challenges Bilodeau discovered in trying to give an artistic expression to her themes.

Initially, she had envisioned creating a traditional narrative, centred on the opening up of the Northwest Passage and its potential impact on Inuit communities. But after spending three weeks on Baffin Island — exploring the land, meeting Inuit elders and talking to people from different walks of life — she decided a standard storyline, one with a main character facing a singular challenge, would not meet her needs. The issues are simply too complex for a singular point of view.

So, *Sila* focuses on an ensemble of characters — a climate scientist, an Inuit activist and her daughter, an elder, a member of the Coast Guard, and a polar bear and her cub — through whom Bilodeau explores the facets and interconnections of many points of view.

"I wanted people to understand the complexity," she says. "That's the only way you can stay away from being radical, which isn't helpful."

Two productions of *Sila* have already been mounted, one at the University of New Hampshire and one at the Underground Railway Theatre in Cambridge, Mass.

Bilodeau is also deep into the second play of her cycle. Called *Forward*, it takes its title from the English translation of the Norwegian word "fram," the name of the ship explorer Fridtjof Nansen sailed in his late-19th century attempt to reach the North Pole. Again, her work weaves together multiple points of view, using travel through time to meet characters behind pivotal developments in our relationship to the Arctic and explore the history of climate change.

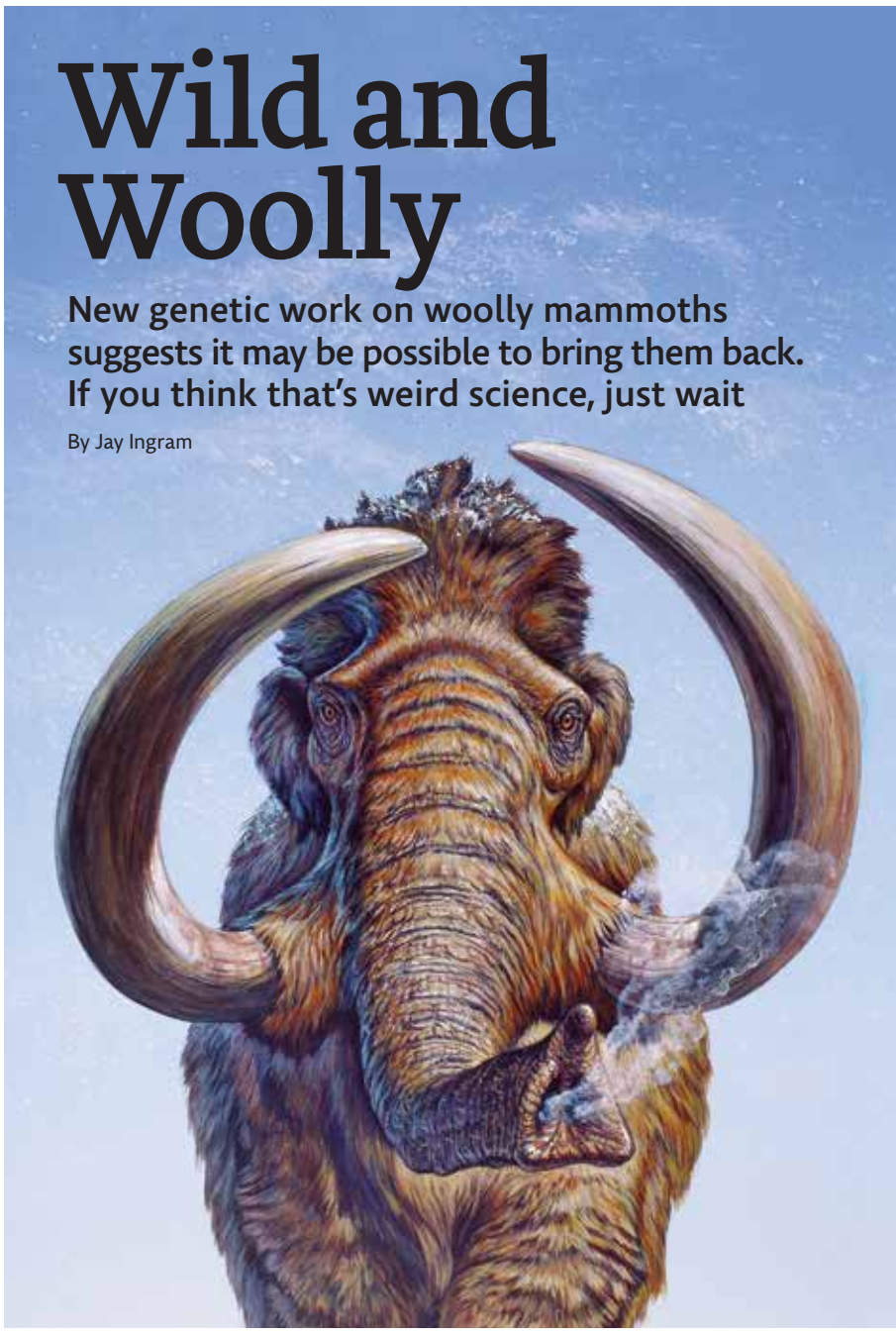
Forward will premiere at Kansas State University in 2016. Bilodeau, meanwhile, has started conceptual work on the third play in a series. Completing the entire project "will probably take my whole career," she admits. But even in these early stages, her larger goal is clearly in focus.

