

**New Introduction to the 2011 Edition of *The First Fossil Hunters***

**Dinosaurs, Mammoths, and Myth in the Greek and Roman World:  
Tracing the History of Human Curiosity about Fossils**

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This book was researched and written in the late twentieth century, based on a radical idea: that the prehistoric fossil record and Greek and Roman mythology were somehow related. When *The First Fossil Hunters* was first published, in 2000, geomythology—the science of recovering ancient folk traditions about complex natural processes or extraordinary events—was an emerging discipline. That ancient people observed, collected, measured, and displayed the fossils of immense, extinct species, and that they had, moreover, recognized them as the traces of remarkable creatures that had flourished and then perished in a distant era, were alien concepts. Scholars had generally regarded ancient Greek and Latin descriptions of the bones of giants and monsters as nothing more than tall tales or superstition. Classicists were unaware that the fossils of dinosaurs, mastodons, mammoths, and other extinct animals were conspicuous features of the natural landscape in antiquity. Scientists, for their part, did not realize that fossils were part of the Greek and Roman cultural landscape.

As the first comprehensive study of ancient observations and interpretations of fossils, from huge dinosaurs to tiny shells, this book documents a vast and long-neglected body

of literary and archaeological evidence, from Homer to Saint Augustine, to show how fossils captured the attention of Greeks, Romans, and their neighbors. Myths, legends, and historical accounts reveal how ordinary folks struggled to understand puzzling petrified remains of unfamiliar creatures buried in their own backyards. Prescientific fossil descriptions, often expressed in mythical language, contain perceptive insights about the deep past. Those ancient understandings were lost during the Middle Ages and only rediscovered in modern times.

In the decade after the original publication of *The First Fossil Hunters*, the evidence for fossil encounters in antiquity has been embraced by classical scholars, ancient historians, archaeologists, art historians, philosophers, geologists, paleontologists, geomythologists, and historians of science. Today, this book serves as a text for college courses in both classical mythology and the earth sciences, and its results are used in educational programs in art, archaeology, myth, biology, anthropology, paleontology, and natural history. *The First Fossil Hunters* has even inspired some novelists (examples include H. N. Turteltaub, *The Gryphon's Skull: A Seafaring Novel of the Ancient Greeks*; and Jack DuBrul's *Havoc*).

American and European television shows about dragons, monsters, giants, and other mythic creatures have featured some of the fossil stories gathered here. One popular example is "Ancient Monster Hunters," the History Channel documentary about my research, filmed at the American Museum of Natural History in 2004. Each time this and similar shows appear on TV, every time a museum exhibition presents fossil legends, and

after each illustrated lecture or interview, I receive letters, emails, and artwork from another generation of children, students, scientists, academics, and independent scholars excited by the links between fossils and fabulous creatures. Many standard reference books on paleontology and dinosaurs now include my theory (presented in chapter 1) that the griffin of Greek myth arose from nomads' observations of well-preserved dinosaur remains in Central Asia. A children's book, forthcoming from *National Geographic*, explains how my detective work revealed dinosaur skeletons lurking at the heart of ancient tales of fierce griffins guarding gold.<sup>1</sup>

Interdisciplinary studies and geomythological investigations are now moving to the forefront of science. For the first time, encyclopedias of mythology, ancient history, and geology include entries for "Fossils" and "Geomythology." An important international collection of geomythology papers, *Myth and Geology*, was published in 2007. Other pathbreaking geomythological publications include Elizabeth and Paul Barber, *When They Severed Earth from Sky: How the Human Mind Shapes Myth* (Princeton University Press, 2004), which explores how myths encode geological events and evidence; and seismologist Amos Nur's *Apocalypse* (Princeton University Press, 2008), which integrates archaeological and legendary evidence for earthquakes. Cindy Clendenon's *Hydromythology and the Ancient Greek World* (Fineline, 2009) analyzes Greek myths in terms of karst geology. Fossil folklorist Christopher Duffin combines geology, medicine, and popular lore in articles on the history of medical uses of invertebrate fossils. In *The Star-Crossed Stone* (University of Chicago Press, 2010), paleontologist Kenneth

McNamara surveys the cultural history of sea urchin fossils from Neolithic times to the present.<sup>2</sup>

