NORTH DAKOTA'S DAWN BEAR

BY JEFF J. PERSON

Finding something new to science can be an exciting thing; however, the one doing the finding typically doesn't know that what they've found is new to science, at least not at first. Often, the larger thrill of a discovery being unknown is elusive at first. These kinds of findings are not unique, but are rare enough to take note of when they happen. Although the NDGS joined the story of *Eoarctos* near its conclusion, these quests of understanding always seem to start simply enough. They usually start with the question, "What is that?" Three words, when put together can start you on a journey with an unknown conclusion. When first asked in 1982 on a plot of land in southwestern North Dakota, and then again in 2015 in an isolated room in the basement of the Heritage Center, this query sparked and re-sparked a flurry of research, answers, and even more questions.

In 1982 paleontologist Robert Emry was on an expedition for the Smithsonian Institution and was visiting a fossil locality in the southwestern corner of North Dakota. He had visited the area many times before and was hoping to collect more rock from a site he had found a few years earlier. The fossils from that site were numerous, tiny, and very well preserved. This same site was rediscovered by NDGS paleontologists 30 years later, and eventually named the "Coquina Locality" because of the sheer density of bones, jaws, and teeth found within. After collecting approximately 200 pounds of material from this first site in 1982, Dr. Emry began to search around the nearby area and discovered a few bones just beginning to erode out of the rock. He concluded that the bones were from a carnivore that he had never seen before and collected a large block of rock around the visible bones that he hoped contained the rest of the skeleton.

FIGURE 1.
Left lower jaw of *Eoarctos vorax* NDGS 1593. (A) shows the occlusal and (B) the side view. Note the crenulations or wrinkles on the teeth. These crenulations add strength to the teeth, making them better for crushing hard shelled animals like snails. Drawings by Becky Barnes.

This fossil collected in 1982 is from the Brule Formation, which is approximately 32 million years old, dating back to what geologists call the Oligocene Epoch. More specifically, the Brule Formation rocks in North Dakota are from the boundary between the Orellan and Whitneyan ages within the Oligocene Epoch. In North Dakota, these rocks are found on the surface only in the southwestern corner of Stark and Slope counties. The environment during this time in North Dakota's history was similar to what you might find in the African Savannah today not only in flora, but fauna as well. The area was not wide-open plains, but a checkerboard of plains and forest with meandering rivers winding through the area. The animals on this ancient savannah consisted of rhinos, saber tooth cats, small three-toed horses, large pig-like animals, alligators, fish, and snails to name only a few of the known fauna.

Fossils from the Brule Formation have been collected by the North Dakota Geological Survey for many years beginning in the late 1980s and early 1990s and continue to be collected to this day. The fossils from these collecting trips ended up in unsorted boxes and drawers during the early years of the North Dakota State Fossil Collection. As the fossil collection grew it became necessary to organize the fossils into collecting localities and then to separate animals within each locality. It was during one of these organizing periods that a very curious-looking lower jaw was discovered by Dr. Clint Boyd (curator of the ND State Fossil Collection) and me (fig. 1). This specimen had been picked up on a collecting trip in the 1990s and then placed in a drawer and forgotten about. The individual who picked up the fossil in the field likely did not have the expertise in the time period or in the group of animals to realize the magnitude of their discovery. This is not uncommon as North Dakota has a plethora of fossils from various time periods.

It would be nearly impossible for any one person to be an expert in all the time periods or animal groups collected from the breadth of localities across the state.

Research on the specimen quickly began to reveal the identity of the animal it came from. Vertebrate paleontologists use a variety of clues visible in the morphology (or shape) of an animal's teeth (especially in mammals) to place it in the overall "tree of life." Luckily, this lower jaw still retained nearly all the teeth, allowing identification of the larger group of mammals to which it belonged. Examination of the teeth revealed the animal belonged to the group of mammals called Carnivora, a specialized group that includes bears, dogs, cats, raccoons, skunks, weasels, and a few other smaller families. However, this animal did not fit neatly into any of these known families. Some of the tooth features were characteristic of bears, while others were characteristic of dogs, while still others were found within multiple other families of Carnivora. So where does it fit? How do we classify an animal that seems to be a chimera of features? After comparing this new jaw to others from the same approximate time period from other areas of the US, we decided it best matched the features of a group of animals called arctoids, which have a poor fossil record from this time period. It is within this group, just outside of the branch leading to modern bears, that this new creature should be placed (fig. 2).

