

# Place names describing fossils in oral traditions

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**Abstract:** Folk explanations of notable geological features, including fossils, are found around the world. Observations of fossil exposures (bones, footprints, etc.) led to place names for rivers, mountains, valleys, mounds, caves, springs, tracks, and other geological and palaeontological sites. Some names describe prehistoric remains and/or refer to traditional interpretations of fossils. This paper presents case studies of fossil-related place names in ancient and modern Europe and China, and Native American examples in Canada, the United States, and Mexico. Evidence for the earliest known fossil-related place names comes from ancient Greco-Roman and Chinese literature. The earliest documented fossil-related place name in the New World was preserved in a written text by the Spanish in the sixteenth century. In many instances, fossil geonames are purely descriptive; in others, however, the mythology about a specific fossil locality survives along with the name; in still other cases the geomythology is suggested by recorded traditions about similar palaeontological phenomena. The antiquity and continuity of some fossil-related place names shows that people had observed and speculated about mineralized traces of extinct life forms long before modern scientific investigations. Traditional place names can reveal heretofore unknown geomyths as well as new geologically-important sites.

Traditional folk names for geological features in the landscape commonly refer to mythological or legendary stories that accounted for them (Vitaliano 1973). Landmarks notable for conspicuous fossils have been named descriptively or mythologically around the world since antiquity, and some of the old names persist in modern usage and maps. Tracing the origins of such names reveals that oral mythologies of various pre-scientific cultures can contain knowledge of significant palaeontological evidence based on repeated observations over centuries, and this lore can lead to new geological discoveries. It can also demonstrate that rational efforts to understand the meaning of prehistoric bones and other petrified remains occurred before modern scientists began to investigate the fossil record.

How far back in time can oral folklore about natural phenomena be traced? Recent analyses of geomyths describing datable geological catastrophes, such as volcanic eruptions and earthquakes, and celestial events, indicate that some traditions have been passed down orally for thousands of years (Dixon 1984, pp. 153–155, 295; Barber & Barber 2005, pp. 6–9, 178–216 and references cited; Mayor 2005*b*, pp. 97, 98–99). Fossil-related geomyths are worthy of study because they show how, before the development of modern palaeontological science in the early nineteenth century, awareness of fossil evidence led to logical scenarios about the history of the earth and perceptive pre-Darwinian insights about extinct life forms.

## Named fossil sites in classical antiquity and modern Greece

Evidence for the practice of naming specific fossil locales can be found in classical antiquity. Greek and Latin sources describe several place names associated with ancient discoveries of the immense skeletons of extinct animals and the aetiological geomyths that accounted for them. Dense concentrations of oversize petrified bones led to the notion that a great battle or slaughter had taken place there in the distant past. For example, ancient Greek writers reported that the smoking earth around the city of Megalopolis (ancient Greek for ‘Giant City’) in the Peloponnesus, where colossal bones of unfamiliar creatures emerged, was known as the ‘Battleground of the Giants’. The god Zeus was said to have destroyed the giant Titans here with lightning in the mythic era before present-day humans. The bones of ‘giants’ had been unearthed and displayed in the Peloponnesus since at least the fifth century BC, according to the historian Herodotus (*c.* 430 BC) and other ancient authors.

In 1902, Greek palaeontologists discovered that the smouldering lignite soil around the ruins of ancient Megalopolis contains plentiful fossils of large Pleistocene mammals, including ancestral rhinoceros and elephant species that lived about 2 million to 10 000 years ago. The fossil bones are stained dark by the lignite, which can burn and smoke for long periods of time. The discovery of very large skeletons combined with this natural

fact gave rise to the idea of a lightning-blasted battlefield where giants were once slain. According to the ancient writers Strabo (c. 30 BC) and Solinus (c. AD 200), the 'Headquarters of the Giants' was at Pallene, on the Kassandra Peninsula in NE Greece. The ancient place name and geomyth were confirmed in 1994, when Greek palaeontologists discovered rich Pleistocene fossil beds at Pallene. In the Roman era, the discovery of steppe mammoth fossils in a river bed in what is now Syria resulted in the naming of Orontes River, after the mythical giant whose bones were supposed to have been buried there (Mayor 2000, pp. 73, 98–99, 128–29).

According to the historian Plutarch (c. AD 100), a conspicuous bone bed on the Aegean island of Samos was called *Panaima* ('Bloodbath', or 'Bloody Battlefield'). The name designated a large flat surface of red soil where immense skeletons continually weather out. According to myth, a violent battle between the god Dionysus's war elephants and an army of Amazons took place here, and the bloodshed was so great that the earth was stained red. Notably, the ancient Greek name for the landmark, 'Bloody Battlefield', was still preserved on seventeenth century Italian maps of Samos, with the Latin name *Guerrarii*, 'Battlefield'.

The fossil beds of Panaima, some of the most prolific in Europe, were first excavated by scientists in about 1870. The most impressive bones are those of Miocene mastodons from about 8 million years ago. The myth about Dionysus's war elephants suggests that mastodon remains were apparently recognized as those of elephants as early as the first century AD. In the late nineteenth and twentieth centuries, Greeks of Samos began to refer to the site as *Elephanton Nekrotafeion*, 'Elephants' Graveyard' (Solounias & Mayor 2005, pp. 288–293). A few kilometres west, on a mountain known as Vigla, old nineteenth-century maps indicate the place name 'Christ's Footprints'. No fossil footprints on the island are yet known to palaeontologists, but the name may refer to fossil tracks or natural depressions in rock (N. Solounias, pers. comm. 2001).

### Named fossil sites in ancient and modern Asia

Traditional place names have also been related to pre-scientific fossil discoveries in Asia. In northern India, for example, the mythic battle of the great Indian epic Mahabharata was said to have taken place in the rich Pliocene fossil bone beds of the Siwalik Hills. Asthipura, 'Town of Bones', was named because of the remains, thought to be those

of giant heroes and war elephants, slaughtered during the legendary war.

In ancient China, the immense skeletons of dinosaurs and early mammals were identified as the remains of celestial dragons who brought rain and provided water. A Chinese chronicle of the second century BC reported that during the digging of a canal in northern China, 'dragon bones were found and therefore the canal was named Dragon-Head Waterway'. 'Dragon bones' were ground into powder for medicine, a practice that continues today among traditional Chinese (Oakley 1975, p. 40).

Other traditional Chinese place names allude to fossil bones. The name of a small village about 48 km SW of Beijing, *Zhoukoudian*, translates as 'Chicken Bone Hill'. It is located in a region of rich fossil remains, both large and small. In this case, prehistoric rodent bones were mistaken for chicken bones. Near Zhoukoudian, *LongGuShan* ('Dragon Bone Hill or Mountain') was a place where ancient miners quarrying limestone often unearthed large petrified bones of prehistoric animals. In 1929, LongGuShan was the site of the discovery of Peking Man, *Homo erectus pekinensis* (Boaz & Ciochon 2004, pp. 3–7).

