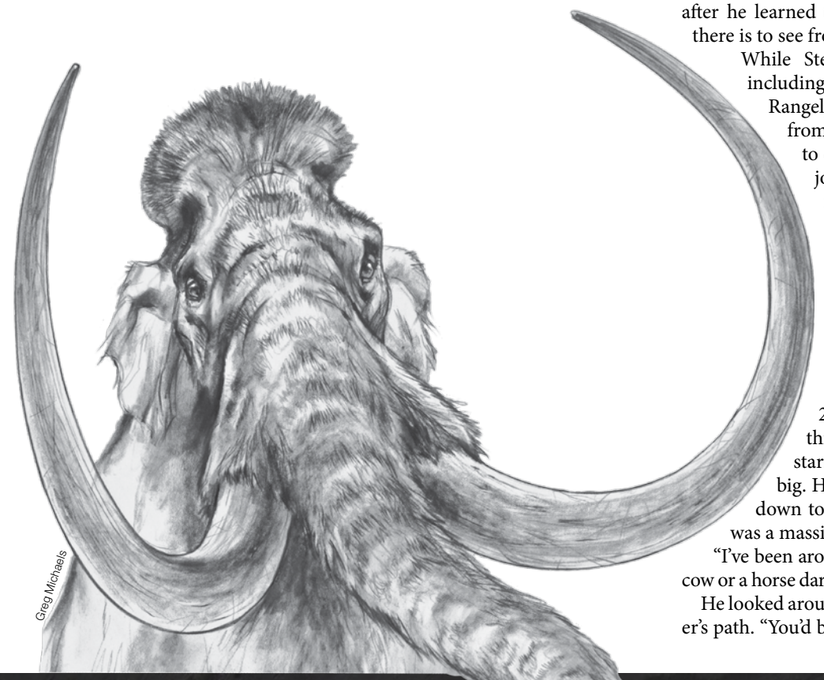
Snowma stodon

Excavating the dig of the century

How a bulldozer operator uncovered one of the world's biggest troves of mastodons, mammoths and other ice-age giants in Snowmass Village.

story by MATT MASICH photographs by RICK WICKER

A team from the Denver Museum of Nature & Science watches an excavator pull a mastodon pelvis, encased in plaster, from the prehistoric lakebed of Ziegler Reservoir.



Greg Michaels

JESSE STEELE WAS born to drive a bulldozer. His father and grandfather drove bulldozers on the Western Slope, and he started working with heavy equipment not long after he learned to walk. He has seen just about everything there is to see from the cabs of these big machines.

While Steele has unearthed some unusual things, including a few dinosaur bones while excavating near Rangely, his work mostly consists of moving dirt from one place to another. That was all he expected to do when he arrived at the Ziegler Reservoir jobsite on a ridge above Snowmass Village in fall 2010, where he and a crew from Gould Construction were to deepen a drained lake to create a new reservoir for the ski town.

The project seemed simple enough, and, for the first few weeks, it was. Every morning, Steele swapped out his cowboy hat for a hardhat and got to work dozing through layers of soft peat on the lakebed. He was nearing quitting time on the afternoon of Oct. 14, 2010, when he felt an unexpected bump jolt through his machine. Moments later, he was startled to see his bulldozer dislodge something big. He backed up, stopped the engine and hopped down to investigate. There, sticking out of the earth, was a massive, three-foot-long rib bone.

"I've been around cows and horses all my life, and I knew a cow or a horse darn sure didn't have a bone that long," Steele said.

He looked around and saw more bones strewn in his bulldozer's path. "You'd better get over here," he called to his foreman, Kent Olson. "There's something going on." Steele and Olson found giant ribs, vertebrae, a partial jawbone and part of a tusk. After a little internet research, they realized Steele had dozed up the skeleton of a mammoth. The local agency in charge of Ziegler Reservoir decided to call in the fossil experts.