"I want to inspire hope," she says, noting that much of the art created around the issue of climate change tends toward the apocalyptic point of view. "Not to belittle the urgency of the problem, but I want to think about it in a way that is hopeful so that we can do something and not feel so powerless."

Wild and Woolly

New genetic work on woolly mammoths suggests it may be possible to bring them back. If you think that's weird science, just wait

By Jay Ingram



MARK HALLETT PALEOART/SCIENCE PHOTO LIBRARY

A mild sensation was created recently by the announcement that the entire genome of the woolly mammoth had been sequenced. Two animals were the source of the genetic information: one was part of the last population of dwarf mammoths, which died out about 4,000 years ago on Wrangel Island in the Arctic Ocean; the other, a Siberian animal that died about 45,000 years ago.

A small part of the excitement created by this announcement centred on the technical feat of reconstructing the genome of an animal long extinct. But much more attention was paid to the possibility that we could now "de-extinct" the mammoth. That is, clone the animal and re-establish it on Earth. This idea deserves a more thorough airing than I have the space for here, but it has a romantic attraction to it, a longing for a return to a wilder, more fantastic world, that until now we've only imagined through museum dioramas.

It's not just the genome sequencing that seems to have brought the possibility closer. In March, a Harvard team revealed that they'd managed to use recently perfected genetic techniques to splice mammoth genes for ears, subcutaneous fat and hair into the DNA of skin cells from a modern elephant. Once there, the genes actually began to produce their specialized proteins, the first time ever that mammoth genes have been working on Earth since the last individual died.

However, the notion of bringing the animal back carries with it significant downsides. For one, captive female elephants would have to incubate the cloned egg, and who would volunteer one to be an experimental animal? And even with substantial fiddling, the first offspring, and the next few that followed, would not be genetically "pure" mammoths anyway. (Although my column of March/April 2012 made the point that most of our living bison aren't genetically pure, either.)

Nevertheless, it's all exciting, multi-faceted and controversial. I'm disappointed, however, that my favourite mammoth controversy is now buried so deeply in the landfill of discarded ideas that it did not even merit a mention in the light of this discovery. This is the dubious "theory" that the abundance of frozen mammoths found in Siberia provided evidence of a cataclysmic event. Maybe even an event of biblical proportions.

Psychiatrist and independent scholar Immanuel Velikovsky, author of such controversial 1950s bestsellers as *Worlds in Collision* and *Earth in Upheaval,* was best known for the notion that catastrophic events on Earth (some referenced in the Bible) were caused by near misses of a wayward planet hurtling through the solar system. Astronomers (including Carl Sagan) went to the lengths of publishing books dismissing these ideas. But Velikovsky also turned his attention to the mammoths, arguing that the discovery of frozen mammoth carcasses in Siberia demanded a special kind of explanation:

"The sudden extermination of mammoths was caused by a catastrophe and probably resulted from asphyxiation or electrocution. The immediately subsequent movement of the Siberian continent into the polar region is probably responsible for the preservation of the corpses."

The movement of the Siberian continent into the polar region?

Here, Velikovsky was asserting that immediately before their mass die-off, mammoths were living in temperate climes. The wrenching near miss of a planet changed the tilt of the Earth and deposited the animals in Siberia, whereupon they immediately froze to death.

There were indeed forces acting against these fabulous animals, but a rogue planet wasn't one of them.

Evidence for this? The sudden extinction of the so-called "megafauna" — mammoths, mastodons, cave bears and many others — bothered Velikovsky. (It is still puzzled over, with consensus these days lighting on a combination of climate change and hunting.) He couldn't figure out any mechanism for freezing mammoths relatively intact, absent of significant spoilage, other than an immediate plunge into bitter Arctic temperatures.

The most bizarre twist in this story was that the Birds Eye frozen-food company experimented with flash freezing and purportedly concluded that for the mammoths to be preserved the temperature had to fall abruptly to -100 C.

Velikovsky also complained that there was nowhere near enough vegetation in Siberia to support a robust population of mammoths. Although fans of his work have added that the stomachs of frozen mammoths contain temperate plant species, detailed examination of stomach contents have revealed an uncontentious array of grasses, sedges and other tundra plants.

The easiest explanation for frozen mammoths is that they fell or stumbled into a mix of muck, sand and water, were buried and eventually froze, only to reappear as the ice melted back.

Not that the Velikovskian ideas need another nail in their coffin, but the genome work revealed that mammoths underwent two significant population crashes, separated by hundreds of thousands of years. There were indeed forces acting against these fabulous animals, but a rogue planet wasn't one of them.