The research for this book, much of it undertaken in the quaint era antedating email and lightning-fast electronic searches of texts and images, was daunting. Collecting the widely scattered, long forgotten ancient literary and archaeological evidence—and then comparing it with obscure paleontological reports—was an arduous labor of love. I spent nearly two decades combing through unindexed Greek and Latin literature for accounts related to fossils, corresponding by “snail-mail” with international scholars and scientists, and traveling to natural history collections and archaeological museums. I devoted gloriously happy hours in dimly lit library stacks to searching out books and journals about nineteenth- and twentieth-century archaeological and paleontological fieldwork. I’m still amazed by the generosity of so many specialists in so many diverse disciplines, who seemed delighted to share their knowledge with an obsessed outsider on a strange mission. My incessant pestering of classicists, geologists, and other specialists turned out to have an unanticipated good result. This quest helped to introduce many scholars from the humanities and sciences to one another for the first time. Today, people of all ages, interests, and educational levels attend my presentations about ancient fossil discoveries. University seminars and public lectures about fossil-related legends are sponsored by unheard-of coalitions of departments of classics, biology, art, geology, archaeology, and philosophy, whose members rarely interact otherwise. *The First Fossil Hunters*, I’m proud to say, has crossed many seemingly insurmountable disciplinary borders.

This book's development was sometimes frustrating but mostly exhilarating. The sensation of losing track of time and place while submerged in libraries and museums often put me in mind of Jacques Cousteau's phrase *l'ivresse des grandes profondeurs*, "rapture of the deep," to describe the giddy intoxication experienced by divers exploring hitherto inaccessible undersea realms. Frequent serendipity, occasional eureka moments, and small triumphs were rewards that kept me going. One day, in Princeton's Firestone Library, I drew two maps of the Aegean world on transparent tracing paper. On one map, red X's marked the spots where people had reported the bones of giants or monsters in antiquity. On the other map I circled the rich deposits of mastodon, mammoth, and other large vertebrate fossils known to modern paleontologists. Fingers crossed, I superimposed the two sketch maps. The X's and O's matched! Maps 3.1, 3.2, and 3.3 show the results.

Another dramatic moment came after months of searching in vain for what proved to be the fossil femur of an Ice Age woolly rhino, treasured by ancient Greeks and unearthed nearly two millennia later by archaeologists in the 1970s. Once stored on the ancient acropolis at Nichoria, southern Greece, perhaps revered as the thigh bone of a mythic giant, this fossil was presumed lost when I began writing *The First Fossil Hunters*. After a long, involved correspondence, to everyone's surprise, the precious relic—a rare example of a large animal fossil collected in antiquity and recovered by modern archaeologists—finally turned up in a cellar in Duluth, Minnesota, where it had gathered dust for more than twenty years. The story of this historic bone is told in chapter 4. From its origins in the Peloponnese, the ancient fossil has traveled from the Mediterranean

across the Atlantic to northern Minnesota, then east to New Jersey and New York City, west again to Bozeman, Montana, and Palo Alto, California. Now, ten years after the original publication of *The First Fossil Hunters*, I'm delighted to say that the peripatetic Nichoria Bone is en route to a permanent home in the Ashmolean Museum, Oxford University, where it will be displayed in the Greece Gallery.<sup>3</sup>

Since 2000, natural history museums have begun to refer to mythic creatures in fossil displays and to produce popular exhibits drawing on the concepts first presented in this book. In 2006, for example, the Teylers Museum, Netherlands, invited me to deliver the keynote address for a popular exhibit directly inspired by *The First Fossil Hunters*: "Fossils and Folklore, Dinosaurs and Dragons." The next year, 2007, I served as a consultant for the American Museum of Natural History's blockbuster exhibit "Mythic Creatures," which also draws on some of my research. One display compares the griffin of Greek myth to a *Protoceratops* skull from Central Asia. Another case explains how ancient sailors might have mistaken a fossil mammoth skull for a one-eyed Cyclops. The "Mythic Creatures" show travels to natural history museums in Chicago, Boston, Toronto, Sydney, Atlanta, and other cities around the world, through 2017.<sup>4</sup>

The London Museum of Natural History maintains an online compendium of folk beliefs associated with invertebrate and vertebrate fossils. In 2010, the museum put together a traveling exhibit, "Myths and Monsters," with animatronic and other dramatic displays of legendary creatures, expanding on an earlier show, "Fascinating Fossil Folklore," which opened at the Walter Rothschild Zoological Museum in 2007. In 2008 the Brabant

NaturMuseum invited me to contribute examples of fossil myths for children's educational programs, similar to online fossil legend and geomythology seminars I've designed for young students. In a show called "Dragons Unearthed" (2008), the largest children's museum in the United States (Indianapolis) unveiled a spiky dinosaur skull dubbed *Dracorex hogwartsia* alongside displays of fossil-related creatures from mythology. Meanwhile, books on the science underlying Harry Potter's magic explain how fossils influenced ancient ideas about griffins and giants.<sup>5</sup>

