THE ART AND CUNNING CRAFT OF BUILDING

Dino Dazzlers

Prehistoric Project: Dino builder Peter May and the *Albertosaurus* he built for the Royal Ontario Museum.

Workshop wizard Peter May can put a spring in the step of a pile of dusty bones. And they won't look a day over 150 million years.

Article by IAN CRUICKSHANK *with photography by* JEFF SPEED

VIEWED FROM THE OUTSIDE, nothing about Peter May's office reflects the extraordinary nature of his job. Considering his professional intimacy with creatures that are a combination of menace, grandeur, and otherworldly bizarreness, you'd expect his workshop to resemble Frankenstein's castle. Instead, his company is housed in a mundane rose-bricked unit in an industrial mall in Oakville, Ontario. Inside, you walk through a long, narrow hallway to gain entry to a cavernous warehouse filled with various gizmos of industry. There's a huge yellow crane, a milling machine, a grinding booth, welding torches, hammers, chisels, and drills. Oh, and then there are the dinosaur bones—hundreds of them, lending an incongruous air of prehistoric mystery to this blandly modern setting.

"That's the baby *Barosaurus* we're working on," says May nonchalantly, as if every unit in the mall has a collection of dinosaur bones littering its concrete floor. A laid-back and unassuming man of 40, May peers down at a chunk of backbone that's gripped in a metal vice. Eventually, through an assembly system he has pioneered, the bone will be mounted on a metal frame and linked up with some 250 others to form a museum-quality display model of the dinosaur. Fully grown, an adult *Barosaurus* was one of the largest creatures ever to have walked the earth—a 24-metre-long, 54-tonne sauropod that existed some 150 million years ago. This particular model, however, is a baby—which May likens to a puppy. "You know how puppies have those gangly legs?" he asks. "Well, young dinosaurs were probably the same: with longer legs and shorter bodies—ungainly."

May's hands are thick, blunt, and powerful, belying his soft touch as a sculptor. Though he's not one to soul search about his motivations, you can sense his professional intensity as he eyes the bones scattered around him and visualizes the final product. "I'm proud of what we've done," he says. "Our dinosaurs are displayed in museums around the world."

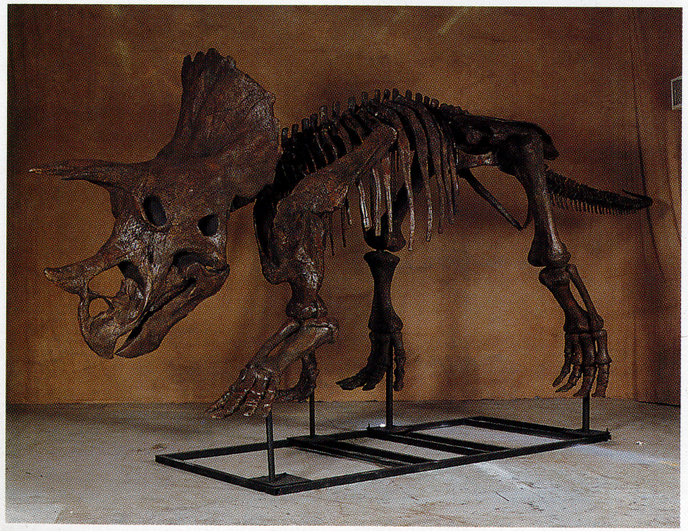
Technically speaking, May is a vertebrate palaeontological technician. That's a dino builder to you and me. He's one of only 30 full-time experts in the world who can take a project right from an expedition dig to the final mounting in a museum gallery. In the last four years, his firm, Research Casting International Ltd., has built some 200 dinosaurs for museums and exhibitions around the globe. Most famously, May's firm, which employs just five full-time workers and a handful of freelancers, built the giant skeletons of a *Tyrannosaurus rex* and an *Alamosaurus* that are featured in a climactic scene of the hit movie *Jurassic Park*. Thanks in part to the increased popular appetite for dinos that was fostered by that 1993 film's success, Research Casting is enjoying booming business these days. And it has moved beyond conventional fossil assembly into the more controversial practice of building popular displays that put flesh on the bones, expressing more complex scenarios of how dinosaurs may have looked and behaved (see story on page 50).

