Reflections

Robert Silverberg

A Bad Day for the Dinosaurs

The other day I felt a sudden wave of sadness come over me as I thought about the poor dinosaurs, extinct so long, wiped out, apparently, in a single day's vast calamity after having enjoyed the pleasures of our world for so many hundreds of millions of years. How extraordinary the big fellows were, how remarkable! And all of them gone. Suddenly I missed them terribly.

I did not, as a matter of fact, find myself wishing they were still extant and wandering around my neighborhood, though. For the past fifty years I have lived in a quiet suburb of San Francisco, in a hilltop home surrounded by a six-foot-high brick wall with an almost impenetrable mass of spiky succulents forming a second barrier on the street outside the wall, and now, in my very senior years, I live a peaceful secluded life. I'm not eager for any sort of disturbance. Since I've been here, I've experienced a major earthquake, a couple of years-long droughts, a vast firestorm that destroyed the neighborhood just adjacent to mine, and two serious frosts, rarities in our generally benign climate. I regard that as my quota of excitement. I don't really want to see the toothy head of a Tyrannosaurus grinning at me over my wall. I don't want a ponderous Brontosaurus marching through my garden. It's bad enough that we have frolicking squirrels uprooting plants here and there, neighboring cats staging their brawls in the shrubbery, the occasional skunk leaving an aromatic souvenir in the dawn. I don't need stupendous gigantic beasts to deal with, too.

And yet I feel sad about their being extinct. I wish we still had some somewhere—at a safe distance from me, of course. Michael Crichton, in *Jurassic Park,* put a whole zoo of reconstituted dinosaurs on an island off Costa Rica, but left us with the threat of rampaging velociraptors getting loose and making trouble on the mainland. A dozen years before that, I used the same idea in a short story called "Our Lady of the Sauro-pods," but I played it safe by putting my reborn dinosaurs on a space satellite, where they posed no danger to elderly residents of the San Francisco Bay Area.

Like most small children, I became fascinated by dinosaurs at an early age. It was my good fortune to live within a subway ride of New York's awesome American Museum of Natural History, which has one of the world's most celebrated collections of fossil dinosaur skeletons on display. Frequently of a Sunday when I was eight or nine years old, my father would take me there to gape at those colossal reptilians on the fourth floor. (The museum holds plenty of other wonders, too, but it was always the dinosaurs that drew me first, and often, after I had moved from one familiar fossil to the next, there was no time left for seeing the rest of the exhibits on the lower floors.) It was those dinosaurs, I'm sure, that awakened in me the romantic sense of the immensity of change that time brings, a feeling that stood me in good stead when I looked in the other direction and began writing stories of the remote and mysterious future.

Like most small children, too, I diligently learned the names of the most celebrated dinosaurs, and could rattle off polysyllables like "Stegosaurus" and "Triceratops" with preternatural ease. Most diligently did I study the dinosaur books my father bought for me in the museum shop, and I still have them today, seventy-five years later. Here is *Fossils,* by the Yale paleontologist Richard Swann Lull, the 1935 edition, a book that was only a few years old when I acquired it. (So was I.) And here is a little pamphlet called "The Sinclair Dinosaur Book," vintage 1937, published by the

Sinclair Oil Company, which has used dinosaurs as a sort of trademark since 1930. (And which stays on theme: these days Sinclair gas stations can provide you with Covid-19 masks portraying them.) On the inside cover I see inscribed, in my childish handwriting of the World War II era, "Property of Robert Silverberg. Please return if lost." But the booklet was never lost: here it is today, still cherished by me.

What we did lose was the dinosaurs. And what we now know, something that was unknown when grade-school me was staring up at the enormous fossil skeletons looming above me in the museum, is how the big beasts met their end.

Some years back it became clear, thanks to the work of Walter Alvarez of the University of California, that what had done in the giant saurians was a single catastrophic event: the collision of a huge meteor into the sea near Mexico's Yucatan Peninsula sixty-six million years ago, creating a crater sixty miles across and twenty miles deep. The impact hurled debris outward for thousands of miles, quite likely as far as the Moon, filling the upper atmosphere with so much sand and rock that the light of the Sun was almost completely cut off, causing an immediate and drastic drop in the Earth's temperature. At the same time, the water displaced by the collision rose in the form of an enormous tsunami, with waves several hundred feet high, that went rolling out over the adjacent coastline, carrying a great population of surprised sea creatures far inland. Within half an hour or so, all that water came sloshing back into the newly formed crater, bringing with it a load of sand and gravel, along with it a burden of trees, rocks, and freshwater fish. And as a secondary effect, earthquakes and tsunamis and wildfires were triggered all over the planet. A bad day, indeed.

