

CONTENTS

<i>List of Illustrations</i>	ix
<i>Introduction to the 2011 Edition</i>	xiii
<i>Acknowledgments</i>	xxix
Geological Time Scale	2
Introduction	3
Historical Time Line	11
CHAPTER 1.	
The Gold-Guarding Griffin: A Paleontological Legend	15
CHAPTER 2.	
Earthquakes and Elephants: Prehistoric Remains in Mediterranean Lands	54
CHAPTER 3.	
Ancient Discoveries of Giant Bones	104
CHAPTER 4.	
Artistic and Archaeological Evidence for Fossil Discoveries	157
CHAPTER 5.	
Mythology, Natural Philosophy, and Fossils	192
CHAPTER 6.	
Centaur Bones: Paleontological Fictions	228

APPENDIX 1.

Large Vertebrate Fossil Species in the Ancient World 255

APPENDIX 2.

Ancient Testimonia 260

Notes 283

Works Cited 333

Index 351

INTRODUCTION

THE CLASSICAL Greek landscape evokes many images—heroes and Amazons, gods and goddesses, painted vases and bronze statues, marble columns and temple ruins. The enormous fossil bones of mastodons and mammoths are not likely to appear in anyone’s mental picture of classical antiquity. But immense skeletons of creatures from past eons indeed lie buried all around the lands known to the Greeks and Romans. And for the ancient Greeks and Romans themselves, vestiges of giants and monsters of the distant past were important features of their natural and cultural landscape. This book explores the relationship between two simple but surprising facts: the Mediterranean world was once populated by giant creatures, and the ancients were continually confronted by their remarkable petrified remains.

The ancients collected, measured, displayed, and pondered the bones of extinct beasts, and they recorded their discoveries and imaginative interpretations of the fossil remains in numerous writings that survive today. Yet “paleontology” is missing in the standard lists of the great cultural inventions of the Greeks and Romans. How did modern science and history come to lose the significant paleontological discoveries, thoughts, and activities of classical antiquity? That paradox inspired my project, to recover the long-neglected evidence of human encounters with fossils from the time of Homer to the late Roman empire (ca. 750 B.C. to A.D. 500).

The history of the ancient engagement with fossils has languished in shadow for several reasons. In the first place, few people are aware that millions of years ago, huge mammals of the Miocene, Pliocene, and Pleistocene eras roamed what would become

the lands of the Greeks and Romans. Those who do study Mediterranean vertebrate paleontology are not acquainted with the detailed descriptions of immense bones and teeth that figure in vivid ancient writings about giants and monsters. Most classical scholars have no idea that huge remains of prehistoric mastodons and mammoths, woolly rhinoceroses, giant giraffes, cave bears, and saber-toothed tigers continually erode out of the earth in Mediterranean lands. Fewer still realize that those fossil exposures exist precisely where ancient Greek myths located the destruction of giants or monsters, and where the ancients claimed to have observed gigantic bones. So it's not surprising that classicists tend to read the ancient allusions to the bones of giants or monsters as mere poetic fantasies or as evidence of popular superstition. I will argue that these allusions are evidence for a native natural history of the prehistoric Mediterranean. Tracing that natural history will lead us down some rarely traveled pathways of classical studies, since many of the best-known ancient thinkers, such as Thucydides and Aristotle, failed to mention remarkable remains.

We can recover the lost fossil knowledge of antiquity only by a new reading of the neglected classical material about extraordinary skeletons in the light of little-publicized modern fossil discoveries in the lands once inhabited by the ancient Greeks and Romans. That means bridging the gulf in communications between modern humanities and the sciences, in order to restore a vital missing chapter in the early history of paleontology.¹

The typical history of paleontology begins with praise for the ancient Greek philosophers who recognized that small fossil shells found far from the seashore represented evidence of former oceans. Next, historians of paleontology remark on the lack of evidence for discoveries of large vertebrate fossils in antiquity. Here, some modern historians do mention one notable insight about animal fossils attributed (erroneously, it turns out) to a Greek philosopher named Empedocles. To explain the supposed disinterest in large prehistoric bones in the classical era, scientists assume that Aristotle's notion of unchanging species was a dogmatic principle that suppressed paleontological speculation in antiquity, just as it did in the Middle Ages. A few amusing medieval fossil misunderstand-

ings about toadstones and unicorns come next, followed by a nod to Renaissance thinkers. We quickly arrive at the official starting point of paleontological history, the scientific discoveries of the eighteenth and nineteenth centuries by Georges Cuvier, Richard Owen, and Charles Darwin.

Four errors about ancient experiences with fossils recur in paleontological histories. First, for the reasons outlined above, it's taken for granted that even though the early Greeks grasped the meaning of tiny marine fossils, somehow the ancients never noticed the huge fossil remains of dinosaurs, mammoths, and other extinct vertebrate species. To account for this mysterious lapse, historians of paleontology speculate that large, mineralized bones were not recognized as bones, and some even suggest that they were "just too big to be noticed."² The extensive ancient evidence, gathered together for the first time here, proves how wrong such assumptions are.

Big vertebrate fossils, even isolated bones and teeth, were objects of intense curiosity and speculation in Greco-Roman times. This fact was well known to the founder of modern paleontology, Georges Cuvier (1769–1832), the French naturalist who first proposed that mammoth bones belonged to extinct elephants. Cuvier was a scientist, but his eighteenth-century classical education meant that he was also familiar with Greek and Latin literature. In his monograph on living and extinct elephants published in Paris in 1806, Cuvier summarized the history of fossil mammoth discoveries around the world up to his time. He traced the earliest finds to classical antiquity, citing several ancient accounts of giant skeletons and tusks that came to light in Greece, Italy, Crete, Asia Minor, and North Africa between the fifth century B.C. and the fifth century A.D. In a sense, then, I am pursuing a historical path first broached by Cuvier, but subsequently forgotten amid the exciting scientific discoveries of his day. It's daunting to embark on a topic initiated by the great Cuvier, but advances in classical studies and paleontological science—and the new information made available to me by experts in both fields—now make it possible to restore the ancient fossil investigations to their rightful place in the history of science.³

The recovery of this long-forgotten evidence contradicts another institutional myth of modern paleontology, that no serious consideration of vertebrate fossils could occur in classical antiquity because the scientific theories of evolution and extinction had not yet been invented. Meaningful interpretation of fossils as organic remains of the past requires an understanding of natural history that the ancients could not have possessed—that is the assumption evident, for example, in Martin J. S. Rudwick’s influential book *The Meaning of Fossils: Episodes in the History of Paleontology*.