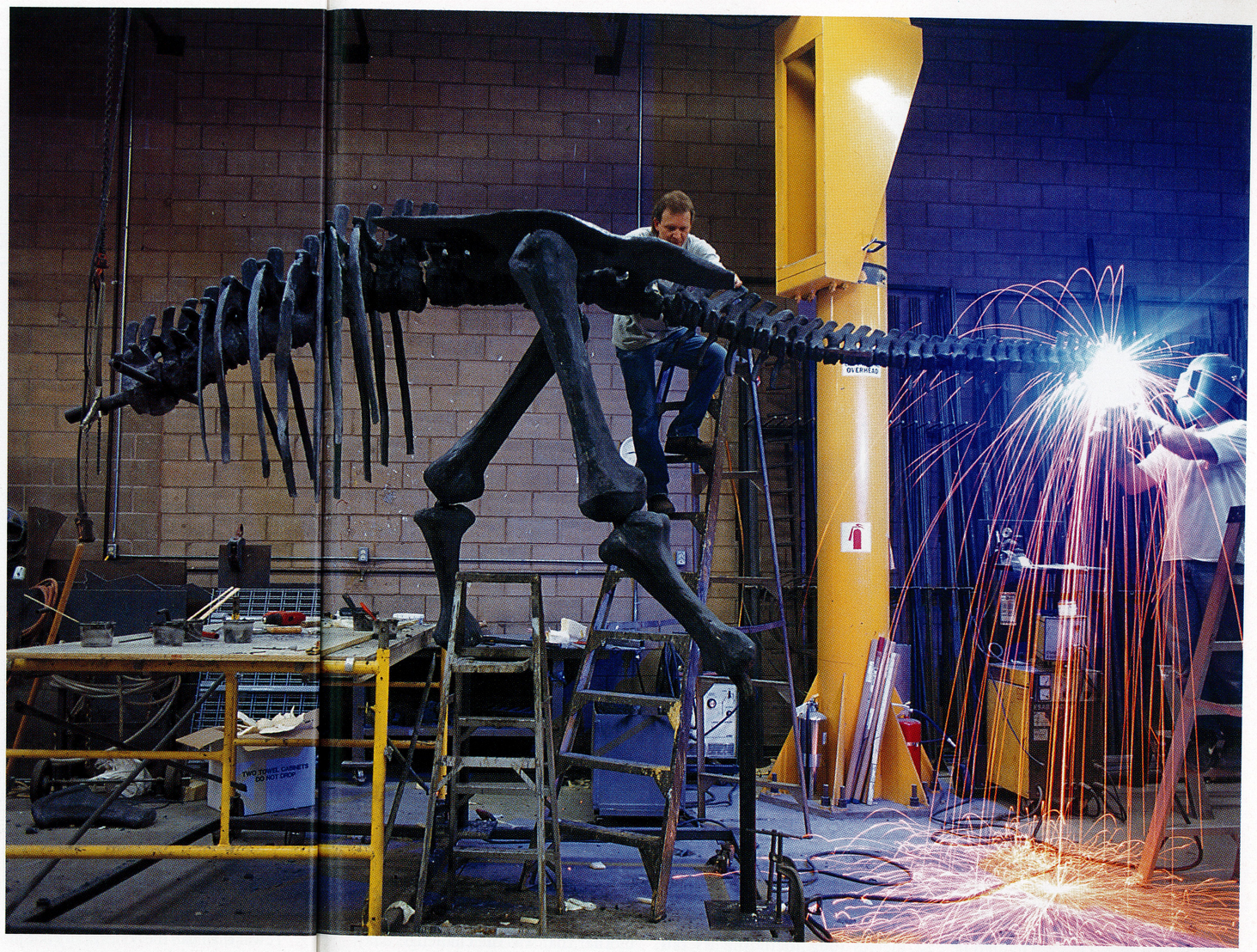
May, a former employee at two major Canadian museums, is now one of the few dino builders who work independently, without a salaried attachment to a large institution. That makes him a rarity in a job that in itself requires a rare blend of skills. "You have to know about palaeontology, be a sculptor, a welder, and know how to mould and cast," he says. "You can't go to school for it. It's impossible to learn all aspects of it without on-the-job training."