In southern Guizhou Province, in south central China, a low hill was long known as 'Lurking Dragon Hill'. The hill contains the abundant remains of exquisitely preserved, 30–36 cm long Cretaceous marine reptiles with long necks, *Keichousaurus hui*. Generations of rice farmers used to search for small dragons here, which they considered good luck: they used the fossil-bearing stone to build their homes. In about 1850, local farmers collected enough silver to buy and preserve Lurking Dragon Hill. It was not until 100 years later that palaeontologists began to study the unique fossils (Morell 2005, pp. 82–83).

Another place name with possible palaeontological associations occurs in an ancient Chinese legend about White Bone Cave on Skeleton Mountain, where dangerous 'rock spirits' were encountered (Owen 1996, pp. 771–806). The notion that spirits were transformed into rock in places whose names included words for bone and skeleton suggests that the legend was a way of explaining mysterious fossils of unfamiliar animals (a similar concept appears in some American Indian geonames, discussed later).

### Fossil-related place names in Europe

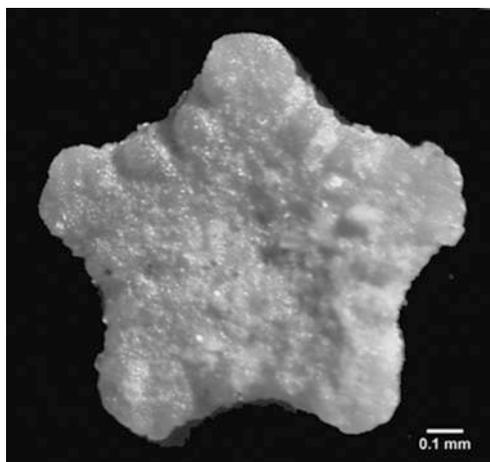
In Europe, various fossiliferous localities have long been known by folk names that refer to the invertebrate or vertebrate remains found there. An example from France recalls the ancient Greek

names for fossil beds that were believed hold the bones of giants. The plain in the Lower Dauphine, France, a few kilometres from St Romans, contains rich deposits of Pleistocene mastodon fossils. Since at least the 1600s, it was called *Champs des Géants* ('Field of Giants'). *Montagne des Cornes* ('Mountain of Horns') near Rennes-les-Bains in the Corbières area of southern France is a folk name that derived from abundant rudists, Late Cretaceous bivalve fossils with a conical, goat-horn-like shape. An Eocene fossil site in southern France with rich reptile and large mammal fossils was traditionally known as 'Alaric's Grave'. The people of the nearby village, La Livinière, believed the bones were those of the Visigoth king Alaric and his warriors, killed in the fifth century AD (E. Buffetaut, pers. comm. 2005). In the Middle Ages, caves and other sites containing fossils of huge Ice Age cave bears were fabled to be the dens of dragons (Abel 1914). *Drachenhöhle* ('Dragon Cave') in Austria and *Drachenloch* ('Dragon Lake') in Switzerland are two place names preserving that medieval folklore (T. Tyrberg, pers. comm. 2005).

In England, a well in Wiltshire was named for marine fossils marked with a striking star pattern. A seventeenth-century antiquarian, John Aubrey, described the well, known as Holy Well or Star Well, as a spring where 'where five-pointed stones doe bubble up' (Aubrey 1969, p. 45). According to folklore, the stars were thought to be petrified elderflowers that had fallen into the spring. But the spring flows over a fault line between the corn-brash layer of the Great Oolite and overlying clay, and the tiny stone stars are fossils continually detached by the action of the water and carried to the surface. The fossils are individual segments of the stems of crinoids, plant-like sea-creatures commonly known as sea lilies (Fig. 1). Crinoids are related to starfish, hence the star-like shape (Jordan 1998).

### Modern American names for fossil sites

Numerous geographical names in the United States and Canada reflect fossil finds going back to colonial times. Some examples are Big Bone Lick (discussed below) and Big Bone Cave, Tennessee, where giant sloth remains (*Megalonyx jeffersoni*) were discovered in 1811. In Alaska, Big Bones Ridge and Elephant Point (named in 1826) are sites where woolly mammoth remains turned up; Dinosaur, Colorado, and Fossil, Oregon were named for nineteenth century palaeontological discoveries, as were Big and Little Lithodendron Washes in Arizona. Shark Tooth Hill in California



**Fig. 1.** Star-shaped fossil crinoid, like those at Star Well, in Wiltshire, England.

and Shark River in New Jersey were named for abundant shark teeth, and fossil shells account for the name of Shell Canyon in Wyoming. Cliffwood Beach, New Jersey, was named for the Cretaceous petrified wood that erodes out of a seaside bluff; and Baculite Beach in Canada and Baculite Mesa and Oyster Ridge, Colorado, are so designated because of the abundance of Cretaceous marine fossils. Many other examples of colonial and modern geographical names based on fossil finds exist throughout the United States and Canada: some are translations of earlier Native American names.

### Native American names for fossil sites

When searching for Native American topographical names that could be associated with prehistoric fossil remains, one must bear in mind that suggestive names in translation, such as 'skeleton', 'giant', 'skull', 'bone', and so on do not always indicate a fossil-based origin. For example, Skeleton Mountain in Calhoun County, Alabama, is a translation of a Creek Indian name for a winding stone wall atop a narrow ridge, erected by prehistoric Woodland Indian cultures, perhaps to create a snake effigy (Alabama Archaeology Society 2004). In contrast, a Yaqui Indian place name, Skeleton Mountain, described below, does refer to fossils.

Names for places in Native American cultures were often geological markers, but they also referred to conspicuous features of topography besides geology. For example, names described attributes of rivers, lakes, or mountains (such as

'stony', 'dry', or 'black'), or landform shapes that resembled animals (such as Bear Butte, South Dakota). Place names also commemorated historical and mythical events and people, indicated details of local economies such as a trading centre or hunting ground, described flora and fauna, or otherwise referred to notable things in the environment. Many place names provided a mental map of important resources or dangers (on Native American place naming, see Rydjord 1982; on traditional naming based on resemblances, see Barber & Barber 2005, pp. 97–102).

In the Western Hemisphere, conspicuous fossil remains of creatures of the Mesozoic (245 to 66 million years ago) and Cenozoic (66 million years ago until the last Ice Age, about 10 000 years ago) ages attracted attention, inspiring legends and place names. Some Native American fossil place names survive in translation only, such as 'Big Bone Creek' and 'Big Bone Lick' for the famous mastodon bone beds in the salt marshes and sulphur springs along the Ohio River. These exposures (now Big Bone Lick State Park, in Kentucky) first came to the attention of European naturalists in the mid-eighteenth century, after Shawnees, Delawares, and other tribes brought large molars and tusks to European forts. Several tribes' explanations for Big Bone Lick have survived, as discussed below.