It’s time to rethink those assumptions. It may be true that no natural philosopher—not even Aristotle—articulated a formal theory to explain vertebrate fossils, and that famous writers like Plato and Thucydides made no mention of giant bones. But that should not mislead us into thinking that the ancient Greeks and Romans had no concepts or paradigms to explain the observed phenomena of unexpectedly large, petrified bones that matched no living creatures. In fact, the earliest recorded paleontological speculations are preserved where no one since Cuvier has thought to look: in the Greco-Roman myths of nature’s past and scattered throughout the lesser-known writings of geographers, travelers, ethnographers, natural historians, and compilers of natural wonders. Reading about the fossil discoveries described in these less-polished texts humanizes the ordinary Greeks and Romans as never before and gives a new immediacy to ancient life. It also reveals the wealth of natural knowledge that lies hidden in the rarely studied popular literature of antiquity.⁴

The third error concerns a “fact” often asserted about large vertebrate fossils in antiquity. Since the early twentieth century, numerous reliable international historians of paleontology have perpetuated a myth: that the Greek philosopher Empedocles studied fossil skulls of elephants in caves in Sicily. This modern myth holds that Empedocles, writing in the fifth century B.C., was the first to relate prehistoric elephant skulls to the ancient legend of the Cyclops, the one-eyed giant killed in a cave by Odysseus in Homer’s *Odyssey*. It is sometimes further claimed that Giovanni Boccaccio was the first to publicize Empedocles’ finds. Here is a typical recent example of this modern myth: “When fossil elephant bones

turned up [in Sicily] in the 5th century B.C., Empedocles interpreted them as cyclops-bones. . . . In the 14th century A.D., Boccaccio repeated the identification, citing Empedocles.”⁵

It is true that Boccaccio was present when peasants discovered a giant skeleton in a cave in Sicily in about 1371. He was among the crowd that gathered, daring one another to touch the giant. When someone finally poked it, the skeleton instantly crumbled into dust, leaving only three huge teeth, parts of the skull, and a vast thigh bone. Boccaccio identified the giant as the Cyclops from the *Odyssey*. But Boccaccio never mentioned Empedocles in his account. And in the surviving fragments of Empedocles’ writings, the philosopher never referred to skulls, caves, giants, or the Cyclops—much less to elephants, which were unknown to Greeks until a hundred years after his death.⁶

So how did this fake fact arise? With the help of other historians who had also been duped by the myth, I traced it back to statements made by the eminent Austrian paleontologist Othenio Abel in 1914 and 1939. What led Abel to make his unfounded claim about Empedocles? Writing about fossil folklore in 1914, Abel hit on the idea that ancient sailors mistook the large nasal opening in unfamiliar fossil elephant skulls for the eye socket of a one-eyed giant. To support his own ingenious speculation, Abel attributed the idea back in time to Empedocles, an ancient philosopher who pondered the origins of life. With no basis in the surviving record, Abel declared that “Empedocles reported such finds in Sicilian caves and believed these to be unassailable proof of the existence of an extinct race of giants.” In the 1940s, Willy Ley, one of the first historians of paleontology to repeat Abel’s Empedocles myth, added the false claim that Boccaccio had cited Empedocles as his authority when he announced the discovery of the Cyclops. In the manner of folk legends, Abel’s and Ley’s plausible-sounding assertions were taken up and elaborated by successive writers who never bothered to check what Empedocles and Boccaccio had really said.⁷

Just as Boccaccio’s giant crumbled to dust when touched, this generally accepted “fact” about ancient paleontology collapses as soon as it is tested against the evidence. It would be easy to see

Abel's misinformation about Empedocles as a deliberate hoax, but I think Abel elaborated on Empedocles' genuine insights about primeval life-forms out of a desire to fill in that disturbing blank in the ancient record mentioned above, namely, the absence of any surviving philosophical theories to explain big fossil bones. Similar impulses have motivated other paleontological fictions both ancient and modern, as we will see in the final chapter.

The fourth error is an unexamined commonplace among paleontologists. It's often suggested that Aristotle's "fixity of species" idea was a deathblow to rational speculation about evolution and extinction in classical antiquity and the Middle Ages. This misleading view unfairly conflates two very different cultures and eras. The notion of immutable species created in one fell swoop was not a monolithic principle in classical antiquity—it only became so in the Middle Ages when Aristotelian thought was merged with biblical dogma in Europe. Instead, for a millennium *before* the Middle Ages, the Greeks and Romans identified large prehistoric remains as vestiges of gigantic, unfamiliar creatures that had appeared over time, reproduced, and transmuted, and then were destroyed by catastrophe or died out long before current human beings appeared on the earth.⁸

The adventurous Greeks and Romans observed prehistoric fossils all around the Mediterranean and as far afield as India. The nature of the ancient sources and the wide-ranging topography of ancient and modern fossil discoveries mean that we will need to jump around a bit in geography and chronology. The word "ancient" has different meanings in different contexts: we are asking how people who lived *thousands* of years ago interpreted the remnants of creatures that lived *millions* of years ago. Timetables and maps will provide us with guideposts as we undertake the temporal and spatial travel required by the synthesis of ancient discoveries with modern paleontological knowledge. The literary and archaeological evidence ranges from the eighth century B.C. to the fifth century A.D. (see Historical Time Line); the geological ages are shown in the Geological Time Scale.

The first chapter traces the paleontological origins of one exotic creature of ancient oral folklore, the griffin. By following clues fortuitously preserved by literate Greeks and Romans, I propose that

the griffin image was based on illiterate nomads' observations of dinosaur skeletons in the deserts of Central Asia. But how did the Greeks and Romans interpret the very different kinds of prehistoric fossils they saw firsthand in their own lands? What species once roamed the prehistoric Mediterranean basin? Who really owns important fossil relics, and who should interpret them? These questions emerge in chapter 2, which surveys the violent geological history of the Mediterranean lands and the modern discoveries of fossil deposits there.