The idea that impressive fossils played a role in how people of the past imagined monsters and giants has been influential on several surprising fronts. People now realize that in fossiliferous lands, the bizarre bones of extinct creatures could help to explain dragon imagery. This idea was taken up by the Lyric Opera of Chicago for the portrayal of the terrible dragon Fafnir in Wagner's opera "Siegfried." For the first time in opera history, Fafnir appeared on stage in 2004/2005 as a gigantic, terrifying skeleton of a prehistoric reptile. Sixteen black-clad acrobats manipulated the monster's long, bony vertebrae and massive skull. Chicago operagoers could compare this revolutionary Fafnir dragon with the magnificent *T. rex* dinosaur unveiled in Chicago's Field Museum in 2000, and with archaic bronze griffins from Greece, displayed in the Art Institute of Chicago.<sup>6</sup>

Many other exciting new discoveries, theories, events, displays, and publications are increasing our knowledge of fossil encounters in pre-Darwinian cultures. The following

pages describe some striking new developments since 2000, which elaborate and update the material presented in chapters 1-6.

Chapter 1 begins with my visits to a tiny fossil storeroom above a village post office and to the modest archaeological collection on the island of Samos. Today, the impressive fossils of Samos are displayed in the new Aegean Natural History Museum in Mytilini, and the bronze griffins and other artifacts are housed in the spectacular Archaeological Museum in Samos harbor. In 2005, paleontologist Nikos Solounias (a native of Samos) and I coauthored a scientific analysis of the ancient insights about the colossal fossils of Samos.<sup>7</sup>

Chapter 1 also recounts the thrilling day in Cornell University Library when I turned a page in Roy Chapman Andrew's 1926 memoir of his Gobi Expedition and found myself staring at a familiar face—the unmistakable profile of a mythical griffin replicated in the skull of a beaked dinosaur (figs. 1.10 and 1.11). The artist's conception of how a griffin could be reconstructed from the skeleton of a *Protoceratops* dinosaur (fig. 1.13) is one of the most requested illustrations from this book. It was created by Ed Heck, who was then a paleontological artist at the American Museum of Natural History. In 2010, Daniel Loxton produced a fleshed-out, colored version to illustrate “The Secret of the Griffin” for *Junior Skeptic* magazine.<sup>8</sup>



We can now expand the geographical distribution of dinosaur fossils to lands closer to the Mediterranean Sea, shortening the distance that oral tales of fierce griffins had to travel to reach Greece in antiquity. Even more exciting, Smithsonian paleontologist Hans-Dieter Sues and his team recently discovered a new species of dinosaur with three horns, along the old caravan trails in Uzbekistan. The *Protoceratops* and *Psittacosaur* dinosaurs of the Gobi Desert and Junggar and Turfan basins of China, whose fossils I suggest influenced the image of the griffin, lack horns. This new discovery of three-horned beaked dinosaur fossils in the western Kizylkum Desert might help to account for the three protuberances on the heads of many griffins in ancient art.<sup>9</sup>

Since the section on Chinese lore linking fossils and dragons was written, Dong Zhiming and other Chinese paleontologists have enlisted the help of peasants familiar with the locations of “dragon” bones traditionally used for medicine. The farmers now understand the scientific significance of the fossil deposits and have helped paleontologists discover new species of dinosaurs.<sup>10</sup>

Not all myths of monsters or giants are fossil-related, of course. Such tales exist in many lands that lack large vertebrate fossil remains, or whose fossils are inconspicuous to untrained eyes. For example, pterosaur fossils exist in Mexico but are not noticeable to ordinary passersby, so legends of giant raptors there cannot be associated with flying reptile remains. Scandinavia has many tales of dragons and sea monsters but has been considered barren of large fossils. In actuality, however, the huge tusks and fossil bones of Pleistocene mammoths exist in southern Sweden and Norway. Moreover, massive

skeletons of marine reptiles, including a 50-foot-long Jurassic *Pliosaur*, have recently been discovered in Norway by Joren Hurum, University of Oslo, Natural History Museum. Did early Scandinavian mythographers know of similar monstrous remains? Further research might reveal interesting answers.<sup>11</sup>

The body of evidence gathered in *The First Fossil Hunters* led the late Canadian paleontologist William A. S. Sarjeant to change his opinion, published in several dinosaur encyclopedias, that large vertebrate fossil bones “were too big to be noticed” by people in antiquity. Sarjeant and I became friends, and in 2001, we coauthored an article on the folklore of fossil footprints for *Ichnos*, the journal of trace fossils. Our article in turn inspired Andrea Baucon, paleontologist at UNESCO's Naturtejo Geopark, Portugal, to reevaluate the identity of the footprints in stone in Italy, believed in antiquity to be the tracks of the Greek hero Heracles and the giant cattle of Geryon (described in chapter 2). Baucon also discovered evidence that Leonardo da Vinci was the first to understand trace fossils, pushing the science of ichnology back several centuries. Baucon and I have coauthored a chapter about trace fossil folklore around the world.<sup>12</sup>