Other place names, such as the Wyandot name for Big Bone Lick and the Hopi-named Moqui Cave in Utah (discussed below), retain the original language along with the tradition. Some Native American place names indirectly hint that a story about fossils once circulated, but is now lost. For example, the significant dinosaur tracksite in Cactus Park near Grand Junction, Colorado, lies beside a particularly large and ancient ponderosa pine tree, traditionally known to the Ute Indians as the 'Ute Council Tree'. Several sets of obvious Jurassic theropod dinosaur trackways (ranging from very large to turkey-sized) lie next to the venerable tree. They may have figured in a Ute legend that made the place an important meeting point (Lockley 1991, p. 185 and note 3).

Some Indian place names seem to indicate an awareness of fossil traces by referring to rock art that replicated genuine fossil footprints. Consider, for example, a place named by the Pit River or Achumawi people of Northern California. In 1908, the Achumawi elder Istet Woiche (born about 1840) told the traditional story of *Ja-mul dok-im-choi*, 'Coyote-man's Track', left in stone when the earth was young. On the south side of Big Bend on the Pit River, just east of Hot Springs, California, Woiche pointed out a large boulder in the gravel channel. The boulder has a noticeable depression, about 20 cm long, shaped

like a man's footprint (Woiche 1992, pp. 85–160). This region of California is mostly volcanic, so fossil-bearing sediments are extremely rare, but it is possible for footprints to have been preserved in hardened lava flows. Authentic footprints of animals and people fleeing a volcanic eruption in 1790 are the subject of a legend in Hawaii (Mayor & Sarjeant 2001). Coyote-man's Track may be a natural foot-shaped depression, or the print could have been carved by an Achumawi shaman to replicate a genuine fossil footprint seen elsewhere (the Achumawi original homeland was the Southwest, where dinosaur tracks are common). It is interesting that two other California tribes, the Southern Nissenan people, and the Chumash, have myths that tell of Sky Coyote leaving pawprints and Sky Lizard leaving five-digit impressions in a large white rock in primeval times before humans (Chumash Creation Story 2003; P. Faris, pers. comm. 2005). The following sections present some traditional Native American names for scientifically recognized fossil sites, with a discussion of the associated myths from more than a dozen cultural groups, beginning with an Aztec geomyth and name that predates the Spanish Conquest in Mexico (1519), and concluding with a recent palaeontological discovery in Canada that confirms two traditional First Nations names for fossil locales.

### *Central and South America*

In Tepexi de Rodriguez, Puebla, Mexico, *Pie de Vaca*, 'Cow's Footprint', was named for trackways of prehistoric camels that were mistakenly identified by local folk as hoof prints left by cattle (G. Callison, pers. comm. 2005). 'Enchanted Cave', near the village of Chimalacatlan in Morelos, Mexico, received its name because of the mysterious bones (of mastodons) that were excavated in the cavern by peasant farmers. In Colombia, an extensive deposit of mastodon bones near Santa Fe de Bogotá was dubbed 'Field of Giants', recalling the similarly named plain in France, above. When Charles Darwin explored deposits of enormous extinct animals of the Pampas in Argentina in the 1830s, his native guides showed him places they called 'Field of Giants', 'Mound of the Giant Creature', and 'Stream of the Unknown Animal'. In Central America, the practice of naming a place for its fossil traces can be traced back to the Aztecs.

*Temacpalco*. After the Spanish conquest of Mexico in 1519, some missionaries took an interest in local traditions. From about 1530 until 1580 in Yucatan, the Spanish Jesuit Bernardino de Sahagun met daily with a group of artist-scribes who were

the keepers of Aztec oral history. Sahagun translated into Spanish a series of centuries-old narratives from the Aztec language, Nahuatl. His 'Historia general de las cosas de la Nueva Espana' is contained in a manuscript known as the Florentine Codex.

The Florentine Codex describes the Feathered Serpent God Quetzalcoatl's odysseys set in the twelfth century AD, around the time that the Aztecs first arrived in central Mexico. Various pre-Columbian Nahuatl place names commemorated places along the Feathered Serpent God's journeys. At one point in the myth, Quetzalcoatl stopped to rest. This spot was venerated because of 'the marks which Quetzalcoatl left upon the stone with his hands when he . . . sat down'. The codex continues, 'His hands, they sank deeply; as if in mud did the palms of his hands sink down. Likewise his buttocks, as they touched the rock, sank deeply'. These marks of the god's hands and seat, the Aztecs told Sahagun, 'are clearly visible, so deeply are they' impressed in the bedrock. For centuries before the Spanish conquistadors arrived, the Aztecs had called the place *Temacpalco*, which means 'Impression of the Hands'. Temacpalco was about 19 km from Tenochtitlan, the Aztec capital (now Mexico City).

The prints were not illustrated in the Florentine Codex. The god's image combined serpent, bird, jaguar, crocodile, and human features. It seems likely that *Temacpalco* contained mysterious fossil impressions in bedrock which were explained by the myth of Quetzalcoatl resting (see Mayor 2005a, pp. 86–87, citing Sahagun 1970–82, book 3, part iv, p. 35, and Torquemada, *Segunda parte*, p. 50, cited by Sahagun's commentators). The sediments around Mexico City are of Pleistocene age, and may hold the tracks of large and unfamiliar Ice Age mammals, which sometimes resemble human prints. Tridactyl dinosaur footprints of various sizes have been studied by palaeontologists in the states south and west of Mexico City, in Michoacan, Coahuila, Puebla, and Oaxaca.

The Aztec myth about a god's prints in stone is not unique. For example, Aborigines point out a place on the coast near Broome, NW Australia, where the giant Emu-man walked and rested. Large feather-like fossil fern impressions in the Cretaceous-era sediments were the spots where Emu-man sat, and large three-toed dinosaur tracks on the beach show where he waded into the sea. The coastal rocks of Broome contain dinosaur prints that resemble gigantic emu tracks (J. Long, pers. comm. 2000). In North America, Delaware (Lenape) elders related their legend about Big Bone Lick to Thomas Jefferson. They maintained that one could view the impression of the Great Spirit's seat and footprints on a rock ledge. This

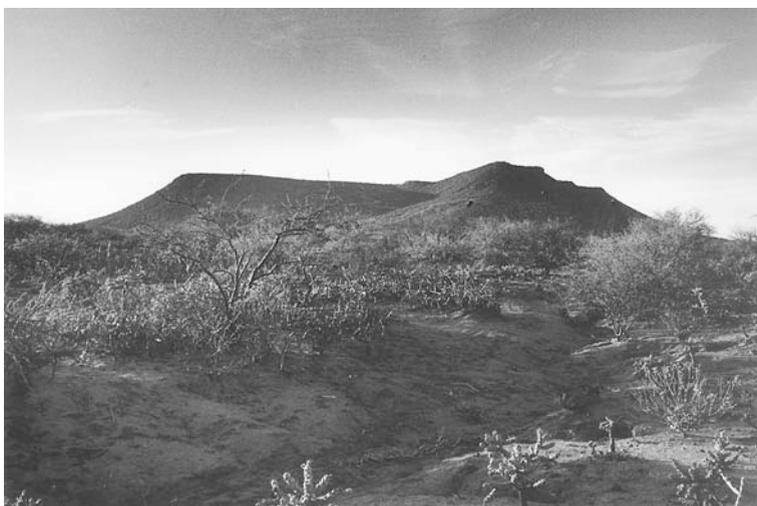
was said to be the place where he descended and destroyed the 'Giant Buffalo' whose bones emerged along the Ohio River (Jefferson 1954, p. 43).