Armed with a working knowledge of the various species of mastodons, mammoths, and other large, extinct mammals whose remains are now known to exist around the classical world (listed by region in appendix 1), we turn in chapter 3 to the narratives describing the exciting discoveries of colossal skeletons from the time of the Trojan War (ca. 1250 B.C.) to the end of the Roman Empire (about A.D. 500). Many sensational firsts in the history of paleontology are registered here: the earliest recorded measurements of prehistoric fossil skeletons, the first descriptions of the natural and human conditions that exposed fossils, the first paleontological museum, the earliest recognition of Miocene mastodons as elephants, the first reconstruction of a prehistoric creature from its remains, the oldest illustration of a fossil discovery, and the earliest-ever descriptions of fossil deposits in Greece and the Aegean islands, Italy, France, North Africa, Egypt, Turkey, the Black Sea, and India. (Appendix 2 gathers a wide sampling of literary evidence to supplement the passages cited in chapter 3.) The bones of gigantic beings were treasured as relics of the mythic past and displayed as natural wonders in temples and other public places. Close readings of the ancient accounts and consultations with modern paleontologists familiar with Mediterranean and Eurasian fossils allow us to determine the true identity of the giant skeletons unearthed in antiquity.

How did classical artists visualize the giants and monsters whose bones were buried in the earth? Have any fossil bone relics collected in antiquity been excavated from ancient sites? Chapter 4 uncovers the little-known artistic and archaeological evidence for the ancient interest in fossils.

Chapter 5 delves into Greco-Roman myth to find the concepts

that helped ordinary people interpret the mysterious, enormous remains that emerged from the earth. Popular lore contained scenarios of life-forms changing over time and their destruction in the deep past. An important theme of this book, the tension between official scientific certainty and popular belief, comes to the fore when we plumb the strange silence surrounding giant bones within the established circle of ancient natural philosophers, including Aristotle. The chapter concludes with a summary of the impressive insights of classical paleontology.

In chapter 6, we learn that paleontological hoaxes originated in the Roman era as a response to the tension between popular and scientific beliefs. Today the gulf between popular superstition and scientific knowledge seems unbridgeable, and scientists often bemoan their failure to communicate their own excitement in the enterprise of separating truth from specious fiction. Some scientific skeptics conclude that it “insults” both myth and science to try to reconcile such different worldviews.⁹ Yet when we compare ancient paleontological “fictions” to some startlingly similar modern examples, it becomes clear that creative scientific curiosity and the exercise of the mythic imagination are more closely related than one might suppose.

“What are fossils, after all,” asks French paleontologist Pascal Tassy, “if not vestiges both destroyed and preserved by time?” The same definition applies to the fragmentary ancient literary and archaeological evidence. Just as a fossil is “petrified time,” so is an ancient artifact or text. The tasks of paleontologists and classical historians and archaeologists are remarkably similar—to excavate, decipher, and bring to life the tantalizing remnants of a time we will never see.¹⁰ This book represents the first attempt to integrate those efforts. I hope the results will encourage further investigations into the earliest stirrings of paleontological inquiry.

INDEX

- Abel, Othenio, 7–8, 35, 85
Achilles, 117, 120, 126, 159, 200, 277
Acker, Karl, 94, 96
Aegean land bridge, 64–65, 91, 106
Aelian, 235, 239, 245, 253; on dragon of Chios, 137, 260; on giant cattle, 102; on griffins, 32–33, 37, 50; on Neades, 58, 261
Aeschylus, 29, 47, 72
Africa, 65, 66, 73, 91, 165, 180, 258, 275. *See also* Algeria; Egypt; Libya; Morocco; North Africa; Tunisia
Ager, Derek, 61
Ajax, 114–15, 126, 150, 159, 266, 279
Albania, 102, 236
Alexander of Abonoteichus, 235
Alexander the Great, 55, 113, 217, 273, 294n.23
Algeria, 142, 154
Alonnisos, 117–18, 126, 270
Alpheios River, 98, 105, 112, 198, 215, 268
Altai Mountains, 21–23, 26, 36, 40, 43, 45, 50
Amazons, 55, 60, 91, 120, 183, 263, 275–76
amber, 71, 220, 275, 280
American Museum of Natural History, 40, 50, 94, 96, 187
Ammon, oracle of, 150, 263, 275, 279
ammonites, 71, 275, 279
amphora, 118–19, 121, 149, 184, 271
Anancus, 101, 126, 152, 256–59
Anaximander, 214–15, 224
Andersson, Johann, 39
Andrews, Roy Chapman, 39–42, 50, 95, 165
Andromeda, 138–39, 162, 274
anomalies, 141–42, 145, 168, 210, 220–23, 225, 227, 241. *See also* paradox
Antaeus, 121–26, 277, 280
anthropomorphizing tendency, 77–82. *See also* humans
Antioch, 58, 73, 237
antlers, 130–31, 168
Antonaccio, Carla, 167–68
Antoninus Liberalis, 261
Apollodorus, 261
Apollonius of Tyana, 225, 269–70; on giants, 116, 222–23; on griffins, 32, 48, 50; in India, 129–35; on marsh ivory, 67
Arabia, 206, 239, 248, 265
Arabis River, 273
Arcadia, 97, 99, 194, 196, 198, 205. *See also* Peloponnese
archaeology, 137, archaeological evidence for fossil collecting, 157–91
Archaeopteryx, 47, 325n.5
Aristeas, 22–23, 25–27, 29, 31
Aristomenes, 113, 184, 267
Aristotle, 46–47, 63, 97, 192, 208–10, 224, 239; on anomalies, 218–21; and fixity of species, 8, 217–19; on Neades, 57–58
Arsinoitherium, 101, 258

