



Caught on camera: filmmaker Ruth Berry checks out a tunnel in the Alaskan permafrost.

Tunnel vision

Is blasting into a river bluff any way to do palaeontology? **Alison Abbott** reports on an unusual expedition into the Alaskan wilderness in search of the bones of polar dinosaurs.

The rabid fox was almost the last straw. In the middle of the Alaskan wilderness, it was tugging at the guy ropes of the mess tent so ferociously that it had torn open its mouth, leaving a trail of bloody spittle across the snow. The gun was in another tent. One person distracted the fox by swinging at it with a frying pan, while another slipped out the back to retrieve the gun. But the ammunition was missing. It took fifteen terrifying minutes to locate it and shoot the fox.

"A comedy of errors" is how Australian palaeontologist Thomas Rich describes the scene. Not funny at all, counters Ruth Berry, the filmmaker who had travelled with Rich to the field site to film his unorthodox plan for getting to dinosaur fossils with the help of some well-placed dynamite. By the time the fox appeared, during the second of three intense expeditions, relations were such that Berry was close to walking away.

Five years ago, the project had looked distinctly more promising. "There are three themes you can always sell at a film market,"

says Berry, who has won assorted awards for her science documentaries. "Hitler, mummies — and dinosaurs." Rich was offering what seemed like a once-in-a-lifetime opportunity: exclusive filming rights to his plan to blast a tunnel into the northern Alaska permafrost above a bed of fossilized dinosaur bones.

At the time, Berry was making a film about the dinosaur bed that Rich, who holds a post at Museum Victoria in Melbourne, had worked for decades on the south coast of Australia with his wife, Patricia Vickers-Rich of Monash University. As Berry researched and shot the film that would be released as *The Terrible Lizards of Oz*, Rich told her how, in the mid-1980s, he had built a tunnel into a fossil-rich cliff face in Australia — and how he wanted to do something similar in Alaska. Such a tunnel, if it worked, would improve access to bones containing unprecedented infor-

mation about polar dinosaurs.

Seventy million years ago the Alaskan landscape was covered with a rich mixture of vegetation including deciduous conifers and ferns, and was home to diverse species of polar dinosaurs. Rich argued that a tunnel could reveal much about the Alaskan dinosaurs and the environment in which they lived¹.

When Berry, an Australian living in Munich, began shooting her new film, she was convinced of the purity and nobility of science and its processes. She lost this naivety quickly — but her documentary will have a happy ending. This summer she was able to film palaeontologists — although they did not include Rich — working the floor of a sturdy permafrost tunnel and finding what they describe as a treasure of fossilized bones. "The film may have an edge to it I hadn't predicted, though," says Berry. "The tensions in the field were often awful."



Hadrosaur fossils abundant in Alaska.

R. BERRY

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Palaeontologists traditionally rely on the natural forces of wind and water to expose fossils, and then work the bones out by hand using pick or brush. On rare occasions they will use earth-moving equipment to get closer to a fossil-rich rock formation. But Rich planned to use dynamite to blast a tunnel above a well-established bone-bed, in order to penetrate deep into the frozen ground to where fossilized bones had not been subjected to seasonal cycles of freezing and thawing.

New digs

Rich told Berry how difficult it had been to get research-funding agencies to pay for a tunnel. "But somehow I didn't believe him," she says. "I was convinced that the importance of learning about the past history of the Earth would be evident to any research body and that there would be no problem."

R. BERRY

Hawking the idea at film markets was as easy as Berry had thought, and she rounded up around \$800,000 — mainly from Film Finance Corporation Australia and from NOVA, a series produced by WGBH in Boston, but also from smaller investors, including the Australian Broadcasting Corporation and ARTE France. This, she reckoned, would cover the costs of three expeditions to bring film crews and scientists to the remote site.

Their target was the Liscomb bone-bed, located more than 900 kilometres north of the university town of Fairbanks, on the banks of the Colville River on Alaska's North Slope. The site is named after Robert Liscomb, the Shell Oil geologist who discovered fossils there while prospecting in 1961. Liscomb misidentified the bones as belonging to mammoths and died in a rockfall the next year; the fossils languished for years in Shell's archives. They came to light only in 1984, when Shell handed them over to the US Geological Survey, which identified them as 70-million-year-old fossilized dinosaur bones.