Paleontologist Evangelia Tsoukala, Aristotle University, Thessaloniki, Greece, who supplied so much valuable information and photographs of mastodon fossils in chapter 2, helped to found the new Mammoth Museum and Dinosaur Park in Thessaloniki. Currently she is establishing two fossil museums for the northern Greek towns of Milia and Siatista. In 2009, Tsoukala achieved the Guinness World Record for the longest mastodon tusks ever found—over 16 feet long. This pair of tusks surpasses Tsoukala’s

1998 record, the 14-foot tusks discussed in chapter 2 and shown in figure 2.25. Tsoukala also served as a consultant for the BBC television show “Greek Myths: True Stories.” The documentary was based on Robin Lane Fox’s *Travelling Heroes in the Epic Age of Homer* (Knopf, 2009), which drew on material in this book. Lane Fox has pointed out more examples of fossil discoveries in antiquity. For example, in the plain of Unqi in northern Syria, Alexander’s successor, Seleucus, unearthed the skeletons of two “giants killed by the gods.”

Ana Pinto, the young archaeologist/paleontologist (pictured in fig. 2.7) who contributed photographs and information about Pleistocene elephant fossils in Spain, made an astonishing discovery in 2002. Pinto received the 2005 Wings WorldQuest Women of Discovery Award—and media attention—for her exploration of remote caves in northern Spain. In a cave inhabited for 60,000 years by early hominids, Pinto found evidence that dramatically changed our understanding of the interactions between Neanderthals and cave bears, mammoths, rhinoceroses, lions, and other extinct megafauna.<sup>13</sup>

Native American ideas about prehistoric remains, mentioned briefly in chapter 2, became the subject of my book surveying prescientific discoveries and interpretations of dinosaur and other fossils in the New World, *Fossil Legends of the First Americans* (Princeton University Press, 2005).

Two images in chapter 3 were especially fun to create. A friend had presented me with a toy model of a mammoth as a joke. Instead of gluing the plastic skeleton together in

proper pachyderm form, I scattered the plastic bones as they might have been revealed by an earthquake, flood, or plow in the time of Homer. Then I tried to imagine how people lacking paleontological knowledge might have visualized the articulation of these enormous bones, many of which resembled huge counterparts of their own limbs. I arranged the little plastic mammoth bones to resemble a humanoid giant. For human scale, I found a plastic Day of the Dead keychain, a jaunty little skeleton man with rhinestone eyes. Barely able to contain my glee, I photographed the pair against black velvet. The effect was crude but surprisingly effective. That image was re-created in a video for the American Museum of Natural History's highly acclaimed "Mythic Creatures" exhibit, which also features an interactive puzzle to allow children to "Build a Giant" by rearranging mammoth bones. Widely disseminated in international media, my image of the bipedal mammoth ogre and his little human friend (figs. 3.4 and 3.5) has been reproduced in scholarly studies, scientific journals, popular books and magazines, classroom and museum materials, and Internet discussions and blogs. The image is accompanied by learned discussion in *The Archaeology of Nostalgia* (Thames and Hudson, 2002) by John Boardman, a leading authority on classical art and archaeology (and one of the lucky few to possess a limited-edition "First Fossil Hunters" T-shirt emblazoned with the iconic pair of skeletons).

When I wrote the section in chapter 3 on ancient beliefs about heroes' bones as recorded by Philostratus, I relied on Jeffrey Rusten's unpublished translation of "On Heroes." Now interested readers can read Rusten's own scholarly discussion of the fossil-bone finds attested in this ancient work. We can also answer the question of whether large

prehistoric elephant species once roamed Crete. When I wrote chapter 3, only dwarf proboscidean fossils were known on Crete. But, as I noted, numerous detailed ancient reports of gigantic bones that came to light on Crete strongly suggested that very large mastodon fossils ought to exist there. My prediction was confirmed in 2003, when Greek paleontologist Charalampos Fassoulas of Crete's Natural History Museum announced the discovery of fossil tusks and bones of the colossal mastodon *Deinotherium giganteum*, one of the largest mammals ever to walk the earth.<sup>14</sup>

Another open question in chapter 3 has stimulated further investigation. I suggested that the dragon folklore of northern India might have been influenced by observations of oversized, extraordinary bones in the fossil beds of the Siwalik Hills below the Himalayas. In 2008, a folklorist and two paleontologists demonstrated the role of Siwalik fossil deposits in myths from *The Mahabharata*, India's famous epic. As of this writing, I have heard from paleontologists who are aware of traditional tales and beliefs associated with dinosaur and other large vertebrate fossils in Egypt, Yemen, Africa, Cambodia, China, Japan, Australia, and South America. More definitive studies of these intriguing fossil legends are eagerly awaited.<sup>15</sup>