- artistic evidence for fossil discoveries, 157–65
- Aryades, 73, 117, 126, 270
- Ascherson, Neal, 30
- Asklepios, 115, 169, 190, 269
- Asterios, 74, 126, 267
- Athens, 112, 113, 153, 169, 217, 272, 276
- Atlantic Ocean, 65, 110, 124, 138, 232
- Atlas, 208
- Augustine, 126, 154–55, 237, 261
- Augustus, 126, 142–44, 172–75, 229, 232, 235, 269, 274, 280, 313n.12
- Azov, Sea of, 146, 196, 256, 273, 279
- Bate, Dorothea, 128
- battlegrounds, 199; of Gigantomachy, 197–98, 278. *See also* Megalopolis; Pallene; Panaima; Phlegra
- bear, cave, 85, 101, 129, 172–75, 166, 206, 255–59
- belemnites, 71, 275
- Beneventum, 143, 277
- Bible, 154, 206, 219, 225. *See also* Christians
- Bigfoot, 222, 236
- Binder, Judith, 26
- Black Sea, 22, 29, 63, 71, 101, 120, 146, 180, 197, 209, 256, 272
- Blanckenhagen, Peter von, 237
- Blashford-Snell, John, 248
- Blitzkrieg, 205, 319n.19
- Blood-Soaked Field. *See* Panaima
- Blundell, Sue, 216
- Boardman, John, 158, 162
- Boccaccio, Giovanni, 6–7, 284–85nn.5–7
- Boeotia, 91, 199, 205, 222, 228, 255, 265
- Bolton, J.D.P., 21
- bone rush, ancient, 110–56, 189; modern Greek, 52, 83–99
- Bos primigenius*, 102, 256–59. *See also* cattle
- Boston Museum of Fine Arts, 157, 163, 165
- British Museum (Natural History), 128, 178, 180
- Brontotherium*, 76
- Bronze Age, 11, 25, 112, 168, 171, 178–80, 184, 186, 201
- Brown, Barnum, 94–98, 169, 190–91
- Brunton, Guy, 177–78
- Buffetaut, Eric, 39, 130, 144–45, 161, 169
- Burkert, Walter, 105
- Burnet, John, 213, 214
- burning soil. *See* battlegrounds
- Cadiz, 74, 197, 232, 267, 269
- Cadmus, 222, 266
- calcite, 85, 131–35
- Calydonian Boar, 126, 142–43, 148, 167, 205–6, 269, 277
- Campe, 150, 263
- Capri, 143, 144, 172–75, 259, 280, 313n.12
- Carthage, 126, 153–54, 272
- catastrophic extinction, 85, 198, 205, 206, 226; vs. gradual, 214
- cattle, giant, 71, 74, 195, 201, 206, 256–59, 267
- Centaur, 16, 193, 194, 195, 204, 205, 216, 221–22, 227, 230, 231, 235–45, 248, 249, 252; Centaur excavation, 241–45
- Cerberus, 195, 205
- cetaceans, 145, 180. *See also* whales
- Chalicotherium*, 85, 91, 130, 188, 248, 255–57
- Chimera, 195
- China, 21, 26, 37–39, 42, 47, 94, 130, 135, 172, 218
- Chios, 75, 136–37, 205, 236, 256, 260, 262
- Christians, 154–55, 203, 217, 236, 322n.39
- Cicero, 136, 137, 171, 262
- Claudian, 155, 195, 196, 262
- Claudius, 229, 239–40, 294n.23
- Clement of Alexander, 110

- Clement of Rome, 263
Coelodonta antiquitatis, 188, 256
Constantine, 237
Constantinople, 280
Corinth, 157, 158, 162, 196, 240
creationism, 203. *See also* fixity of species
Cretaceous, 40, 43, 45, 64, 65, 136, 145, 165, 166, 249
Crete, 63, 66, 102, 126–28, 172, 182, 196, 205, 256, 264, 273, 274, 278
crinoids, 71, 181, 221, 275, 276, 277
crocodile, 130, 181, 177, 257
cryptozoology, 222, 326n.6, 329n.24
crystallization in fossils, 70, 85, 131–35, 208–9, 275, 305n.28
Ctesias, 30–31, 37, 42, 48
cubit, 293n.18
Cumae, 206, 220, 263, 279
curiosities, cabinets of, 140, 244. *See also* display; marvels; museum; relics
Currant, Andrew, 178, 180
Currie, Philip, 42–44, 47
Cuvier, Georges, 5, 55, 95, 124, 213, 283n.3, 305n.25
Cyclops, 6–7, 35–36, 194, 195, 201, 215, 284n.5
Cyprus, 64, 170, 182

Damarmenos, 106, 268
Dardanelles, 114–17
Darwin, Charles, 202, 224
Deinotherium, 75, 77, 85, 91, 118, 129, 137, 154, 255–59
Delos, 63, 205
Demostratus, 229–30
Dinosauroid hominid, 249–52
dinosaurs, 21, 52, 64, 65, 135–36, 142, 150, 160, 165, 231, 247, 248–52, 257, 259, 283n.1, 291n.9, 304n.23, 306n.29, 324n.2. *See also* *Protoceratops*
Diodorus of Sicily, 141, 144, 150, 235, 244–45, 253, 263–64
Dionysus, 55, 60, 91, 150, 180, 229, 230, 263, 275–76
Dioscorides, 264

display, of fossils, 55, 58–60, 77, 93, 99, 104, 110, 115, 138–44, 149, 167, 170, 181, 190, 222, 266
Dniester River, 71, 265
Dodson, Peter, 43, 48, 223, 247
dragon, 34–35, 93, 129–39, 223, 233, 260, 279; bones of, Chinese, 21, 38–39, 94; in India, 129–35, 164; teeth of, 164, 222
dugong, 145, 166
Dzungarian Gate, 27, 36. *See also* Junggar Basin

earthquake, 57, 60, 61, 65, 72, 93, 116, 119, 128, 129, 131, 146, 150, 182, 194, 196, 202, 207, 226, 271, 272, 273
echinoids, 71, 175, 182, 264
Echo, 208, 266
Efremov, Ivan A., 248
eggs: dinosaur, 42–43, 45, 50, 95, 165; ostrich, 140, 181
Egypt, 54, 61–62, 71, 101, 135–36, 148–53, 175–78, 180, 199, 211, 221, 235, 236, 239–40, 258, 263, 264, 265, 272, 274, 276, 277, 279, 280
eight-ball, 213
Einstein, Albert, 245
Eisner, Thomas, 245
Elasmotherium, 101, 146, 196, 257
Eldredge, Niles, 226
elephant, 6–7, 55, 60, 65–67, 98–101, 106, 120, 124, 126, 128, 130–31, 138, 142, 144–45, 169, 182, 185, 190, 196, 206, 215, 222, 247, 248, 255–59, 266, 268, 269, 274, 276; dwarf, 35, 128; skull of, 35, 71–72, 77, 115, 118–19, 267. *See also* ivory; mammoths; mastodons; teeth; tusks; individual species
Elephas hysudricus, 130–31, 248, 257
Elis, 106, 268, 274
Empedocles, 6–8, 215–17, 220, 224, 239, 284–85nn.5, 6
Enceladus, 261, 262