THE PHONES WERE ringing off the hook the next day at the Denver Museum of Nature & Science. The museum staff was grateful to get the call, as construction workers all too often keep quiet about fossils to avoid delays. Museum scientists visited Snowmass Village for a press conference the next week and found that the entire Roaring Fork Valley seemed to have caught mammoth fever, with thousands of people lining up to see the bones at the Snowmass Village Water & Sanitation District's offices.

Meanwhile, the construction crew fenced off the mammoth find but otherwise kept working, unearthing still more bones while the bone crew prepared to dig. Now the scientists knew they were looking for multiple animals. Even more tantalizing, one of the new finds was a mastodon tooth.

Mastodons were elephant-like giants that lived at the same time as mammoths, but it is rare to find them at the same site. The lankier mammoths, closely related to modern Asian elephants, grazed in grasslands; the slightly shorter, stockier mastodons, which came from a separate line of elephant evolution, lived in forests. Only three partial mastodons had ever been found in Colorado, compared with more than 100 mammoths. The find at Ziegler Reservoir was getting a lot more interesting.

About 30 scientists and volunteers began their work three weeks after Steele dug up the first bone. Paleontologists carefully scraped away dirt from the original mammoth, while others used shovels to

Cody Newton finds ancient bison bones at Ziegler Reservoir.

scout out new areas. The construction crew helped, too. Steele and others ran their bulldozers while a team of "blade runners" trotted next to the machines' blades to spot fossils.

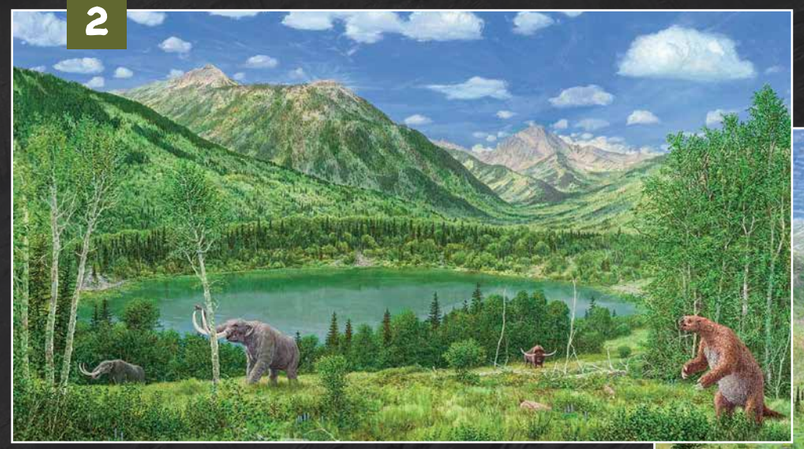
"It was total managed chaos," said Ian Miller, a curator of paleontology at the museum and co-leader of the dig with Kirk Johnson, then the museum's chief curator and now director at the Smithsonian's National Museum of Natural History.

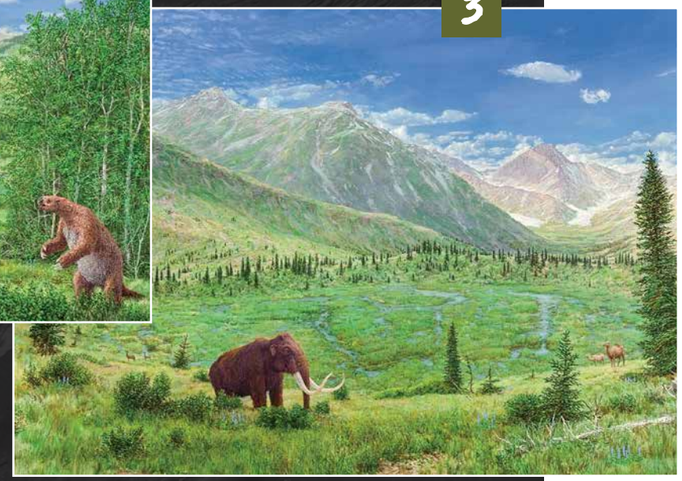
They had to work quickly. It was already November, and the winter storms that would soon dump fresh powder on nearby Snowmass Ski Resort would also bring an end to the dig. Miller worried one of the blade runners might get squished by a bulldozer during the mad rush, but, thankfully, none did.