Some readers have assumed that the Monster of Troy depicted on the ancient Greek vase (figs. 4.1 and 4.2) was the starting point for my research. In fact, it was the very last piece of artistic evidence to be included. By the time I was halfway done with the book, I had gazed at that monster's bizarre head many times without comprehending what I was looking at. As chapter 4, on artistic evidence, neared completion, I decided to take one

more look at this vase. Suddenly, the identity of the weird creature snapped into focus. After years of poring over the fossilized skulls of extinct Mediterranean megafauna, my eye finally saw the monster's features for what they were. My new "search image" (see chapter 1) suggested that the ancient artist had modeled the Monster of Troy on the extraordinary sight of a large, strange skull weathering out of a cliff side. Like the best scary monsters, this imaginary beast is a hybrid, grafting realistic features from large mammals, birds, sharks, crocodiles, serpents, and other reptiles onto the skull of an extinct giraffe, a common but striking fossil in the Aegean. It was a great honor when the curators at the Boston Museum of Fine Arts thanked me for solving the mystery of their celebrated artifact and invited me to present my findings. On that visit, we noticed yet another layer in the composite nature of this famous monster. What we had taken to be a scratch on the vase, across the monster's brow, turns out to be a deliberately painted antenna, like that of a grasshopper or beetle. We can now add insects to the long list of species contributing features to the Monster of Troy. Like the lolling tongue, quivering antennae helped to bring the fossil monster to life.

Are there any other artistic depictions of "monsters" that could be related to ancient observations of baffling fossils, besides the ones mentioned in chapters 1 and 4? Perhaps. I maintain a file of numerous unidentified creatures in ancient art, gathered from around the world. I invite readers to share with each other and me their own readings of such images. Meanwhile, now that archaeologists are aware that fossils were deliberately collected in antiquity, the evidence for dedications of fossils in temples and graves is steadily accumulating.<sup>16</sup>

Chapter 4 describes thousands of heavy, polished black fossil bones wrapped in linen and dedicated more than 3,000 years ago at two Egyptian shrines of Set, god of darkness. These hoards of fossils had been lost to science since 1924, but some of the bundles resurfaced in the Bolton Museum, Lancashire, UK, in 1999 (fig. 4.10). Inspired by this intrigue in *The First Fossil Hunters*, the museum's Egyptologist, Tom Hardwick, and geologist, David Craven, opened an investigation in 2007 to determine the identity of the bones. A "Bone Bundle Mystery" contest offered a prize to whoever could guess what species of extinct animal lay inside one of the bundles. After the winner was announced, Hardwick and Craven revealed the identity of the bone (scaphoid from an extinct giant antelope), and speculated about why the tons of fossils were gathered and placed in the shrines to Set at Qau el-Kebir. Ancient encounters with fossils in Egypt beckon historians and paleontologists to delve deeper.<sup>17</sup>

Modern historians of science and philosophy have long assumed that the first rational explanations of fossils were not developed until the Renaissance and Enlightenment in Europe. That is no longer the case. Since the publication of this book in 2000, scholars of the history and philosophy of science have begun to express a newfound appreciation for coherent speculations about fossil remains and their meanings in prescientific cultures. David Sedley, eminent scholar of ancient natural philosophy, was particularly struck by the questions raised in chapter 5. Why did the Greek natural philosophers ignore the immense petrified bones of extinct species, even though such relics were displayed in local temples all around the Mediterranean? Sedley suggests some thoughtful solutions to

this enigma in his book *Creationism and Its Critics in Antiquity* (University of California Press, 2008).<sup>18</sup>

In chapter 6, “Centaur Bones,” I discuss impossible creatures and paleontological hoaxes, ancient and modern. In 2009, I proposed a new explanation for the Satyr preserved in salt and displayed in Antioch, described by Saint Jerome. The marvel could have been an ancient miner, trapped and mummified in collapsed salt mines. Several of these “salt men” have recently come to light in northern Iraq—salt mummification gives them an uncanny resemblance to images of elderly Satyrs in Greek art (fig. 6.3). Another faux mythic creature featured in chapter 6 (figs. 6.5 and 6.6) is the provocative Centaur of Volos. This pseudo-archaeological excavation, created by artist William Willers, celebrated its tenth anniversary in 2004 at the University of Tennessee. In 2009, Willers completed an even more ambitious creation: a full-size “Centaur” skeleton (made from zebra and human bones) mounted in a glass museum case. The marvelous new Centaur of Tymfi is in a private collection, currently negotiating a permanent home. Notably, one can now commission naturalistic-looking taxidermy models of other impossible mythic creatures, such as griffins, tritons, basilisks, chimeras, and dragons.<sup>19</sup>