- English Channel, 106, 110, 144–45
Eocene, 65, 119, 126, 139, 160, 175, 258
Ephesus, 55, 60, 63, 74, 275
Ephialtes, 204
Eratosthenes, 211, 278
Erman, Georg Adolph, 19–21
Erol, Oguz, 61
Erymanthian Boar, 205–6
Etna, Mount, 215, 261
Euagon, 57–58
Euboca, 64, 91, 106, 109, 118, 208, 255, 266, 268, 274
Eumachus, 153–54, 272
Euphorion, 58, 261
evolution, 203–4, 224, 226, 318n.18
extinction, 202, 205–7, 214–18, 223, 226, 244
extraterrestrials, 233, 236, 252, 295n.25

fakes. *See* hoaxes
Falconer, Hugh, 133–35
Fayyum, 152, 175, 258, 309n.42
femur, 18, 66, 99, 105, 119, 197, 201, 202; at Heraion, Samos, 183; at Nichoria, 185–90
Feynman, Richard, 245
fish, fossil, 65, 71, 137, 172, 209, 275, 278, 281. *See also* marine fossils; shark teeth
Fisher, Philip, 141, 245
fishermen, and fossils, 106, 182
fixity of species, 4, 8, 203–4, 217–18, 221, 224
flood myths, 206–7, 210–11, 219, 223, 225, 226, 278, 310n.45, 323n.43
flying reptiles, 135–36, 265
footprints, fossil, 71, 74, 221, 265, 277, 292n.15
fossil, definitions of, 67–68, 208
France, 95, 102, 144–45, 166, 259, 274, 283n.1

Gabinus, 124, 280
Gallipoli Peninsula, 75, 116, 257, 270

Gaudry, Albert, 85, 322n.36
Gedrosi, 273
gems. *See* crystallization in fossils
geological time periods, 2
geology: of Mediterranean, 61–72, 225; ancient understanding of, 61–64, 67–72, 195
geomythology, 193–94, 202
Geryon, 71, 74, 75, 102, 119, 195, 196, 197, 205, 230, 235, 244, 265, 267
Giants, 61, 73, 113–29, 133, 139, 143–44, 150, 163, 193–202, 223, 231, 232, 239, 244, 261, 263, 262, 264, 265, 268, 270, 271, 273, 277, 279, 280, 281. *See also* Gigantomachy
Gigantomachy, 74, 99, 118, 129, 155, 195–98, 204, 212, 213, 215, 230, 262, 278
Ginsburg, Léonard, 77
giraffes, 75, 101, 126, 129, 255–58. *See also* *Giraffokeryx*; *Helladotherium*; *Libytherium*; *Samotherium*
Giraffokeryx, 130–31
Gironde River, 145, 166
Gobi Desert, 22, 27, 37–46, 49, 64, 150, 202, 204, 248, 257
gold, 19, 28–33, 32–33, 36–38, 45, 50, 288n.24
Gomphotherium, 75, 101, 130, 150, 154, 256–58
Gorgon, 29, 138
Greek Anthology, 264
Greenblatt, Stephen, 245
Greene, Mott, 194
griffin, 8, 15–52, 58, 60, 71, 72, 135, 164, 181, 204, 223; nests of, 32, 43; wings of, 31–32, 47–49; and young, 26, 33
Guthrie, Stewart, 80–81, 237
Guthrie, W.K.C., 216

Hadrian, 117, 145, 145, 240, 270
Halitherium, 145, 166, 259
Hansen, William, 148

- Hebrew traditions, 139, 203
Hebron, 139, 265
Hector, 113, 269
Helike, 63, 112, 268
Helladotherium, 85, 160, 255
Hera, Temple of. *See* Heraion
Heracles, 71, 74–75, 76, 104, 112, 122, 157, 163, 195, 196, 205, 206, 221, 230, 261, 263, 265, 266, 271, 276, 277, 279
Heraion (Temple of Hera, Samos), 16–17, 58, 180–83
hero cult, 11, 111, 146, 167–68, 170, 185, 189, 200–202, 314n.20. *See also* heroes' bones
Herodotus, 61, 97, 201, 236, 265; in Egypt, 135–36; 199; on griffins, 29–30, 31, 37, 46; on marine fossils, 211, 264; on Orestes, 110, 121, 126, 215, 264
heroes' bones, 73, 83, 110–21, 182–83. *See also* hero cult
Hesiod, 113, 193, 194, 204
Hesione, 157
Himalayas, 101, 110, 130, 248. *See also* India; Nepal; Pakistan; Siwalik Hills
Hippocrates, 169, 190–91
Hippopotamus, 101, 177, 181–83, 256, 258, 275
hoaxes, 8, 81, 139, 144, 226, 230–37, 240, 243–46, 295n.25
Hofstadter, Douglas R., 246
Holocene, 99, 128, 206
Homer, 3, 6, 35–36, 38, 115, 117, 154, 157, 159, 193, 194, 204, 262, 271, 273
hominid fever, 77–82. *See also* humans
Horner, Jack, 21, 46, 49, 50, 51, 76, 203, 207, 216, 224, 225, 246, 247, 253, 289n.32
horse, 39, 85, 91, 120, 177, 186, 256
Hot Springs Mammoth Site, 249
Hughes, J. Donald, 206
humans, elephant fossils perceived as, 60, 77–82, 201
Humphreys, Sally, 140–41, 148
Huxley, George, 58, 111, 112
hybrid creatures, 16, 204, 215–16, 221–22, 230, 236, 237, 249. *See also* Centaurs; mermaid; Triton
hyena, 85, 91, 101, 206, 255
Hyllos, 74–75, 119, 267, 271
Ice Ages, 65, 101. *See also* Pleistocene
I Ching, 38–39
Idas, 148–49, 184, 185, 197, 271
imagination, 51, 222, 239, 243–47, 253
Imbros (Imroz), 75, 119, 271
India, 55, 60, 91, 171, 222–23, 236, 257; dragons in, 129–35, 268, 269, 274
Indricotherium, 76, 85, 257, 331n.4
Inwood, Brad, 213, 218
Isis, 152–53
Israel, 139, 182, 258, 265
Issedonians, 23, 25–27, 30, 43, 50
ivory, 67, 104–10, 170–71, 182, 186, 209, 223, 274; marsh ivory, 67. *See also* tusks
Jenny Haniver, 233, 325n.4
Jerome, 236
Jersey (Channel Island), 144–45, 259
Joppa, monster of, 138–39, 162, 232, 274
Josephus, 138, 265
Junggar Basin, 27, 43
Kas, 171
Kassandra Peninsula. *See* Pallene
Kazakhstan, 27, 49, 166
Keller, Elizabeth Fox, 245
Kimon, 112, 266, 267, 276
Klagenfurt dragon, 34–35, 93
kneecap, 66, 114, 117, 266
Koch, Albert, 139
Kos, 119, 169, 190–91, 256, 261, 271
Krishtalka, Leonard, 81–82
Kuhn, Thomas, 141, 219
Kyrieleis, Helmut, 181, 183

