

[BARNOSKY:] Species do not last forever. You can think of species a lot like you think of a human lifetime -- they have a beginning and they have an end.

[NARRATOR:] Anthony Barnosky and Kaitlin Maguire are paleobiologists. In their search for a better understanding of today's world, they study animals that haven't walked the earth in millions of years.

[BARNOSKY:] The big focus of my research is trying to understand what is the normal background rate of extinction; that is, what is the normal pace of species origination and extinction. It's really important to understand the normal, or background, rate of extinction because without that, you have no basis of comparison for knowing whether or not the number of extinctions we're seeing today are too many or not.

[MAGUIRE:] The oreodont skeleton's right over that way...

[NARRATOR:] Barnosky and Maguire are here in eastern Oregon's John Day Fossil Beds National Monument with a special permit to search for fossils of ancient mammals.

[BARNOSKY:] We've just come across an oreodont skeleton here, and oreodonts are a completely extinct group of mammals. Their body form looks sort of like a deer and sort of like a pig, if you can imagine that mixture. That's part of an oreodont's spine. We have part of a leg bone, the shin. We see little bits and pieces of bone. So it looks like there's most of an oreodont skeleton buried in this hillside.

[NARRATOR:] By studying fossils like this, the team is gathering data. Data that will help them determine when the species first appeared and when they disappeared. And by collecting these data for many species, they can calculate how often extinctions normally occur.

[BARNOSKY:] The John Day Fossil Beds are a really special place for doing the sorts of research I do. Here we have the longest record of mammalian evolution and extinction in a single place anywhere in North America.

[NARRATOR:] The strata of rock here were formed over tens of millions of years. They accumulated as layer after layer of volcanic ash and other sediments were slowly deposited, one on top of the other.

[BARNOSKY:] If you look at some of the formations around here, for example Blue Basin goes from about 31 million years old to about 28-1/2 million years old. On the other hand, Sheep Rock is a little bit younger ultimately -- it starts at about 29 million years old, and goes up to as young as 25 million years old. And from the Mascall Overlook, you can see even a younger sequence of rocks running from about 16 million to 7 million years old. So if you put all of those three sets of exposures together, we're going from slightly older than 30 million years all the way up to 7 million years, and it's arranged in essentially three separate chapters.

[NARRATOR:] These chapters of time contain both the origins and extinctions of many species of mammals, including oreodonts.

[MAGUIRE:] We know that this specimen is about 29 million years old because of where it's found, so it is above certain layers that we know are older at 30 million, and then it's below some of the other layers which we know are much younger

[NARRATOR:] The team wraps the oreodont specimen in a plaster jacket for transport back to the lab for more precise identification. Maguire takes samples of compressed volcanic ash near where they found the specimen. This volcanic rock contains microscopic zircon crystals, which can be radiometrically dated to determine accurate ages of the rock layers -- and the specimens near them.

[MAGUIRE:] With zircon dating, we can get within 10,000 years, which is a phenomenally short range span for the fossil record. And these methods that they're using today are new, and we've never before had this precision in dating rocks.

[NARRATOR:] In the paleontology lab at John Day fossil beds, scientists work to identify the exact species that was buried in these layers. We use teeth to identify mammalian species. First of all, because they preserve really well in the fossil record. And second of all, they have distinct morphological features or shapes to them that are specific for each species.

[NARRATOR:] It turns out that the oreodont Maguire and Barnosky uncovered is in the species *Eporeodon occidentalis*, and lived around 28.8 million years ago. This and specimens of other oreodont species tell us that oreodonts first appeared here about 48 million years ago, and went extinct about 5 million years ago. But that's only part of the picture. The specimen's details can now be added to a database containing millions of fossils from thousands of species across the globe.

[BARNOSKY:] Over the past couple of hundred years, we've now accumulated literally millions of specimens in museums. And at this point, paleontologists have identified over 12,000 species. All of that information is now in computerized databases. We can go to those and we can actually, for each one of those 12,000 species, say, when was the first occurrence, when was the last occurrence. Knowing that information for thousands of species, we can then calculate out the overall background extinction rate for mammals as a whole. All we're really trying to do is say, if we had a million species out there on the landscape, how many of those would we expect to see going extinct in a year? And we call that measure, extinctions per million species-years.

[NARRATOR:] Barnosky's analysis has revealed that, for mammals, the background rate of extinction is about two extinctions per million species-years. If we apply this background extinction rate to the approximately 5500 species of mammals on Earth today, we would expect one mammal species to disappear every hundred years.

[BARNOSKY:] And what we've found is that species in the past 100 years have been going extinct somewhere between 28 to 67 times too fast.

[NARRATOR:] It's a daunting conclusion. Species are going extinct way too quickly. Does this mean we're headed for the sixth mass extinction?

[BARNOSKY:] All that stands between us and the sixth mass extinction are keeping those threatened and endangered species on Earth. If we did not do that, within as little as three centuries, you would lose 3 out of 4 of every species you're familiar with.

[NARRATOR:] And once species are gone, they cannot be recovered. That biodiversity is lost forever.

[BARNOSKY:] The bad news obviously is that the rates of extinction that are going on today are way, way too fast. The good news is, most of what we want to save is still out there to be saved. All we have to do is step up the conservation efforts that we already know how to do. We have the sixth mass extinction looming, we know what's causing it. We know how to fix it. All we have to do is fix it.