According to the Shawnees, impressions in rock 'like a man sitting in snow' were left by giant men who had once hunted the 'Grandfather of the Buffalo', whose great bones were found in the Ohio Valley. Besides Pleistocene fossils, this geographic region also boasts many noticeable trackways (Mayor & Sarjeant 2001; Mayor 2005a, p. 54 and n. 18). Similar Assiniboine and Sioux legends about seat prints in stone were collected in Montana by ethnologist Robert Lowie (Lowie 1909, p. 105). Some of these folk motifs may have been inspired by observations of fossil footprints of mammals or dinosaurs, or even impressions of dinosaur hindquarters, which have been scientifically recorded (Mayor & Sarjeant 2001, p. 157). Another possibility is the fossil of a giant turtle, whose carapace creates a large human 'sitzmark'-like impression.

The Aztec myth about Temacpalco, Impression of the Hands, is the earliest fossil-related place name recorded by Europeans in the New World. It was written down by the Spanish in about 1530, but it had been preserved in oral folklore from pre-Columbian times, originating some time after AD 1200, when the Aztecs first settled in the region of Mexico City. The following geomyth from northern Mexico was also set in the pre-Contact era.

*Skeleton Mountain.* The Yaqui legend about Skeleton Mountain, a sacred site in Sonora, NW Mexico, begins by explaining how a certain *kawi*, 'mountain', came to be named *Otom* or *Otam Kawi*, 'Skeleton Mountain'. Heaps of fossil bones weathered out of this and other foothills of the Sierra Madre Occidental above the Rio Yaqui (Fig. 2). The legend of Skeleton Mountain tells of an enormous raptor bird that preyed on the Yaquis' ancestors. Oral versions of the tradition were recounted by two Yaqui elders from Sonora, Mariano Tapia, born about 1887, and Refugio Savala, born in 1904.

In the legend, long ago before pueblos, the Yaqui people still lived in crude shelters made of mud and branches, cowering in constant fear of monstrous bird of prey that lived on the slopes of *Otam Kawi*. The multitude of bones and skulls spilling out of the slopes of Skeleton Mountain were said to be the victims of the raptor. A brave youth set off to destroy the bird. He dug a hole in the bone field and hid there in ambush. After he killed the huge bird, the boy led a party of elders from the Yaqui villages to see the proof of the pit he had dug and the giant creature's remains (Savala 1945).



**Fig. 2.** Skeleton Mountain (*Otam Kawi*), a fossil site that figured in Yaqui legend. Sonora, Mexico. Photo: D. Burckhalter.

The Yaqui legend of Skeleton Mountain accounted for the variety of fossil bones weathering out of the mountainside, and it described the discovery, by digging, of the remains of a gigantic bird. Could the tale have been influenced by ancestral memories about Ice Age teratorns, enormous Pleistocene raptors with 3.7–5.2 m wingspans which coexisted with early humans in the Americas? Teratorns and prehistoric giant condors (with a 3 m wingspan) may have been capable of grabbing children and small adults. But it is more likely that observations of petrified or mummified carcasses of immense prehistoric raptors and their bone-filled nests contributed to the tale of Skeleton Mountain.

In the 1970s in the gravel beds along Rio Yaqui below Skeleton Mountain, Mexican and American palaeontologists began to study the remains of Pliocene and Pleistocene elephants, bison, horses, and other prehistoric creatures that lived about 5 million to 10 000 years ago. The fossils wash down from the western slopes of the Sierra Madre and are frequently found by Yaqui people today on Otam Kawi and other hills. Higher up, more complete skeletons erode out of the mountainsides, and patches of earlier Jurassic–Cretaceous remains may also exist in the Sierra Madre, which could include the fossils of pterosaurs or flying reptiles (R. White, pers. comm. 2002).

Versions of the legend of Skeleton Mountain probably originated before European Contact, since it is set in the period of primitive mud and wattle shelters, before the development of sophisticated pueblo settlements. By the time the Spanish

encountered the Yaqui in about 1730, the Yaqui had been living in pueblos for many centuries. The traditional account shows no European influence, and the place name *Otam Kawi* is still used today.

#### *North America*

*Great Horn River.* The Iroquois Confederacy, based in what is now New York State and Pennsylvania, included the Onondaga, Seneca, Cayuga, Oneida, Mohawk, and later the Tuscarora nations. The territory of the Delaware (Lenape) group, whose language was Algonquian, ranged from New York to Virginia and Ohio. Iroquois and Delaware people had long observed the fossil remains of mastodons, especially huge ivory tusks, in their territories. In Algonquian and Iroquoian languages, the word *chemung* and its variations, *shemung*, *skeemon*, *shimango*, etc. mean 'great horn'. Chemung River and Chemung County in central New York derive from the Cayuga and Seneca word *chemung*, place of the great horn. Recently, local historians reported that nine tusks have been found in the Chemung River, confirming the Indian names. The Delaware version, *shemung*, was given to the Shemung River in eastern Pennsylvania, another region where mastodon fossils occur.

The name *chemung* was undoubtedly in use before the arrival of Europeans, but the earliest documentation of the name and variations appeared in the mid-1700s. A French translation, *Chaamonaque*, occurs on a map of 1757; there is a reference to

the Shemung River in Pennsylvania from 1767, and to a place called Shemung near Jamestown, Virginia in 1777 (Hilbert 1975). In about 1795 in Paris, Georges Cuvier (the father of modern palaeontology) received a letter from the American naturalist Benjamin Smith Barton stating that Delaware Indians had found mastodon molars and a 3 m-long ivory tusk in a tributary of the Tioga River, near the head of the North Branch of the Susquehanna River, in New York State. Barton wrote that '*les sauvages delawares*' called the stream *Chemung*, which he translated as 'Rivière de la Corne' or 'River of the Horn'. In 1808, Thomas Jefferson learned of a Delaware discovery of a very large spiral tusk in the same river (Mayor 2005a, p. 62 and n. 25).