The diggers discovered bones at a rapid clip. In the first three days, they found five different species: a mammoth, five mastodons, two ancient bison, a deer-like animal and a giant Jefferson's ground sloth – the first ever discovered in Colorado. People joked that Snowmass Village should change its name to Snowmastodon Village. That didn't happen, but the dig soon became known as the Snowmastodon Project.

Miller was pulling such long shifts – and pulling so many bones from the ground – that he barely had time to think about what a significant discovery this was. About a week into the dig, as he was excavating a massive prehistoric bison skull with horns more than six feet across, the full impact of the moment hit him. "I just stopped and took a breath," he said. "It was the first time I really got a chance to reflect and realize, 'Wow, this is world-class. This is actually happening.' "

It wouldn't be happening much longer. The snow





1. A glacier receding 130,000 years ago created a lake at Snowmastodon. 2. It was surrounded by a conifer forest when mastodons, ancient bison and ground sloths lived there 120,000 years ago. 3. It had become a marsh by about 70,000 years ago, when mammoths roamed.

Jan Vriesen (series)

Glenn Randall

began in earnest, and the dig had to shut down for the winter on Nov. 14. By that point, 600 bones and 15 tusks had been discovered – and most of the site had yet to be dug.

THE SCIENTISTS RECONVENED at the Denver Museum of Nature & Science in late 2010 to plot their next move. Their excitement over the Snowmastodon Project was tempered by the knowledge that the site was due to become a reservoir by the end of 2011. They struck a deal with the Snowmass Village Water & Sanitation District: They could excavate the remaining fossils from May 15 to July 1, after which dam construction would resume and the lakebed would be flooded.

"We had seven weeks, and we needed to move 20 million pounds of dirt," Miller said. He and co-leader Kirk Johnson enlisted a team of 55 scientists to work on the dig, including local experts from the Denver museum and the Lakewood office of the U.S. Geological Survey, as well as top scientists from across the world. Doing much of the grunt work were nearly 500 volunteers.

"Kirk Johnson sent me an email saying, 'It's the dig of century. You've got to be there,' " said Kent Hups, a paleontologist-turned-science-teacher at Northglenn High School. He planned to volunteer at the dig for a week as soon as classes ended in early June. However, the night before the last day of school, he had to have an emergency appendectomy.

Hups' doctor said he'd have to stay in bed for two solid weeks. "Duly noted," Hups replied. Ignoring his doctor's orders, he headed to Ziegler Reservoir a few days after being discharged from the hospital. He wasn't about to miss the dig of the century.

Every shovelful of dirt Hups dug was agonizing, but he pushed through. His biggest find was a mastodon femur more than three feet long. He pulled the heavy bone from the waterlogged soil of the lakebed, sending a stream of water, or "mastodon juice," pouring out of it. "It was customary to drink some of the mastodon juice when you found a big bone," Hups said. He partook, finding it to be "gritty, with an aftertaste of ancient megafauna."

The team was uncovering about 250 fossils each day by the fifth week. Johnson motivated the crew, offering bounties for certain bones. "Bring me the head of Ziggy the sloth!" Hups remembered him shouting at one point. But time was running out.

"In the end, we were pretty worried, working 18 hours a day," Miller said. "We called up everybody we ever knew: former students, random acquaintances, cousins – anybody who could hold a shovel."

Carol Lucking uses a toothbrush to clean ancient grit from the jaw of an ice-age deer excavated alongside mammoths.

They managed to excavate the entire site by the first week of July, coming home with 5,500 large bones and 30,000 small bones from nearly 50 different species. As they were packing up, a truck came to collect the four port-a-potties workers had used during the dig. The ground beneath the port-a-potties, or port-a-loos, as an engineer from New Zealand called them, was the only spot yet to be excavated. They dug, and Snowmastodon revealed its parting gift: a nearly complete mastodon skeleton, the largest discovered anywhere in the world. "We named it Portaloo," Miller said.

When all was said and done, Snowmastodon turned out to be the most extensive high-altitude ice-age fossil site ever unearthed.