- Lapatin, Kenneth, 105
Lascaux Cave, 102, 166
Lemnos, 65, 116, 118–19, 126, 270
Lesbos, 58, 209, 217
Leuke, 120
Levi, Peter, 97, 232
Ley, Willy, 7
Libya, 186, 206, 211, 236, 274, 278, 280
Libytherium, 150, 151, 258
lightning, 133, 149, 189, 197–98, 205, 226, 268, 269
lignite, 75, 99, 187, 198
Linnaeus, 46, 218
lion: cave, 85, 101, 255–56; Nemean, 195, 206
Lisbon, 231, 274
Lister, Adrian, 119, 297n.35
Lloyd, Geoffrey, 76, 120, 213, 217–18
Loch Ness monster, 222, 248
Lucian, 235, 240, 265
Lucius Flaccus, 128, 278
Lucretius, 210, 216, 217, 221, 239
Lydia, 74, 75, 117, 193, 197, 201, 221, 267, 270
Lyons, Beauvais, 244–45

Macedonia, 91, 99, 113, 256
Major, Charles Forsyth, 91, 94
Makrosciris, 126, 153, 272
Malta, 142, 171–72, 211, 259, 262, 281
mammoths, 19, 65–66, 77, 93, 98–101, 105–6, 111, 115, 126, 139, 143, 145, 146, 154, 171, 172–75, 185, 198, 201, 206, 247–48, 248, 249, 255–59; definition of, 299n.38. *See also* individual species
Mammuthus africanavus, 101, 126, 154, 258
Mammuthus meridionalis, 101, 106, 196, 256–57, 259
Mammuthus primigenius, 101, 106, 256–57, 259
Mammuthus trogontherii, 73, 101, 256–58
Manilius, 144, 196, 235, 265

marine fossils, 166–67, 171, 181, 211, 214. *See also* fish; shells
Marsh, Othniel, 76
marvels, 139–44, 240, 193, 228, 228, 231–32. *See also* display
Masinissa, King, 142, 262
mastodons, 55, 67, 73, 85, 91, 93, 101, 115, 118–19, 129, 137, 139, 146, 152, 154, 180, 183, 196, 201, 255–59; definition of, 299n.38
Meander River, 181, 236, 274, 276
measurement, of fossils, 73, 111, 115–16, 118–19, 120–22, 126, 128, 146, 153, 200–201, 303n.18
Mediterranean geology and paleontology, 61–72, 61–103, 225, 255–59
Megalopolis, 83, 97–99, 101, 111, 115, 148, 186–87, 189, 197–98, 220, 256, 268
mermaid, 144–45, 230, 233. *See also* Nereid
Mesozoic, 64, 95, 210
Messenia, 113, 148–49, 168, 183–90, 267, 271
Metellus Creticus, 128, 278
Middle Ages, 4, 8, 203, 209, 225, 233
Miletus, 63, 74, 214, 267
mining, 93, 95, 137, 150, 175, 221, 274, 277. *See also* gold
Minnesota Messenia Expedition, 184–90
Minoan civilization, 66, 102
Minotaur, 216, 237
Miocene, 52, 64, 66, 74, 75, 91, 93, 99, 109, 112, 115, 118–19, 129, 137, 145, 160, 166, 171, 180, 183, 185, 198, 207, 209, 211, 214, 224, 255–59
Moldavia, 71, 120, 256
Mongolia, 26, 39–42, 49, 95, 165
monster, remains of, 129–39, 193, 194, 204, 215–18, 239, 204, 274, 278. *See also* dragon; Monster of Troy; sea monster
Monster of Troy, 157–65, 190, 222, 263, 279

- Morocco, 110, 121–26, 258, 277, 280
Morris, Sarah, 26
Mosasaurus, 95, 142
mummies, 144, 232–33, 235; 325n.4
museum, at Capri, 140, 143, 144,
172–75. *See also* display
myth: Greek, 113–15, 122, 138–39,
141, 144, 148–49, 155, 163–64,
192–211, 212, 226, 230–31, 245,
246; definition of, 286n.2; Egyp-
tian, 150–53; Indian, 133

Napoleon, 95, 142
Native Americans, and fossils, 76, 93,
198, 289n.31, 308n.38, 318n.14
Natural History Exhibit Hall, 300n.3,
311n.2
natural philosophers, 46–47, 145,
208–27, 230, 240–41; silence of
on big bones, 58, 116, 141, 191,
192–93, 210, 212–14, 223–24
Naxos, 204, 256
Neades, 55–60, 83, 91, 94, 131,
180–81, 204, 218, 261
Neogene, 64, 65, 75, 85, 101, 109,
115, 122, 137, 153–54, 183, 196,
255–59
Nepal, 130, 248
Nereid, 144–45, 230, 231–32, 274.
See also mermaid
Nichoria, 185–90
Nile, 61–62, 136, 177, 181, 277
Nitria. *See* Wadi Natrun
Norell, Mark, 50
Norman, David, 252
North Africa, 65, 91, 101, 121–26,
149–55, 172, 205, 211, 258. *See
also* Algeria; Egypt; Libya; Mo-
rocco; Tunisia
Novacek, Michael, 50
nummulites, 71, 221, 274, 277, 280

Oakley, John, 159
Oakley, Kenneth, 39, 166, 177
Oligocene, 101, 119, 211, 258
Olympia, 26, 99, 104, 105, 109, 111,
112, 119, 189, 197, 256, 268, 271
oracle, 73, 117, 236, 270, 273; at
Claros, 73, 268; at Delphi, 54, 106,
110–13, 264, 267, 268, 276, 278
Orestes, 110–12, 116, 121, 126, 144,
159, 169, 189, 215, 264, 270, 273,
278
Orion, 205, 273
Orontes (giant), 73, 126, 268
Orontes River, 73, 117, 144, 180,
182, 215, 257, 279
Orthos, 195, 205
Osborn, Henry Fairfield, 213
Osiris, 150–53, 177, 263. *See also*
Makroseiris
Ostia, 138–39
ostrich, 47, 85, 91, 140, 161, 181,
206, 255–57
Ostrom, John, 47, 48, 51
Otus, 204, 205, 273
Ovid, 64, 142, 207, 266