At the time of Cuvier and Jefferson, Euro-Americans were struggling to explain the masses of mastodon fossils in America. They actively sought out Delaware and Iroquois knowledge about the bone beds, recording their traditional explanations for how these remains came to be buried in the earth. The Iroquois imagined that the tusks were the horns of huge water monsters that had lived in ages past and might still lurk in deep water. Perhaps because the Pleistocene-era mastodon bones, teeth, and tusks frequently emerge from riverbanks and marshes of the mid-Atlantic states, the Iroquois and other groups assumed that they belonged to water creatures. In contrast, the Delaware and Shawnee identified the huge remains along the Ohio River as the Grandfather of the Buffalo', viewing them as gigantic ancestors of the largest horned animal they knew, the American bison. As noted earlier, they imagined that the Great Spirit had destroyed these giant beasts with lightning before the time of present-day humans. These Native traditions provided alternatives to the biblical myth of Noah's Flood that prevailed in Europe and America until Cuvier's declaration that mastodons were the extinct ancestors of living elephants (on mastodon discoveries in colonial America, see Semonin 2000).

*Witch Buffalo at Bitter Spring.* The Wyandots (Hurons) of the Great Lakes area also had an oral tradition about the mastodon and other large mammal bones that lay in the salt bogs of Big Bone Lick on the Ohio River. The Wyandot legend, first written down by an ethnologist in 1850–90, identified the remains as those of 'Witch [or Spirit] Buffalo', immense bison that stood as high as trees with horns extending from their foreheads as long as a man is tall (Fig. 3). Long ago, these Witch Buffalo had dominated the 'great and ancient spring' of pure water at Big Bone Lick, forcing out smaller game animals and keeping the Wyandots from hunting or gathering

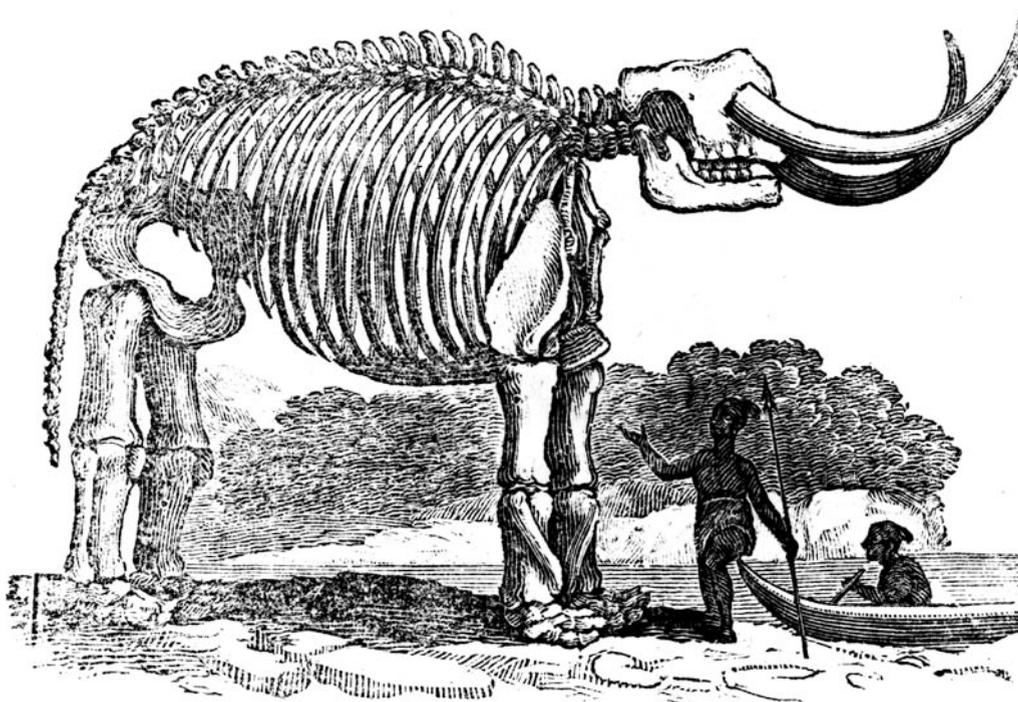
salt there. At last, the Witch Buffalo were wiped out, leaving the heaps of big bones at the spring. After the destruction of the giant bison, the pure spring became undrinkable. The place where the Witch Buffalo had once reigned and then died came to be called *Oh-tseh-yooh-mah*, 'Spring of Bitter Water' (Barbeau 1994, pp. 276–278).

The Wyandot geomorph accounts for the sulphur springs, briny marshes, and masses of fossils at Big Bone Lick. Notably, among the Pleistocene animal remains along the Ohio River are the skulls of extinct giant bison with straight horns spanning 1.8 m. Apparently these remains were recognized by Wyandots, Iroquois, and other early Indian observers as much larger relatives of living bison, leading to the names 'Witch Buffalo' and 'Grandfather of the Buffalo' to refer to all of the enormous creatures that had perished there in the past.

*Place Where the Great Mosquito Monster Lies.* Other types of fossil remains captured the attention of Iroquoian groups. The Tuscaroras pointed out a rock near Brighton, south of Syracuse, New York, that held the tracks of the Great Spirit and of the Giant Mosquito Monster. According to David Cusick, a Tuscarora Indian who published traditional Iroquois oral chronicles in 1825, this large flying creature lived at the same time as giant bears, huge lions, and mastodons, thousands of years before the arrival of Columbus.

The Great Mosquito Monster was said to have been killed at a salt lake bed located at Onondaga, New York, known to the Iroquois as *Kah-yah-tak-ne-t'ke-tah keh*, 'Place where the Great Mosquito Monster lies'. According to another version of this legend told by the Seneca chief Cornplanter (1736–1836), long ago the Cayugas and Onondagas came to view the huge carcass. The body was bigger than a bear's and its wingspan was as long as three men. Its claws were as long as arrows and the beak was filled with sharp teeth. The Great Mosquito Monster's footprints were also pointed out: they were three-toed, like a bird's, but about 51 cm long and the trail could be followed for about 91.5 m (Cusick 1825, p. 18; Canfield 1902, pp. 59–61).

The site of the legendary monster's death, in a salt lake bed, and its physical description suggest a conflated and garbled account of various fossil types found in New York State. Raptor birds of the Pleistocene epoch had very large talons and wingspans. But the toothy beak suggests the skull of a crocodile-like reptile, perhaps a Triassic phytosaur of 200 million years ago. Another fossil possibility is the large, 'false-toothed' bird (*Pseudodontornis*) of the Pleistocene. Long-standing traditions about real raptors of the Pleistocene and Holocene, such as teratons and giant condors—or



**Fig. 3.** Native Indians discovering a fossil mastodon skeleton along a river in the NE United States. Wood engraving by A. Anderson, for T. Bewick's *A General History of Quadrupeds*, 1804. Courtesy of Graphic Arts Collection, Department of Rare Books and Special Collections, Princeton University Library.

discoveries of their fossil remains—may have contributed to this and other widespread Native American tales of flying monsters. New evidence shows that the range of large condors extended over the North American continent until fairly recent times. For example, in 1984 palaeontologists at the Hiscock archaeological-palaeontological site in New York State discovered skeletons of very large condors along with the human artifacts (Chandler 2001).