As this book was going to press in 2000, I struggled to come up with an elegant title (“Fossil Hunters in Togas” was one suggestion). Even more elusive was a concise description of my cross-disciplinary fields of study. As an independent scholar, I had no formal academic title. Classical folklorist, historian of “science before Science,” historical detective, investigative reporter of fossil legends, scholar of prescientific



cultures, historian of pre-Darwinian paleontology, geomythologist—each of these labels captured some aspects of my research but failed to encompass the whole, seemingly random mélange. In 2006, I found an academic home at Stanford University, as a research scholar in classics and the history of science, a designation both fitting and roomy enough for my lifelong fascination with the history of human curiosity. If *The First Fossil Hunters* has begun to fulfill my original goal of restoring ancient Greek and Roman fossil investigations and speculations to their rightful place in the history of science, I hope with this reissue to encourage continuing studies of the earliest inklings of paleontological thinking around the world.

Reports are already accumulating to suggest that evidence for the timeless human interest about the petrified remains of dinosaurs and other long-extinct species could be pursued in the fossil-rich regions of China, India, Central and Southeast Asia, the Middle East, Europe, Russia, the Arctic, Africa, South America, and Australia. Unexplored fields, ripe for future research, await investigation by the next generation of legendary fossil hunters. Our new paleontological perspective might cast light on many traditional stories and artistic representations of remarkable creatures.

## Notes

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<sup>1</sup> The “Ancient Monster Hunters” DVD is available from the History Channel and Amazon.com. My griffin/*Protoceratops* hypothesis and other materials from this book are presented in, for example, D. Fastovsky and D. Weishampel, *Dinosaurs: A Concise Natural History* (Cambridge University Press, 2009); David Norman, *Dinosaurs: A Very Short Introduction* (Oxford University Press, 2010, 2005); Douglas Palmer, *Fossil Revolutions* (HarperCollins, 2004); and Bruce Lieberman and Roger Kaesler, *Prehistoric Life: Evolution and the Fossil Record* (Wiley-Blackwell, 2010). Not everyone accepts my griffin/dinosaur hypothesis: see S. L. Lyons, *Species, Serpents, Spirits, and Skulls: Science at the Margins in the Victorian Age* (State University of New York Press, 2009). *National Geographic*’s forthcoming children’s book, conceived by Marc Aronson, follows several other *National Geographic* features about *The First Fossil Hunters*, including “They Might Not Be Giants: Reading the Bones of a Mythic Race,” *National Geographic*, Geographica Section (August 2004), and “Dino-Era Fossils Inspired Monster Myths,” [news.nationalgeographic.com/news/2005/06/0617\\_050617\\_monsters.html](http://news.nationalgeographic.com/news/2005/06/0617_050617_monsters.html).

<sup>2</sup> See my entries “Fossil” and “Griffin” in *Medieval Folklore: Encyclopedia of Myths, Legends, Tales, Beliefs, and Customs* (ABC-CLIO, 2000); “Dragons,” *New Book of Knowledge* (Grolier, 2004); “Geomythology,” *Encyclopedia of Geology* (Elsevier, 2004); “Fossils,” *Wiley-Blackwell’s Encyclopedia of Ancient History* (Blackwell, 2010); and “Ancient Fossil Discoveries and Interpretations,” *Oxford Handbook of Animals in*

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*Classical Thought* (Oxford University Press, 2012). In 2007, the earliest depiction of a fossil on a coin was discovered by M.A.S. McMenemy, "Ammonite Fossil Portrayed on an Ancient Greek Countermarked Coin," *Antiquity* 81 (2007): 944-48. *Myth and Geology*, ed. L. Piccardi and W. B. Masse (Geological Society of London, 2007). Christopher Duffin, "Fossils as Drugs: Pharmaceutical Paleontology," *Ferrantia* 54 (2008); "Fish Otoliths and Folklore," *Folklore* 118 (2007).

<sup>3</sup> Thanks to the efforts of Dr. Claudia Wagner, Dr. Susan Walker, Professor Michael Vickers, and Professor Sir John Boardman, the Nichoria Bone will be available to scholars and posterity in the Greek and Roman Antiquities Department, Ashmolean Museum, Beaumont Street, Oxford OX1 2PH, UK, displayed in the Greece Gallery. The dark brown/black fossilized distal end of a large mammal femur, with sharp break, was excavated on the acropolis at Nichoria (occupied Middle Bronze Age to Byzantine era) in 1969-1975 by the Minnesota Messenia Expedition and placed in a plastic specimen bag labeled "Nichoria K G p Femur of Pliocene elephant." Presumed lost until 1998, the fossil was rediscovered in the Archaeometry Laboratory, University of Minnesota, Duluth. In 2001, the friable fossil was stabilized with Vinac B-15 dissolved in acetone by the Paleontological Restoration Department, Museum of the Rockies, Bozeman, Montana.