May's experience and native talents have won him many kudos in the museum community. Ian Morrison, chief technician of the ROM's vertebrate palaeontology department, says: "He has an innate talent for seeing how bones fit together. To do this job well, you need to be able to form a 3D picture in your head to figure out how to articulate the bones, and Peter has a really good eye for it."

Building a dinosaur from fossil remains entails a mix of precise technical craft and informed speculation. Only a few complete dinosaurs have ever been found in fossil form with every bone in correct articulation. Typically, to complete a display of a full creature, missing bones must be sculpted out of plasticene, their design based either on mirror parts

Bond seems trapped in the belly of a large beast as he works on the vertebrae on the underside of a *Triceratops* skeleton, near right. Sculptor Steve Wisenbaugh sends sparks showering as he welds on a section of the creature, far right, while Bond gives a bone a final touch-up. Built for a scientific company in Japan, the menacing *Triceratops*, below, looks set to chase off rivals and predators. The three-horned dinosaur roamed western North America about 70 million years ago, and its distinctive bony neck shield is thought to have provided an attachment for large neck muscles that allowed for mobility needed in combat.





are carefully drilled and threaded by May and his colleagues. Thanks to this system, May and his crew rarely need to travel to client museums to install a dinosaur. Typically, five or six sections of the animal are packaged up and sent off in large shipping crates with a box of bolts and an instruction manual. And, presto! At the destination museum, local technicians can often assemble a full display model in less than a morning's work.

How Peter May came to master his curious craft is more a matter of happenstance than charmed destiny. Born in Oldham, a small town on the outskirts of Manchester, England, May moved to Canada at the age of 8 and has no recollection of a youthful infatuation with dinosaurs. "I missed out on the whole dinosaur thing," he admits with a laugh. "They must have taught it after I left England but before I got to Canada." In high school, May discovered the pleasures of sculpture and decided to attend the University of Guelph to earn his B.A. in Fine Arts. The summer after his graduation in 1977, he landed an interview in Toronto at the Royal Ontario Museum (ROM), which had an opening for a junior technician in its vertebrate palaeontology department. The job involved a little bit of everything—making moulds and casts, repairing small engines, and driving a four-wheel-drive truck.

"They also asked if I liked to go camping, which I did," May recalls, "and I thought, this is a dream come true." May got the job but had one reservation. "I didn't know anything at all about dinosaurs, and that worried me. But Gordon Gyrmov, who was to be my boss, said, 'Don't worry, you'll pick it up as you go along.'"

May was immediately enrolled in the museum's unofficial apprenticeship program. Gyrmov, chief technician, helped him pick up pointers in palaeontology. May's knowledge of dinosaur assembly began right in the field: he went on many expeditions that immersed him in the actual business of locating and excavating dinosaur fossil sites. Back at the museum, he learned a lot about welding and working with steel from a man named Rudy Zimmerman, a former World War II Luftwaffe test pilot who flew the Messerschmitt jets.

In 1982, after a solid apprenticeship at the ROM, May was offered a job to help establish the Royal Tyrrell Museum of Palaeontology in Drumheller, Alberta. As senior technician, he was in charge of moulding and casting bones for almost all the original displays at the facility (which opened in 1985 and now boasts 40 dinosaur displays, making it one of the largest museums of its kind in the world). Then, in 1986, Gord Gyrmov passed away, and May was hired as chief technician back at the ROM in Toronto. At the ROM, as at the Tyrrell, May was approached about doing outside work for

Snyder watches as Rehkopf paints a model *Barosaurus*, prototype for a larger museum version with animated parts.

other institutions. He soon figured it made sense to start up his own firm. So, in 1987, Research Casting was born.