What about the footprints of the Great Spirit and the Mosquito Monster? As noted earlier, fossil tracks of extinct mammals, such as giant sloths or bears, can resemble large human prints, and dinosaur tracks have been taken for human hand or foot prints or bird or lizard tracks (for a survey of worldwide fossil footprint lore, see Mayor & Sarjeant 2001). The large bird-like footprints near Syracuse suggest a trackway of a three-toed dinosaur, but that region is not known for Mesozoic sediments. However, tens of thousands of very conspicuous tridactyl dinosaur prints exist not far away, in the Connecticut River Valley of Connecticut and Massachusetts, and in Rockland County, southern New York. The Connecticut Valley dinosaur footprints were first

noticed by white settlers in 1802, who attributed them to 'Noah's Raven' from biblical myth. Some of these large tracks were identified as *Eubrontes* dinosaur prints in 1845, and others were made by *Grallators*, theropods that lived about 200 million years ago (Fig. 4). The largest prints measure about 43 cm long, and the trackways crisscross and extend for some distance in the rock (Weishampel & Young 1996, ch. 4 and pp. 106–105; Mayor & Sarjeant 2001, p. 151).

Fossil footprints called 'Devil's Tracks' (probably a mistranslation of Indian words for 'sacred' or 'mystery' tracks) have been associated with American Indian lore since colonial times. Sites with this name occur in Long Island, New York; Montville, Connecticut; and Rhode Island. Indians of the Northeast collected rock slabs containing footprints (called *uki* stones by the Iroquois) and transported them to villages for religious purposes (B. Mann, pers. comm. 2002). The Great Spirit and the Mosquito Monster tracks may have been brought to Syracuse as *uki* stones, or they may have been man-made replicas of real dinosaur tracks, a common type of rock art across the American continent. In the eastern



**Fig. 4.** *Gallator* dinosaur track, like those found in the Connecticut River Valley.

United States in the 1840s, the geologist Charles Lyell investigated some bird and mammal tracks in rock in Pennsylvania and found them to be Indian carvings. Recently, archaeologists discovered a dozen isolated pseudo-fossil footprints, about 30 cm long and 13 cm deep, carved into granite outcrops (real fossil footprints are impossible in granite) across southern New England (D. Schwartz, New England Archaeological Research Association, pers. comm. 2000).

*Lake of the Water Spirit's Bones.* In northern Indiana, Lake Manitou, also known as Devil's or Spirit Lake, was originally called 'Lake of the Water Spirit's Bones' by Potawatomi Indians. *Manitou* means powerful nature spirit, but was translated as 'demon' or 'devil' in English, hence the numerous Spirit and Devil's lakes on US maps. Since the late 1700s, white settlers heard stories from Indians about the lake. Gigantic water monsters were said to lurk at the bottom, and huge bones appeared on the shore from time to time. The Indians avoided fishing or camping at the lake. Influenced by these eerie legends, homesteaders began to report live water monster sightings as early as 1828. Massive mastodon fossils often emerge from lakeshores and streams in Indiana, and their unfamiliar forms and dimensions apparently inspired the lake's Potawatomi name and folklore (Mackal 1980, pp. 210–211).

*Wonderful Bone Creek and spirit animal mounds.* The Pawnees were intensely interested in remarkable objects that stood out on the surface of the windswept prairies of Kansas and Nebraska, such as meteorites, large fossil bones, and marine fossils of striking appearance. Records going back to about 1750 show that the Pawnee name for Spring Creek, a tributary between the North Loup and Cedar River north of Grand Island, Nebraska, was *Paruksti Kisu Kitsu*, 'Wonderful Bone Creek', because of enormous, unfamiliar animal bones discovered along the creek bed (R. Echo-Hawk, pers. comm. 2002).

The rolling terrain of Kansas and Nebraska was covered by the great inland sea during the Cretaceous period (144–65 million years ago), and the distinctive chalk bluffs of the Niobrara Formation contain the petrified remains of many kinds of marine creatures, enormous mosasaurs, long-necked plesiosaurs, huge sea turtles, and large pteranodons (flying reptiles), as well as palm-sized shark teeth and countless seashells. Overlying alluvial Miocene to Pleistocene mammal deposits also dot Kansas and Nebraska. Bones of mammoths, mastodons such as *Stegomastodon* and *Amebelodon*, rhinoceros and camel species, and giant sloths continually erode out of mounds along river drainages.

Wonderful Bone Creek demonstrates that such remains commanded the attention of the Pawnees at an early date. Pawnee medicine men undertook vision quests at *nahurac* ('spirit animal') mounds along riverbanks in Nebraska and Kansas, where they encountered mysterious creatures and received special healing powers. The names of seven spirit animal mounds have been preserved. One, *Pahua* ('Hill Swimming on Water'), was on the Republican River in western Nebraska, described by Pawnee elders as a high timbered bank or island where immense petrified bones spilled out. Medicine men tunnelled into *Pahua* to commune with the spirit animals and giants. In about 1700, a Pawnee hunting party excavated a very large fossilized femur poking out of *Pahua*. This 'giant's' bone was transported back to the village and enshrined until the late nineteenth century in the Stone Medicine Bone Lodge, a society of traditional healers. Powder from the mineralized thigh bone, probably that of a mastodon or mammoth, was used to make a medicinal infusion, recalling ancient Chinese 'dragon bone' medicine (Dorsey 1906, pp. 294–295). The notion of 'spirit animals' at fossil exposures also recalls the Chinese legend of White Bone Cave and the Potawatomi legend of the Water Spirit's bones.

The traditional names for two other *nahurac* mounds also indicate early Pawnee fossil discoveries. *Nakiskat* ('White Bone Mound') was named

for fossil that protruded from a high bank near the confluence of the Platte and Missouri rivers in Nebraska. White Eagle, a Pawnee elder interviewed by ethnologists in 1914, told of a great medicine man who had received his healing powers from strange creatures at *Nakiskat*. Another famed medicine man, described by the early ethnologist George Bird Grinnell, had learned his healing powers inside 'The Mound where Spirit Animals Sleep', the name for a bluff about 61 m high on the Platte River in Nebraska. Both mounds are in areas with fossil exposures (Grinnell 1928, pp. 246–247; Parks & Wedel 1985, p. 162 and n. 4).

According to Pawnee myth, before present-day people existed, the Creator became angry with the giant beings and sent flood waters to destroy them. These huge beings 'sank down in the mud and were drowned. The great bones found on the prairie are [their] bones . . . . We have seen big bones underground', the elders told Grinnell, and 'they convince us that giant beings did sink into the soft ground in the past'. After the destruction of the giants, said the elders, the Creator 'created a new race of men, small, like those of today' and he promised that the bones of those former powerful creatures would provide strong medicine for the Pawnees (Grinnell 1961, pp. 354–356; Dorsey 1906, p. 296).