The Liscomb bed turned out to contain a whole trove of dinosaur fossils — mostly fragmented skulls and bones belonging to hadrosaurs, plant-eating dinosaurs known as duckbills. Throughout the 1980s and 1990s, the site had been worked by Roland Gangloff, a palaeontologist at the University of Alaska in Fairbanks, who then handed over key work to Anthony Fiorillo, a palaeontologist at the Museum of Nature & Science in Dallas, Texas, who specializes in Alaskan dinosaurs^{2,3}.

By spring 2007, Berry was set to go, but Rich had still not secured funding to build the tun-

nel itself. So Berry made the daring decision to pay for it with \$167,000 out of her film budget. This meant cutting back on computer animation — a high price to ensure the continuation of her filming project. "But, to be honest, I was seduced by the excitement of the science and the purity of scientific values," she says. "I felt I was doing something good for the world."

NOVA was keen to have an American protagonist in the film as well as an Australian. Berry got in touch with Fiorillo, widely seen as the leading expert on Alaskan dinosaurs, and arranged to film his team at a nearby bone-bed in August 2006, when the group planned to helicopter out a plaster jacket containing a huge horned dinosaur skull. And because the Australian Broadcasting Corporation wanted Rich to be the film's main protagonist, Berry paid for him to fly up and be filmed talking palaeontology with Fiorillo. Only then did she learn that you can bring scientists together, but you can't make them spark. During two days in the field, they didn't speak, in part because Fiorillo was ill. "I hadn't appreciated there would be rivalry," she says. "I'd imagined them talking together excitedly about the great science that might emerge."

Fiorillo and his colleagues clearly felt their site was being invaded by Rich's plan to test the feasibility of building a permafrost tunnel. "It's a bit audacious to go into a well-occupied site solely to see if a technology works," says Fiorillo.

That was a taste of problems to come. In March



Having a blast: Thomas Rich shows off a fossil.

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— Ruth Berry

2007, Berry left on her second expedition to the Colville, planning to bring the heavy mining equipment up on the still-frozen river. When she arrived in Fairbanks with her small film crew and a team from the University of Alaska, she found that the permits were not yet ready — delaying the start for two weeks.

Mike Kunz, the Bureau of Land Management field officer responsible for the Colville area, was also starting to worry that Rich did not understand the difficulties of working in the extreme conditions of the Arctic at that time of year.

"There was consternation about this among the expedition principals," he remembers.

Getting out to the site involves a two-day drive from Fairbanks through increasingly wild locations with names such as Coldfoot, Gobblers Knob and Last Chance. The road, built to follow and service the massive Alaskan oil pipeline, finishes at Deadhorse. From there, it is a four-hour drive southwest to get to a site maintained by the oil company ConocoPhillips, where Kunz arranged for the expedition to stay while a skeleton team travelled the remaining distance to set up the final camp.

High stakes

Team spirit broke down almost as soon as the full group reached the Colville. One of the stakes Rich had planted in summer a few years earlier to mark where the tunnel should be drilled had disappeared, and the remaining one seemed to be in the wrong place; squabbling ensued. And as temperatures sank as low as -40°C , and 20°C colder with wind chill, Rich worried team members by failing to adhere to safety instructions, often leaving his tent without the regulation hat and gloves.

Rich says that his experience working in Antarctica had taught him what was acceptable and what was not in extreme weather conditions.

Within ten days, a team of permafrost miners led by Robert Fithian had blasted into the river bluff and created the tunnel. Checking frequently that they were not hitting bones, and altering the angle when that seemed to happen, they carved a volume roughly ten metres deep, three metres wide and three metres high, with insulated thermal walls, a thermal door and a portico jutting out of the cliff face. The tunnel's floor rose towards the back so any water entering in the event of spring flooding could flow out again.

On the last morning, Rich decided to baptize the freshly minted tunnel with a bottle of champagne he'd brought for the occasion. The



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others were too busy at the time, so Rich went and opened the bottle alone. Not helpful, as far as the filmmaker was concerned. “We tried to redo the celebration later in the day,” says Berry. “I didn’t film it with the big camera because I thought it would look insincere.” It’s a decision she now regrets.

The final expedition, in August 2007, was to be the climax of the filming. Berry had hoped to capture a glorious moment when the door was opened. She would have liked to film Rich with Kevin May, a palaeontologist from the University of Alaska, locating the bone-bed after some careful digging — and ideally pulling out an extraordinary fossil specimen. But the August trip was no less traumatic than the spring one.