Pakistan, 65, 91, 130, 257, 273
Palaeoloxodon antiquus, 99–101, 106,
190, 204, 256–59
Palaephatus, 164, 220–22, 239, 266
Pallene, 119, 128–29, 194, 197–98,
255, 261, 263, 264, 271, 278, 279
Pan, 137, 262
Panaima, 54, 91–92, 275–76
paradox, 141–42, 148, 245, 246. *See
also* anomalies
Paraka, 130–31, 270
Paros, 211, 236, 274, 281
Pausanias, 63, 65, 206, 219, 224,
241, 253, 266–69; as doctor, 115,
302n.12; on giant bones, 60, 72–
75, 82, 97, 99, 102, 112–16, 126,
144, 159, 183, 193, 194, 200, 202,
266–69; on Gigantomachy, 197,
198; on griffins, 32, 37; on Pallene,
129; on Pelops's bone, 104–10,
180, 268; on Satyrs, 236; on Tri-
ton, 228–32, 235, 249; on tusks,
142–43
Peloponnese, 26, 77, 97–101, 104–
11, 148–49, 168, 182–90, 215,
256, 267

- Peloponnesian War, 11, 111, 182
Pelops, 104–10, 112, 167, 169, 170, 180, 187, 189, 268, 274
Perseus, 138–39, 162
Persia, 30, 133, 199
Peshawar, 130, 270
Petrie, Sir Flinders, 177–78
petrification, 67–71, 139, 207–8
petrified forest, on Lesbos, 66, 209
Phanagoreia, 196, 256, 279
Phillips, E. D., 225
Philo, 64
Philodemus, 126, 128
philosophy. *See* natural philosophers; individual philosophers
Philostratus, 63, 116, 219, 220, 222, 231, 245; on giant bones, 116–20, 126, 129, 223, 270–71; on griffins, 32; on India, 130, 135, 159, 269–70
Phlegon of Tralles, 126, 145–54, 184, 185, 239–40, 271–73
Phlegra, 66, 119, 194, 197–98, 261, 264, 279, 271
Phloion, 54, 55, 92, 137, 276
Phoenix, 235
Pikermi, 83–91, 97, 106, 112, 118, 130, 153, 170, 185, 196, 207, 255
Pitdown Man, 233, 236, 250
Pindar, 63
plants, fossil, 71, 171, 209, 273, 274.
See also petrified forest
Plato, 117, 193, 201, 210, 213, 224, 273
Pleistocene, 39, 52, 64, 65–66, 70, 85, 98–101, 105, 109, 115, 120, 128, 142, 143, 144, 165, 172–75, 177, 186, 198, 205–6, 224, 249, 255–59
Pliny the Elder, 146, 154, 201, 206, 217, 262, 273–75; on Centaur, 235, 240; on giant bones, 124, 126, 128, 143, 205, 273; on griffins, 31–32, 37, 46, 63, 67, 70, 94; on monsters, 144–45, 231–32, 274; on petrification, 133, 171, 208, 209, 273–75
Pliocene, 39, 52, 64, 75, 99, 101, 137, 150, 165, 166, 177, 183, 185–86, 255–59
plowing up fossils, 39, 74, 93, 98, 102, 143, 150, 154, 280, 267
Plutarch, 54, 245, 275–77; on Antaeus, 122, 126; on Centaur, 240–41; on Samos, 54–57, 91, 95, 120, 183, 275–76; on Satyr, 236; on shells, 175, 276
Polybius, 63
Pomponius Mela, 31
Pontus, 146–47, 182, 272
Posidonius, 138, 279
Procopius, 126, 143, 277
Prometheus, 29, 72
Protesilaus, 126
Protoceratops, 40–44, 46, 48, 51, 65, 71, 202, 257
Pseudo-Aristotle, 220–21, 277
Pittacosaurus, 40, 43, 48, 257
pterosaur, 50, 76, 135
Ptolemy, 27
Pulak, Cemal, 171

Qau, 136, 177–78
quarrying. *See* mining
Quintus Smyrnaeus, 200, 277–78

Rapp, Rip, 184, 187
Ray, John, 175
reconstruction of extinct animals, 45–51, 146–48, 226, 272
Reese, David, 165, 168, 170, 178, 180, 186, 311n.4
relics, 139–44. *See also* display; marvels; saints' relics
replica: of giant, 146–48, 226; of marine fossils, 172
rhinoceros, 19–21, 35, 65, 75, 77, 85, 91, 101, 115, 120, 121, 129, 130, 172–75, 183, 185, 196, 255–59
Rhodes, 63, 113, 144, 184, 186, 196, 256, 264, 272
Rhoeteum, 115, 117, 270, 279
Riis, P. J., 182