The Pawnee names for mounds that contain 'spirit animals' and bones of 'giants' reflected their geomyth about extraordinary creatures of great magnitude that drowned and were buried in mud long ago. Petrified clams, fish, turtles, and other out-of-place sea creatures scattered across the arid prairie were evidence that the prairie was once flooded. The myth accurately envisions the vast, shallow sea that covered the Great Plains in the Cretaceous era, and accounts for the skeletons of huge marine reptiles and other large creatures that had been trapped in soft mud.

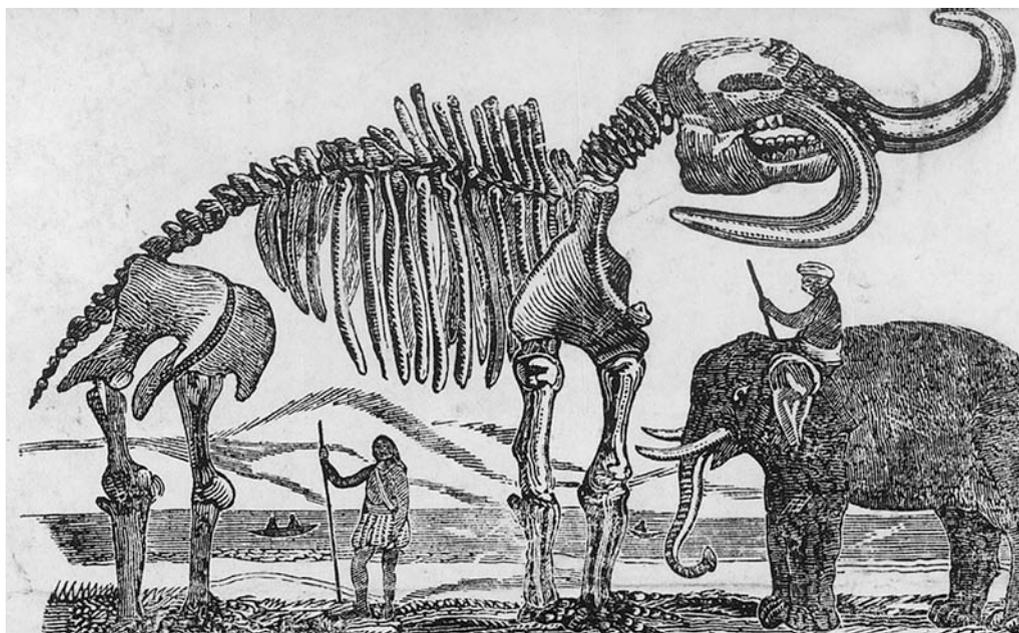
*Big Bone River.* According to a traditional Osage Indian oral tale first published by Albert Koch of the St Louis Museum in 1840, long before white settlers arrived in Missouri from the eastern United States, monstrous animals had invaded from the east. The animals already occupying the land of Missouri were infuriated by these intrusions, and in the valley of 'Big Bone River', in south-central Missouri, the invading monsters and the native animals assembled for a battle, in which many on both sides were killed. After the battle, according to the myth, the monsters' carcasses were buried by the Great Spirit in the Big Bone River. The myth also said that the Osage ancestors had gathered some of the bones and made burnt offerings. Every year the Osages gave offerings at a rock ledge overlooking Big Bone River and the battlefield of the monsters.

The legend was confirmed by historical palaeontological discoveries. In 1806, in Paris, Georges Cuvier acquired a mastodon molar from Big Bone River, sent to him by Benjamin Smith Barton, who earlier had reported the place name *Chemung* in New York, above. There were thousands of mastodon bones along the 'rivière des *Indiens Osages*' (the Osage River) and Big Bone River, Barton wrote. Many of the skeletons were buried in a standing position and were well preserved in peat bogs.

These rivers proved to be a rich source of fossils for early American palaeontology. In 1838, Albert Koch, inspired by the Osage oral narrative of the Battle of the Monsters, unearthed the remains of a giant ground sloth *Myiodon* on the Osage River. In 1839, with further digging along Big Bone River, Koch amassed hundreds of molars and tusks and several enormous skeletons, including a well-preserved *Mastodon americanus*. Koch dubbed one of the skeletons the 'Missourium' and exhibited it (misassembled), along with the first printed version of the Osage fossil tradition about Big Bone River, in Philadelphia, Dublin, and London (Fig. 5).

The Osage oral tradition, published by Koch in 1840, is striking on many levels. The abundance of so many large, unfamiliar bones of mastodons, giant beavers, oxen, horses, and giant sloths in the river valleys was explained by a great war between competing animals. The most productive river was known as 'Big Bone River' (it has since been renamed the Pomme de Terre River). The scenario shows that the Osage distinguished several different species of animals of a past era, a notable palaeontological perception in a pre-scientific culture. The Osage also noticed that some of the fossils seemed burnt, whereas others had sunk deep in the riverbed; thus the detail in the legend that their ancestors had burned some carcasses and the Great Spirit buried others in Big Bone River. Indeed, some *Mastodon giganteus* bones discovered in Koch's excavations were charred by fire and mixed with ashes (Mayor 2005a, pp. 200–207). Moreover, many of the fossils are blackened by the lignite in the peat, which makes them look burnt. This detail brings to mind the lightning-blasted 'giant' bones in the ancient Greek Battlefields of the Giants, discussed at the beginning of the paper.

*Bird and lizard tracks.* The Navajos and Pueblo Indians were aware of the impressive dinosaur tracks in the deserts of the Southwestern United States (Fig. 6). As noted earlier, three-toed theropod dinosaur footprints resemble avian tracks and palaeo-Indian petroglyphs and pictographs often include drawings of birds along with artistic



**Fig. 5.** Osage Indian standing under a mastodon skeleton, at Big Bone River, Missouri. From Albert Koch's exhibit in Dublin, about 1843. A version of the Osage tradition of the Battle of the Monsters at big bone River accompanied Koch's fossil displays. Courtesy of American Philosophical Society, Philadelphia.

representations of dinosaur tracks (Fig. 7). The resemblance to bird tracks is evident in the old Navajo place name for an extensive *Dilophosaurus* dinosaur trackway near Cameron, Arizona: 'Place with Bird Tracks' (Lockley 1991, p. 185).