Floor plan

When the expedition assembled at Deadhorse, it emerged that Rich planned to use power tools to cut half of the tunnel floor into 40-centimetre blocks and transport them to a laboratory in Australia, leaving the other half for May to excavate with his more conventional methods. May was worried that blocks of permafrost might disintegrate when they thawed; Berry was furious at what she saw as a personal betrayal. “I’d invested a lot of time, energy and money in the project,” she says, “and there would be nothing to film if the bed was just carted away.”

Kunz was also concerned. He put Rich’s Bureau of Land Management licence on hold while he checked with experts to ensure that the large air compressor and its supply of diesel Rich planned to have helicoptered to the top of the bluff would not endanger the environment. He cleared that aspect, but put his foot down when it came to cutting the blocks. “These issues had not been addressed in the permit application,” he says, “and when Rich had mentioned it to me a few months earlier I’d informed him it wasn’t going to be acceptable. The blocks would melt into glob and we’d have no idea of the position of bones in relation to each other or to other items in the excavation unit.”

Rich, for his part, wasn’t happy with what he considered “micromanagement”. He says that none of the permit officers had asked for details about the method of excavation and that those on site in Alaska “did not understand the pioneering nature of the project”. He says he thought he could do more work in carefully controlled lab conditions away from the site. “The tunnel is so cold and cramped, it makes everything very slow,” he says.

With the disgruntlement following the team



Researcher Anthony Fiorillo talks fossils on the banks of northern Alaska’s Colville River.

to the bone-bed, the next disappointment was finding the tunnel chock-full of debris and ice — much more than had been anticipated — from spring flooding. May and his team were unable to help dig it out, having had no safety training with a jackhammer. The unskilled workers took as long to clear the tunnel as the miners had taken to dig it from scratch.

With no chance of removing the blocks, Rich left with his team of four a fortnight earlier than planned, even before the team had reached the bone-bed in the tunnel, and transferred his permit to May. By the time the film crew left, Berry did not have her hoped-for ‘eureka’ moment in the can. May then had only six days left to dig with his remaining team, comprising just one museum colleague, his 11-year-old son and Anne Pasch, emeritus professor at the University of Alaska. But he says that was long enough to dig 30 centimetres deep and find around 80 bones in good condition — “much better,” he claims, “than what we would have expected to gather outside, where they would have been subject to successive freeze-thaw cycles.” Although very cold, the tunnel was “a fabulous place to work,” he says. “And although we lost a lot of time this season, next year we’ll be better prepared and we’ll hit the ground running.”

But Fiorillo, who was working on the same bone-bed 75 metres from the tunnel in August, insists that it offers no advantage. “I have been finding intact fossils outside the tunnel without problem,” he says. He adds that the expedition

disturbed his own team: “The noise of the generator they were using to light the tunnel was making us crazy while we were working the bone-bed, not to mention all the helicopter traffic.” Fiorillo and his team were so harried they shifted their camp — “hard to imagine how it could get crowded in the Arctic, isn’t it?” he asks with dark sarcasm — and he says that they couldn’t excavate exactly where he wanted to. He also objected to Rich’s arriving at his technology project with a group of scientists.

But Kunz says that the tunnel worked “spectacularly well”. Berry, although still bristling, also concedes that the tunnel was a success. “In fact, it’s beautiful, but no one can say that it has proved its scientific value yet,” she says. “That will maybe happen next year.”

She says she’ll still have her film, even if the shots from Alaska were not all she had imagined. The back story — about how palaeontologists showed that dinosaurs really existed at the poles and how scientists are now trying to work out how they managed to survive in the cold, dark extremes — is exciting enough for most networks, she says. “In showing the world that dinosaurs really did live at the poles, I’ll have achieved my aim.”

Alison Abbott is Nature’s senior European correspondent.

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2. Fiorillo, A. R. & Gangloff, R. A. *J. Vertebr. Paleontol.* **20**, 675–682 (2000).
3. Gangloff, R. A., Fiorillo, A. R. & Norton, D. W. *J. Paleontol.* **79**, 997–1001 (2005).

See the online version of this story for a short video of Ruth Berry’s film in the permafrost tunnel

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