An early job that dramatizes some of the extreme challenges in May's work was a prestigious assignment from the American Museum of Natural History in New York. It called on May to build a fully grown *Barosaurus* that would be the tallest freestanding dinosaur skeleton ever constructed—a one-tonne replica, 15 metres tall and over 24 metres long including its tail. And as if that wasn't enough, the museum decided to tag a story line onto the exhibit: the *Barosaurus* and one of her offspring would be attacked by the carnivore *Allosaurus*, an especially nasty meat-eater. To fend off the predator, the mother *Barosaurus* would rise up on her hind legs, ready to save her child by smashing down on the *Allosaurus*.

Both the carnivore and the juvenile *Barosaurus* were constructed fairly quickly. It was the five-storey mother that was the challenge. May and his crew drove down to New York to collect the bones—original fossilized specimens—and he remembers trying to pick up the hip bone. "It weighed 400 pounds and took four of us to move it," he recalls.

Although the American museum had 80 percent of the fossil bones of the complete creature, the real bones were far too heavy for a freestanding mount. So, Research Casting took latex moulds from the originals and used polyurethane foam (a lighter material than the more standard WEP) to pour casts. The missing pieces of the *Barosaurus* were completed by using examples from *Diplodocus*, a closely related type of sauropod. May's version of the *Barosaurus* tipped the scales at a healthy 900 kilograms, with the majority of the weight in the bottom half of the skeleton. To ensure that the enraged mother wouldn't come crashing down, May reinforced the mount. "The vertebrae of the lower back were huge, so we went with four-inch steel," he says. Fully built, the mother *Barosaurus* was too tall to fully rear up inside Research Casting's warehouse, so May hired a crane to hoist the pieces and mounted the dinosaur out in the parking lot. The crew eventually loaded the three disassembled dinosaurs into a van and reassembled them in the rotunda of the American Museum of Natural History.

"The exhibit has the effect of causing awe and wonder when people walk into the rotunda," says Lowell Dingus, the museum's director of special projects. According to Dingus, the display is designed to show both what palaeontologists know and, more importantly, what they don't know about these prehistoric marvels. "Fossils are good at telling some things, like the size of the dinosaur and who it is related to," says Dingus. "But other questions, such as how they behaved, what colour they were, or what kinds of sounds they made, we can't answer. We don't know for sure if the *Barosaurus* could rear up on its hind legs or would go into this defensive position." For this particular exhibit, the museum curators got together to discuss what form the display should take.

May's most high-profile assignment came in 1992 when he spotted a report that Steven Spielberg was making a movie about dinosaurs. "I read in the newspaper about the plans for making *Jurassic Park* and sent his company a letter saying, here's what we do, if you need a skeleton give us a call," says May, in typically matter-of-fact fashion. "And they did." Soon after, May and his crew were on a Hollywood sound stage, mounting a skeleton of a *Tyrannosaurus rex* menacing an *Alamosaurus*. During a crucial chase scene, four of the movie's main characters try to escape a villainous *Velociraptor* by swinging onto one of the skeletons, sending the mounted bones crashing to the floor.

After the movie, the Research Casting crew rebuilt the skeletons and, using moulds from the movie, cast and then painted fleshed-out versions of some of the dinosaurs from *Jurassic Park*. With Spielberg's cooperation, May put together an exhibit that included the dinosaurs, props and clips from the movie, and a scientific section with real fossils. "The Dinosaurs of *Jurassic Park*" went on display at The American Museum of Natural History on the same day the movie opened, and within three months, over 400,000 people viewed the display. Research Casting later built a second set of dinosaurs for a *Jurassic Park* exhibit that toured museums throughout Europe and South America.