- Roman Empire, 3, 9, 33, 102, 110, 155, 167, 226, 235–40
- Rome, 137, 138–39, 142–47, 228, 229, 230, 236, 239–40, 269, 272, 273
- Ronan, Colin, 224
- Rudenko, Sergei, 23, 29
- Rudwick, Martin J. S., 211, 284n.3, 323n.48
- Russell, Dale, 42–44, 161, 249–52
- saints' relics, 77, 155
- Saka-Scythians, 22, 27, 166. *See also* Scythia, Scythians
- Samos, 15–18, 43, 52, 54–60, 65, 74, 83, 91–97, 120, 129, 131, 137, 180–83, 188, 190, 204, 205, 218, 256, 261, 275–76
- Samotherium*, 15, 16, 18, 21, 52, 65, 91–93, 151, 160, 180, 183, 188, 256
- Sanders, William, 75, 119, 165
- Sandford, K. S., 177
- Satyr, 137, 236–37, 248
- Scaurus, Marcus Aemilius, 126, 138–39, 274
- Schefold, Karl, 158–59
- Schliemann, Heinrich, 178–80
- science, vs. popular belief, 10, 46, 141–42, 192–93, 225–26, 240, 245. *See also* imagination
- Scythia, Scythians, 19, 22–52, 58, 64, 93, 135, 164, 204, 257, 265
- sea monster, 138–39, 144–45, 158, 205, 218, 228–33, 244, 267, 274
- search image, 70, 80, 120, 160, 217; definition of, 21
- sea urchin, fossil, 71, 175
- Segobriga, 70, 274, 292n.14
- Séguin, R., 249
- selenite, 70, 131–32, 275, 292n.14
- Sen, Sevket, 75, 119, 161, 205
- Seriphos, 208, 256
- Sertorius, Quintus, 121–26, 277, 280
- Set, 177–78; shrines of, 136, 150–52
- Severus, Septimius, 139, 147
- shark teeth, 71, 166, 171, 172, 175, 186
- shells, fossil, 65, 71, 145, 166–67, 171, 175, 186, 210–11, 223, 275, 278–79, 264, 266, 267, 276, 281. *See also* marine fossils
- shipwrecks, and fossils, 106, 170–71, 268
- shoulder blade, 66, 77, 99, 169, 215; of Pelops, 104–10, 268, 274
- Siberia, 19–21, 26, 93, 101
- Sicily, 7, 33, 36, 64, 71, 197, 201, 210–11, 215, 223, 259, 261, 262
- Sigecum, 157, 117, 263, 270, 279
- Sikyon, 113, 228, 267
- Sipylos, Mount, 63, 113, 181, 221, 277
- Sivatherium*, 130–31, 150, 257, 258
- Siwa, 150, 263, 279
- Siwalik Hills, 91, 130–35, 198, 248, 257
- Skiron, 196, 266, 276
- Skoufos, Theodore, 96–98, 198
- Skyros, 112, 266, 267, 274, 276
- Sloan, Robert, 185, 187
- Socrates, 213
- Solinus, 126, 128, 137, 210, 278
- Solounias, Nikos, 91–92, 94, 187–88
- Spain, 65, 70, 74, 131, 171, 197, 208, 259, 271, 274
- Sparta, 110–11, 113, 116, 144, 159, 169, 182, 184, 189, 264, 267, 268, 269, 270, 276, 278
- Sphinx, 16, 47, 195, 237
- spinosaurs, 135–36
- squid, giant, 230
- Stegodon, 130, 165, 257
- Strabo, 63, 64, 71, 124, 126, 194, 278–80
- Stymphalian birds, 206
- Suda*, 280
- Suetonius, 143, 146, 145, 280
- Syria, 58, 73, 144, 171, 178, 180, 182, 197, 198, 257, 279
- Tacitus, 280–81
- Taman Peninsula, 126, 146, 196, 256, 273, 279

- Tanagra, 228–35, 233, 235–37
taphonomy, 49, 66, 67–72, 226
Tarbosaurus, 248–49
Tassy, Pascal, 10
tattoos, 23, 25
taxonomy, ancient, 75–76, 117, 226
teeth: fossil elephant, 66, 77, 126,
129, 145, 155, 160, 164, 166, 168,
169, 182, 190–91, 222, 226, 262,
266, 272; horse, 186; shark, 71,
166, 171, 172, 175, 186; Tiberius's
reconstruction from, 146–48
Tegea, 99, 110–11, 113, 116, 142,
159, 197–98, 206, 215, 264, 269,
278
temples, fossils displayed in. *See* display; Heraion; relics
Tenedos, 159, 278
Tesakov, Alexey, 196
Tethys, Sea of, 64–65, 214
Tetralophodon, 126, 154, 257
Teutobochus, 77
Thebes, 113, 197, 265
Theophrastus, 67, 93, 171, 209, 212,
217, 220, 274
Theopompus of Sinope, 146, 196,
273
Thera (Santorini), 66
Theseus, 112, 169, 196, 266, 267,
276
Thessaly, 91, 119, 126, 205, 237,
240, 241, 256, 271, 278
Thomas, Angela P., 178
Thucydides, 192, 201
Tiberius, 73, 144–48, 182, 226, 229,
231–32, 271–72, 274
Tien Shan, 26, 36
tiger, 206; saber-toothed, 85, 101,
255–56
time, concepts of, 140–41, 224
Titans, 29, 194, 195, 207
tortoise, giant, 85, 130, 196, 206,
255, 257
trade, fossil, 166, 180–81, 186, 190
Trapezus, 197–98
T. rex, 95, 248
Triassic, 43, 71, 137
Triton, 145, 228–33, 233, 235–37,
241, 244, 248, 249, 252, 253, 274
Trojan War, 9, 63, 99, 102, 104, 112,
113, 114, 116, 178–80, 268, 278
Troy, 63, 75, 104, 105, 114, 116, 117,
150, 178–80, 200, 257, 263, 266,
267, 270. *See also* Monster of Troy
Tsoukala, Evangelia, 99, 129
Tunisia, 153–55, 258
tusks, 67, 98–101, 115, 131, 142–43,
145, 171, 168, 182, 206, 262, 269.
See also Calydonian Boar
Typhon, 73–74, 151, 194, 195, 196,
197, 198, 223, 230, 261, 263, 264,
278, 279
Ubelaker, Douglas, 80
Ulu Burun, 171
Ursus spelaeus. *See* bear
Utica, 126, 154–55, 258, 261
Uzbekistan, 43
vase painting, 26, 30, 157–65, 222, 237
Vermeule, Emily, 170
Verres, 142
Vesuvius, Mount, 119, 198, 271
Virgil, 143, 154, 281
Vitaliano, Dorothy, 193–94
volcanoes, 66, 194, 198, 209
Wadi Natrun, 149–50, 152–53, 258,
272, 279
Wagner, Andreas, 47, 85
well digging, 98, 111, 301n.7
Wendt, Herbert, 151
whales, 65, 126, 138–39, 147, 160,
170, 232, 258, 269, 279, 331n.4
Willers, William, 243–45, 249
wonders. *See* marvels; Phlegon of
Tralles; relics
wood, petrified, 171, 273. *See also*
petrified forest
Xanthos of Lydia, 211, 279
Xenophanes, 80, 137, 171, 210, 215,
224, 281
Xenophon, 236

- Zabirna, 150, 263
Zdansky, Otto, 39–40
Zeus, 99, 140, 195, 197–98, 207,
261, 262, 263, 264, 269, 279
- Zhiming, Dong, 42
zooarchaeology, 168–69, 184–86
Zygodaphodon borsoni, 101, 255–
56