<sup>4</sup> The "Dinosaurs and Dragons" show, Teylers Museum, Haarlem, and the AMNH "Mythic Creatures" exhibit are described by Brian Beatty in "Monsters in Manhattan and Haarlem," *PalArch Foundation Newsletter* 5, 1 (January), PalArch.nl. See my

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introduction, “Fossielenfolklore en wetenschap,” to the catalog *Dino’s en draken: Fossilien in mythen en volksgeloof* (Teylers Museum, 2006); and Edward Summer, “Mythic Creatures, Bigger than Life,” *Skeptical Inquirer* 31, 5 (2007). The “Mythic Creatures” show is online at [amnh.org/exhibitions/mythiccreatures](http://amnh.org/exhibitions/mythiccreatures).

<sup>5</sup> Natural History Museum, London: [nhm.ac.uk/nature-online/earth/fossils/fossil-folklore](http://nhm.ac.uk/nature-online/earth/fossils/fossil-folklore) and [nhm.ac.uk/business-centre/touring-exhibitions/exhibitions/myths-and-monsters/index.html](http://nhm.ac.uk/business-centre/touring-exhibitions/exhibitions/myths-and-monsters/index.html). “Fascinating Fossil Folklore” show at Walter Rothschild Zoological Museum, Herefordshire: [nhm.ac.uk/about-us/news/2007/february/news\\_10496.html](http://nhm.ac.uk/about-us/news/2007/february/news_10496.html).

“Dragons Unearthed” and *Dracorex hogwartsia* skull at the Indianapolis Children’s Museum:

[humanexperience.stanford.edu/feature-dragons](http://humanexperience.stanford.edu/feature-dragons). Roger Highfield explains mythical giants and griffins in terms of fossils in *The Science of Harry Potter* (Penguin, 2003); see also A. and E. Kronzck, *The Sorcerer’s Companion* (Broadway Books, 2004).

<sup>6</sup> On dragons, monsters, and fossils, see, for example, David Gilmore, *Monsters* (University of Pennsylvania Press, 2003); and Stephen Asma, *On Monsters* (Oxford University Press, 2009). The operatic “fossil monster” Fafnir was the creation of puppet master Lisa Aimee Sturz, [redherringpuppets.com/theat\\_siegfried.html](http://redherringpuppets.com/theat_siegfried.html).

<sup>7</sup> Nikos Solounias and Adrienne Mayor, “Ancient References to Fossils in the Land of Pythagoras.” *Earth Sciences History* 23 (2005).

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<sup>8</sup> Daniel Loxton, “The Secret of the Griffin,” *Junior Skeptic* 38, in *Skeptic* 16, 1 (2010).

The links between fossils and monsters are described in numerous publications for children; for example, “Rampaging Reptiles,” *Muse* 7, 9 (2003); “When Giants Walked the Earth,” *Muse* 8, 6 (2004); “Making Up Monstrous Myths,” *Calliope* (2008); and *Fantastical Creatures and Magical Beasts* by Shannon Knudsen (Lerner, 2009).

<sup>9</sup> Hans-Dieter Sues and Alexander Averianov, “Turanoceratops tardabilis<m->the First Ceratopsid Dinosaur from Asia,” *Naturwissenschaften* 96 (2009).

<sup>10</sup> On Dong Zhiming’s recent discoveries of “dragon bone” dinosaur fossils in China, see Kevin Holden Platt, “Dinosaur Fossils Part of Longtime Chinese Tonic,” *National Geographic News*, [news.nationalgeographic.com/news/2007/07/070713-china-dinos.html](http://news.nationalgeographic.com/news/2007/07/070713-china-dinos.html). For the history of peasants and paleontology in China, see Sigrid Schmalzer, *The People’s Peking Man* (University of Chicago Press, 2008).

<sup>11</sup> “Giant ‘Sea Monster’ Fossil Discovered in Arctic,” *National Geographic*, [news.nationalgeographic.com/news/2008/02/080226-sea-monsters.html](http://news.nationalgeographic.com/news/2008/02/080226-sea-monsters.html) and [news.nationalgeographic.com/news/2006/10/061006-arctic-reptiles.html](http://news.nationalgeographic.com/news/2006/10/061006-arctic-reptiles.html). Paleontologist Wolfgang H. Berger speculates that Ice Age mammoths may have influenced Nordic myths of Frost Giants and other tales in “On the Extinction of the Mammoth: Science and Myth,” chapter 7 in *Controversies in Modern Geology*, ed. D. Muller et al. (Academic Press, 1991).

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<sup>12</sup> See the original introduction to this book, note 2, for Sarjeant's earlier statements.