May expects that his company will increasingly produce these kinds of displays. The current fascination with dinosaurs continues unabated, and Research Casting is cranked up for a busy season. Besides the baby *Barosaurus*, orders include a *Triceratops* for Japan, a mastodon for New Brunswick, 10 miniature dinosaur models for an animation project in New York, and an exhibition devoted to the Ice Age.

Whenever the work gets to seem a little too much, May and his crew take comfort in the knowledge that they can really make an impact. "When our dinosaur arrives at the museum it becomes a huge celebrity," he says. "A couple of years ago we built an *Ankylosaurus* [a nine-metre-long plant-eater with a spike-studded back] for a museum way out in the Japanese countryside, and when we arrived, it turned into a festival. The Shinto priests came and blessed the dinosaur, and the next day we were invited to a green-tea ceremony. We got dressed in kimonos and walked up to the home of the oldest man in the village, where we had the tea, and he then showed us some ancient paintings." May pauses and concludes—in what is truly high emotion for him—"It was really something."

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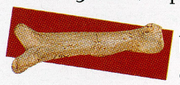
Amid rows of replica dinosaur bones, Research Casting artists Mark Rehkopf and Tim Snyder put finishing touches on a model baby *Barosaurus*, left. Top, the claw and foot bones of a *Deinonychus* await moulding. Above, technician Warren Bond paints a gel coat onto a rubber mould for a *Centrosaurus* skull. Playing an important role in the complex casting process, this gel picks up the finest details of the bone.

of the original fossils or on bones of another dinosaur of a similar species. And today, in fact, most exhibits mounted by newer institutions are constructed entirely of replicas of original bones. "Few museums can get the real thing," says May. "If a museum in Japan, say, wants an original dinosaur, they would have to spend half a million dollars for an expedition to find one." So, instead, they go to someone like May, who can build them a model based entirely on castings from originals, and costing between $5,000 and $130,000, depending on size.



To recreate a bone, May and his colleagues coat the original fossil or the plasticene replica in a flexible mould-making material, such as latex. Once the latex dries, it forms an exact mould of the fossil; the dino makers then split the mould open along its seams and remove the original. A hard fibreglass jacket, or shell, goes over the rubber mould to hold its shape; then, through a pour spout in the mould, they fill the cavity with water extended polyester (WEP), a kind of durable plastic. After about five minutes, the WEP hardens into a new replica of a dinosaur bone, then is popped out of its jacket and taken to a grinding booth to shave away the flashing left from the seams of the mould. The bones are then painted with acrylic paint to match the colour of the original fossils; sometimes they are given a final protective coating of clear acrylic spray.

In casting the bones for the *Barosaurus*, May faced some typical challenges. Fewer than half the bones of any one juvenile *Barosaurus* have ever been excavated; for this model, about 60 percent were missing from the original skeleton and had to be sculpted. To base his extrapolations on real evidence, May had to do considerable research. "I went down to the Dinosaur National Monument in Utah where they have part of what may be a young *Barosaurus in situ*," May says. "I took a rubber mould from the rock face, and it gave us the hind and fore limbs and part of the hip." Then May had to decide how to pose the model dinosaur. Usually the client sends May a drawing of what they want. He then assesses whether the pose is anatomically possible by looking at the range of available motions based on the "vertebrate mechanics" of the actual fossil. He suggests changes where necessary, and if the client agrees with them he goes ahead with building the model.

Once fully sculpted, the *Barosaurus* bones are ready to be assembled. This is where May's particular ingenuity shines. He uses something he calls the key-way system, which allows the entire fossil to be built in several modules that can be shipped easily and assembled quickly by technicians at the client site. It works this way: holes are drilled through the core of individual bones so they can be slid onto lengths of steel tubing; bones of the skull, neck, backbone, tail, and legs are each joined together to form a separate module; and then the modules can be connected by bolts that fit snugly into holes that