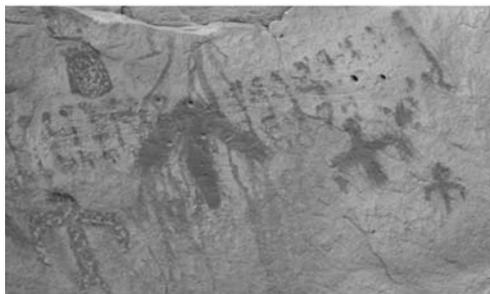
In New Mexico, the traditional Indian name for a site near Jemez Pueblo (occupied in AD 1450–1700)



**Fig. 6.** 'Place of the Bird Track' was the Navajo name for a *Dilophosaurus* dinosaur tracksite, like this one near Moenave, Navajo Reservation, Arizona. Photo: A. Mayor.



**ACTUAL DINOSAUR TRACK**



**PICTOGRAPH OF DINOSAUR TRACK**

**Fig. 7.** Top, dinosaur footprints, Zion National Park, Utah. Bottom, Indian pictograph near the fossil tracks. Photo: G. McDonald, US National Park Service.



**Fig. 8.** Bechan Cave, Utah. The Navajo name *Bechan* describes the vast heaps of mammoth dung in the cave. Photo: S. Anderson, Northern Arizona University.

is *Gee-tow-ta-own-lay-new*. According to William Whatley, the tribal archaeologist at Jemez Pueblo, the name translates as ‘Place where the giant stepped’ (Mayor 2005a, p. 139 and n. 37). The San Isidro fossil beds adjacent to the pueblo contain theropod *Camarasaurus* and sauropod *Seismosaurus* dinosaur remains. The name perhaps referred to fossil footprints. The myth that once accompanied the place name is unknown.

West and north of Tuba City, beyond the Navajo village of Moenave, on the Navaho Reservation in Arizona, Ancestral Pueblo petroglyphs were carved (AD 1000–1200) on cliffs containing dinosaur remains. Later, Navajos observed the giant reptile fossils around Tuba City and Moenave, along with fossilized nests containing dinosaur eggs and hundreds of criss-crossing dinosaur tracks impressed in hardened mud. The traditional Navajo name for this place is *Naasho’illbahitsho Biikee* or ‘Big Lizard Tracks’ (Tuba City 2004). In Navajo mythology, many different kinds of fearsome water monsters and other terrifying creatures had populated the previous ages before the present age. All of the monsters were destroyed by the mythical Twin Heroes and buried in the ground or else transformed into distinctive landforms.

*Bechan Cave.* A different sort of fossil deposit inspired the descriptive Navajo name for Bechan

Cave, in southern Utah. *Bechan* translates as ‘Big Faeces’. Bechan Cave, a large rock shelter in Navajo Sandstone, is renowned among palaeontologists as one of the world’s most remarkable deposits of mammoth dung (Fig. 8). The cave contains more than 300 square metres of woolly mammoth coprolites (fossilized excrement) and a great amount of hair, left by the Ice Age pachyderms 12 000 years ago (Mead *et al.* 1986).

*Moqui marbles.* *Moqui* is a Hopi word that appears in several place names in Utah, such as Moqui Cave near Kanab; Moqui (or Moki) Canyon near Lake Powell; and Double Moqui, a rounded Ancestral Pueblo structure in Grand Staircase-Escalante National Monument. These places were named for unique spherical concretions called ‘moqui marbles’, formed of pink sand encased in a layer of dark grey-red hematite. Ranging from very small up to 20 cm in diameter, moqui marbles weather out in large numbers at the bases of Jurassic Navajo Sandstone Formation cliffs in Utah and Arizona (Fig. 9).

In the Hopi language, *moqui* means ‘dear departed ones’. According to Hopi tradition, the spirits of dead relatives descend to earth at night and play games with the marbles. When they depart at dawn they leave the marbles as a reassuring sign to the living relatives that they are



**Fig. 9.** Moqui marbles eroding out of Navajo Sandstone Formations, Grand Staircase-Escalante National Monument, Utah. Photo: B. Beitler, University of Utah.

happy in the afterlife. The Hopi collect the marbles to honour and welcome the spirits of their ancestors. *Moqui* names designate places with great concentrations of the stony spheres.

One scientific theory hypothesized that moqui marbles were Cretaceous molluscs trapped in sand about 130 million years ago. As the molluscs decomposed, the internal liquid was drawn out, leaving hollow centres. As water filtered through the outer shell over the ages, fine pink sand filled the centres and iron deposits formed in layers around the outer shell, along with phosphorus and lime from the molluscs' shells. In 2004, some scientists proposed an alternative theory, that moqui marbles were formed about 25 million years ago from chemical reactions between bacteria in briny fluid and precipitating minerals that resulted in the layered spherical concretions. They suggested that the 'blueberry' concretions found recently on Mars were similarly formed and indicated the presence of water and bacteria. In a striking parallel to the Hopi idea that moqui marbles in the desert represented life after death, the Martian marbles are taken by scientists as a positive sign of past life on the barren planet (University of Utah 2004).

The Hopi and their Ancestral Pueblo ancestors collected other kinds of fossils, including

ammonites and petrified wood, for sacred purposes. Numerous Navajo names for geological features of the Painted Desert and Colorado Plateau refer to terrible monsters killed in deep time (Mayor 2005a, ch. 3). This evidence of early interest in explaining geological and palaeontological features makes it likely that many other traditional Native American place names in the Southwest were inspired by observations of the large dinosaur exposures and curiously shaped invertebrate fossils that are so conspicuous in the desert.

*Animal Bones Brutally Scattered About.* In 1892, a University of Nebraska geologist examined the great quantities of fossils that continually eroded out of a high butte above the Niobrara River at Agate Springs, western Nebraska. The skeletons were identified as a variety of large Tertiary mammals, including rhinoceros-like brontotheres, entelodonts (giant carnivorous pigs), and chalicotheres (huge grazing beasts with claws). Beginning in 1904, palaeontologists from the Carnegie Museum (Pittsburgh, Pennsylvania), Yale University (New Haven, Connecticut) Princeton University (New Jersey), the American Museum of Natural History (AMNH, New York City), and other US institutions undertook extensive excavations at the prolific fossil site, now Agate Springs Fossil Beds National Monument. The butte, which was dubbed Carnegie Hill, produced tons of significant fossils. Huge blocks of the massed bones are currently displayed in the AMNH and other natural history museums. The animal remains on Carnegie Hill were so densely packed that single block measuring 1.5 by 2.4 m contains nearly 5000 fossil bones.

For the Lakota Sioux, Agate Springs on the Niobrara River was a traditional place for gathering food, finding special stones and bits of fossil bone for medicine bundles, and making offerings to the spirits. Long before the palaeontologists flocked to Carnegie Hill, which entombs thousands of ancient mammal fossils, the Lakota had given the butte a vividly descriptive name: *A'bekiya Wama'-kaskan s'e*, 'Animal bones brutally scattered about' (Fig. 10). It was a sacred place because of the immense bones of mysterious creatures, believed to have been fearsome monsters destroyed by lightning bolts hurled by Thunder Birds. When the earth was young, