, are normally too faint to see.

"We can see this star at a distance where we've never seen an isolated supernova"

Now, David Coulter at Johns Hopkins University in Maryland and his colleagues have spotted a type II supernova called SN Eos from when the universe was just a billion years old, using the James Webb Space Telescope.

The stellar explosion was fortunately placed behind a massive cluster of galaxies, whose powerful gravity magnified its light and made it tens of times brighter than it would normally appear.

The researchers analysed the spectrum of light coming from SN Eos, making it the earliest supernova to be confirmed using spectroscopy. The results clearly show it is a type II supernova, which means it must have come from a massive star (arXiv, doi.org/qm76).

It also shows that the star that produced it had very low amounts of elements other than hydrogen or helium – less than 10 per cent of the amounts in our sun. This is how astronomers think the early universe looked, because there hadn't been much time for multiple generations of stars to form and die and produce heavier elements.

"That tells us immediately about what kind of stellar population [the star] exploded in," says Or Graur at the University of Portsmouth, UK.

When we see light at these distances, it is typically from small galaxies, where you can infer average properties of what stars might be in those galaxies. But studying individual stars at these distances is typically not possible, says Matt Nicholl at Queen's University Belfast, UK.

"We can see this individual star, with beautiful data, at a [distance] where we've never seen an isolated supernova," he says.

This would have been just a few hundred million years after a period in the universe's history known as the epoch of reionisation, says Graur. That was when light from the first stars began to strip electrons from neutral hydrogen gas, which blocks most forms of radiation, and turned it into ionised hydrogen, which is transparent. Before this, the universe was opaque, so SN Eos is effectively as distant a supernova as we might hope to see. ▮