Adrienne Mayor and W.A.S. Sarjeant, "The Folklore of Footprints in Stone: From Classical Antiquity to the Present," *Ichnos* 8 (2001):143-63. Andrea Baucon, "Leonardo da Vinci, Founding Father of Ichnology," *Palaios* 25 (2010):361-67. Baucon's reevaluation of the fossil tracks in Italy is based on new discoveries in 2005, reported in the journal *Palaios*: [palaios.sepmonline.org/cgi/content/abstract/20/6/534](http://palaios.sepmonline.org/cgi/content/abstract/20/6/534). Another possibility is Stone Age human tracks, like those discovered in Italy in 2003: see P. Mietto, M. Avanzini, and G. Rolandi, "Human Footprints in Pleistocene Volcanic Ash," *Nature* 422 (March 2003). My coauthored chapter with Baucon, "Trace Fossils in Folklore," is forthcoming in the *Trace Fossils* volume of *Developments in Sedimentology*, ed. D. Knaust and R. G. Bromley (Elsevier).

<sup>13</sup> Claudia Dreifus, interview with Ana Pinto, "Think Like a Neanderthal," *New York Times*, Science section, June 7, 2005.

<sup>14</sup> "On Heroes": see Jeffrey Rusten, "Living in the Past," and other essays in *Philostratus's Heroikos*, ed. E. B. Aitken and J.K.B. Maclean (Brill, 2004). Gigantic mastodon fossils were discovered in an olive orchard in Crete in 2003: see Hillary Mayell, "Cyclops Spurred by 'One-Eyed' Fossils?" [news.nationalgeographic.com/news/2003/02/0205\\_030205\\_cyclops.html](http://news.nationalgeographic.com/news/2003/02/0205_030205_cyclops.html).

<sup>15</sup> On paleontology and myths of India, see Alexandra Van der Geer, Michael Dermitzakis, and John de Vos, "Fossil Folklore from India: The Siwalik Hills and the

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*Mahabharata*,” *Folklore* 119 (April 2008). Salagram stones, sacred ammonite fossils, are associated with the Hindu god Vishnu: see D. Messerschmidt and J. Sharma, “Hindu Pilgrimage in the Nepal Himalayas,” *Current Anthropology* 22 (1981); H. Hagen , “On Saligrams<m->Holy Stones of India,” *Contributions to Himalayan Geology* 4 (1988); and R. Rao, *Salagram Kosha* (Kalpatharu Research Academy, Bangalore, 1996), [salagram.net/sstp-salkosh1ch.html](http://salagram.net/sstp-salkosh1ch.html).

<sup>16</sup> For fossils in archaeological contexts, see, for example, H. A. Raymond, “Fossils as Votive Offerings in the Greco-Roman World,” *Preliminary Report from the BYU Wadi Mataha Expedition* (Brigham Young University, 2004).

<sup>17</sup> For the results of the “Bone Bundle Mystery” contest at the Bolton Museum, and discussion of why the fossils were placed in the Egyptian shrine to Set, see [www.boltonmuseums.org.uk/news/bonebundlemystery](http://www.boltonmuseums.org.uk/news/bonebundlemystery) and [www.boltonmuseums.org.uk/news/mystery-bones-identified](http://www.boltonmuseums.org.uk/news/mystery-bones-identified).

<sup>18</sup> The questions I ponder in chapter 5 are also prominent in Michael Leddra’s *Time Matters: Geology’s Legacy to Scientific Thought* (Wiley-Blackwell, 2010).

<sup>19</sup> On the so-called salt men of Iraq and the possibility that a similar mummified salt miner of the Bronze Age may have been displayed as a Satyr in ancient Antioch: “Mythic *Bio-Techné* in Classical Antiquity: Desire and Dread,” *BioTechnique Exhibit Catalog* (Yerba Buena Center for the Arts, San Francisco, 2007). See also Dan Vergano,

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“Mythical Satyr May Be Preserved in Salt,”

[usatoday.com/tech/science/columnist/vergano/2007-07-22-satyr-salt-man\\_N.htm](http://usatoday.com/tech/science/columnist/vergano/2007-07-22-satyr-salt-man_N.htm). The art

and biology departments at the University of Texas maintain an Archive of

Contemporary Centaur Scholarship:

[notes.utk.edu/bio/unistudy.nsf/0/78dff46a51a10457852563f0000529bc?OpenDocument](http://notes.utk.edu/bio/unistudy.nsf/0/78dff46a51a10457852563f0000529bc?OpenDocument).

For mythical composite creatures and imaginative taxidermy, see

[customcreaturetaxidermy.com/Site/FANTASY\\_WORKS.html](http://customcreaturetaxidermy.com/Site/FANTASY_WORKS.html).



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