And for the dinosaurs it was a death warrant. Small cold-blooded creatures like lizards and snakes, with slow metabolisms, could crawl into burrows and wait it out while the dust settled and temperatures gradually returned to normal. Minor mammals, among them our ancestors, could hide the same way. Plants survived in the form of seeds, spores, bulbs, underground tubers. But the major dinosaurs had no place to hide and, though some of them evidently were warm-blooded, unlike most reptiles, their great size made it impossible for them to adapt to the sudden change in the weather. With astonishing speed, speaking in terms of geological time, the dinosaurs all perished.

Some recent scientific work has shed new light on the extent of the catastrophe. In North Dakota, a goodly way north of the Mexican impact crater now known as Chicxulub, a rancher discovered a rich fossil bed in 2012 that contained a jumble of trees, branches, fishes, and other animals, all plainly millions of years old and showing signs of some terrible apocalyptic event: everything was glued together by sediment and debris, the tree trunks were charred, the huge sturgeon and paddlefish had been ripped and smashed, the carcasses of other creatures showed no sign of bloating or decay, indicating that they had all perished swiftly—in a moment, in the twinkling of an eye, as the Biblical phrase has it.

The rancher quietly mined his find for a few years, selling off some of the fossils, but eventually he called in a paleontologist from the Palm Beach Museum of Natural History, Robert A. DePalma, to make a scientific investigation of the site. DePalma found an abundant store of fossils there—"You would be blind to miss the carcasses sticking out," he said—but what particularly caught his attention were multitudes of tektites, little glass beads that are created by planetary impacts of titanic size. Most of the fossilized fish at the site had tektites in their gills, as though they had inhaled them at the moment of death. What DePalma noticed next was that the top layer of the fossil zone was rich in iridium, an element similar to platinum more common in meteorites than it is in the rocks of Earth.

Tektites—iridium. It was an immediate link to the Chicxulub meteor that was the

doomsday event for the dinosaurs. The chaotically scrambled trove of fossils and telltale companion minerals in that North Dakota fossil bed provided what one of the paleontologists called a "snapshot" of the day the Mesozoic world ended.

Alvarez and his associates, years before, had found the Mexican crater teeming with tektites: the tiny glass spheres had been created by the fiery impact, flung high in the air, and fallen back from the sky. And the layer of sand and gravel that had been deposited by the waves returning after the tsunami was laden with iridium. The age of the North Dakota fossil deposit, marked as it was by tektites and iridium as well, left little doubt that it had been laid down on that very day that the meteor had hit the Gulf of Mexico. The Earth had absorbed such a blow that rivers and lakes even as far as North Dakota had risen from their beds and fallen back again, carrying with them a heavy burden of atmospheric debris that entombed the trees and marine creatures until their discovery sixty-six million years later.

There was no summer the year of the meteorite. Nor the year after that, nor the next one, either. A shroud of debris filled the air; sunlight could not get through; the great reptiles struggled against the unfamiliar chill, until only the hardiest of them remained, and then they, too, succumbed. Leaving their fossilized remains in fossil beds all over the world until, millions of years later, the remote descendants of certain tiny mammals that had survived the change of climate dug them up, reassembled them, and mounted them for display in museums, where the small boy I once was stared at them in awe and wonder.

As I said, I get along quite well without having to cope, amidst the various other challenges that life in California presents me with (earthquakes, fires, droughts, traffic jams), with thirty-foot-long reptiles intruding on my suburban retreat. Yet my childhood fascination with dinosaurs has never abated, and in a strange way I feel sorry for them, going about their saurian business as they were, the great herbivores munching up huge quantities of vegetation every day, the great carnivores eyeing the herbivores and thinking about lunch, when—suddenly—a visitor from space, traveling its errant course through the heavens, found its way to the Gulf of Mexico.