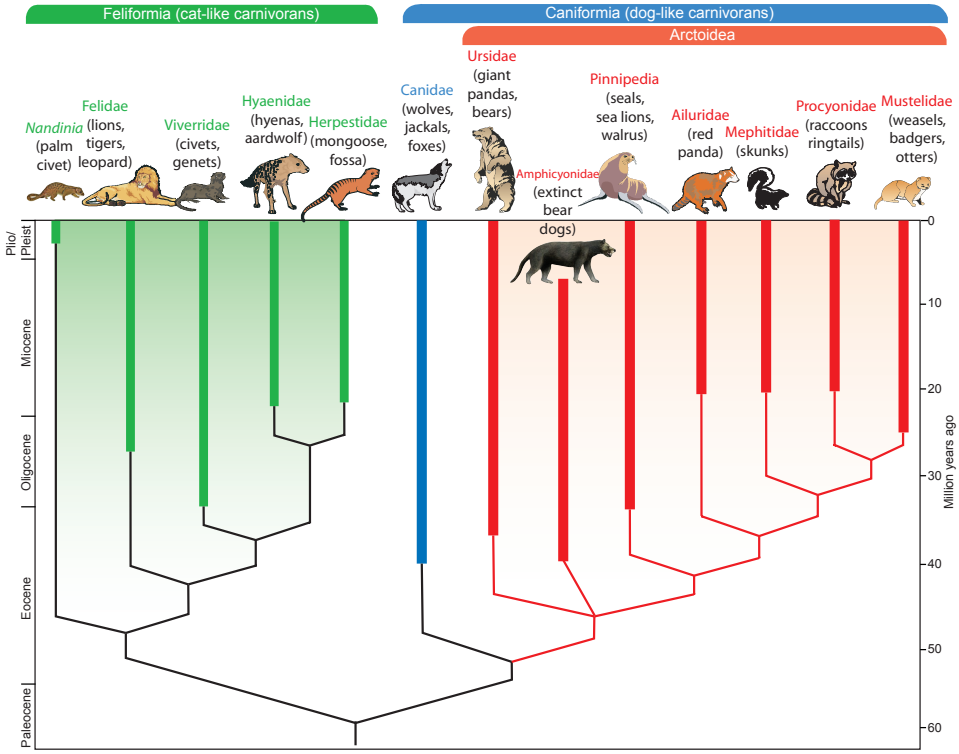

FIGURE 2.
Phylogenetic tree showing relationships of various groups of Carnivora. *Eoarctos vorax* belongs near the base of the thick red line defining Ursidae or bears.

This animal would have been about the size of a modern-day raccoon. Features of the teeth give us insight into the possible diet of this new critter (fig. 1). The teeth are slightly bulbous and low crowned, that is, they are short and squat. The teeth are also highly crenulated (wrinkled). Crenulations on teeth are often present in animals that have a need to crush hard items in their diet. Imagine this creature squatting alongside a slow-moving stream with a snail in its paws as it uses its crushing teeth to break the shell and then eats the raw escargot within (fig. 3). The name given to this new animal is *Eoarctos vorax*, which translates to "dawn bear the voracious eater."

The original lower jaw found in the NDGS collections was soon joined by additional specimens discovered during the next two field seasons. Since we didn't know what the rest of the skeleton looked like, every additional specimen we could confidently assign to this species consisted of lower jaws and isolated teeth.

FIGURE 3.
Eoarctos vorax feeding on snails near a North Dakota stream during the Oligocene Epoch approximately 32 million years ago. Painting by Mark Hallett.

FIGURE 4.
3D printed skeleton of *Eoarctos vorax*. The lighter tan portions of the skeleton represent pieces found in the original specimen. The darker gray portions represent pieces missing from the original specimen.

All the specimens we recovered were coming from the same small parcel of land in southwestern North Dakota. The same ranch, unknown to us, that Dr. Emry had recovered a specimen from, more than three decades earlier. That original specimen had returned with him to the Smithsonian Institution in Washington D.C. where the encasing rock had been removed revealing a nearly complete skeleton. Dr. Emry had also recognized that this specimen was a unique kind of Carnivora, but as he was not a specialist in this group of animals, he loaned the skeleton to the leading expert on early dogs; Dr. Xiaoming Wang, at the LA County Museum in Los Angeles, California, expecting Dr. Wang to take the lead on a full description and naming of this new animal.

During our research phase of the identification of this new animal, there comes a point where one needs to consult the input of other experts. It was at this stage that we reached out to Dr. Wang asking his opinion on where this animal would fit in the tree of life. Once Dr. Wang saw images of our specimen, he recognized the morphology immediately and realized we were working on the same animal that he was describing. We all decided it would work best for science to collaborate and publish information on the new species in one paper compiling all our specimens and giving a more complete picture of this newly discovered animal.

One large benefit of teaming up with Dr. Wang and his colleagues is access to the full skeleton of this new animal. The entire skeleton was 3D scanned during research and a copy of that data was offered to the NDGS for 3D printing and exhibition (fig. 4). The skeleton has been 3D printed and is now the newest addition to the geologic time gallery at the Heritage Center (fig. 5). A print of the commissioned mural by paleo artist Mark Hallett (fig. 3) is exhibited with the skeleton, compiling all the most recent information about the animal and environment *Eoarctos* inhabited in North Dakota 32 million years ago. To reflect the place in time when *Eoarctos* would have been living in North Dakota, special care has been taken to put the exhibit in proper sequence with existing exhibits. The new specimen is placed after the Paleocene swamp exhibit and adjacent to the current Oligocene exhibit. Come to the Heritage Center Geologic Time Gallery to see *Eoarctos*, the newest piece in the puzzle of prehistoric life in North Dakota.

FIGURE 5.
The new exhibit at the Heritage Center and State Museum in Bismarck featuring *Eoarctos vorax*. The 3D printed skeleton, lower jaw (NDGS 1593), as well as some terrestrial and aquatic snails can be seen in the exhibit case. Banner painting by Mark Hallett.