WITH THE DIG CONCLUDED, the scientists pieced together what they could about Snowmastodon. Using various dating techniques for the different layers of sediment, they determined the site was a time capsule spanning 85,000 years of ice-age history, from 140,000 to 55,000 years ago. The lake formed about 130,000 years ago, when a glacier melted there at the end of the second-to-last glacial period.

The area around the lake was forested 120,000 years ago, when mastodons, giant sloths and ancient bison roamed there. By 70,000 years ago, it was a marsh surrounded by grassland, providing a home for mammoths. Fossils from this interglacial period are rare, because when the last wave of glaciers came along, they crushed and scoured away everything in their paths. But the glaciers that came along 20,000 years ago stayed in the Roaring Fork Valley and didn't reach up the ridge, saving Snowmastodon from obliteration.

In addition to Snowmastodon's impressive animal remains, diggers discovered startlingly well-preserved logs and plant matter.

"The place was chock-full of things that looked like they died yesterday," said Jeff Pigata, a geologist with the USGS in Lakewood. One layer of peat opened up like pages in a book, revealing ancient leaves that were still green. The leaves, which had lain for millennia

American Mastodon

130,000-100,000 years ago

Columbian Mammoth

87,000-55,000 years ago

Long-horned Bison

130,000-100,000 years ago

Jefferson's Ground Sloth

130,000-110,000 years ago

Snowmastodon yielded bones from 35 individual mastodons, as well as mammoths, long-horned *Bison latifrons* and a giant sloth that had never before been found in Colorado. Listed here are the dates these animals lived at the Snowmastodon site.

Illustrations by Marjorie Leggitt

in unoxygenated groundwater, turned brown within minutes when exposed to air. "Pulling up sediment and finding green leaves that are 100,000 years old? That never happens – but it did," Pigata said.

By figuring out which plants and trees lived at which times, Pigata and his colleagues were able to determine what the weather was like. They were surprised to learn that past climate changes affected this high-altitude site differently from lower elevations. Researchers now have enough samples from the reservoir for decades of research into the causes of this discrepancy.

Professional scientists aren't the only ones who continue studying Snowmastodon. When Hups, the Northglenn High School science teacher, returned to class in fall 2011, he brought with him bags of soil and sediment, known as matrix, collected from the fossil site.

For the past five years, his students have sorted through the matrix with tweezers searching for seeds and microfossils. They hope to present their findings at the Denver Museum of Nature & Science. Some students have become such experts that scientists seek them out by name to help the professionals identify plant species by their seeds. The experience has inspired some youngsters to seek out careers in paleontology. "I work with these students, and they're not students anymore," Hups said. "They're colleagues doing the exact same research I'm doing."

Snowmass Village continues to feel the effect of the epic find in its backyard. The town's small Ice Age Discovery Center tells the Snowmastodon story with photos, fossils and an on-site paleontologist to answer questions. This is just the beginning, said Tom Cardamone, executive director of the discovery center. Plans are underway for a large, state-of-the-art facility, slated for an early 2019 opening. Exhibits at the new Ice Age Discovery Center might include lifelike recreations of a mother and baby mastodon, complete with sound effects of heartbeats, breathing and vocalizations; an immersive theater experience showing what Ziegler Reservoir looked like from 130,000 years ago to the present, with images displayed on every wall and even the floor; and a full-size skeleton cast of Portaloo, the giant mastodon.

Snowmastodon has also had a profound impact on Jesse Steele, the eagle-eyed bulldozer operator who kicked off the whole thing. He now treats each construction job with a paleontologist's mindset.

"I'm very, very careful anymore," he said. "I don't just slam the ol' dozer into the ground."

After all, he never knows when the next dig of the century might turn up.

Snowmass Village

To dig deeper into the story of Snowmastodon, visit dmns.org/science/the-snowmastodon-project, or go to snowmassdiscovery.org.

Sculptor Kent Ullberg sits inside his work-in-progress "Snowmastodon." The finished sculpture was installed in front of the Denver Museum of Nature & Science in 2014.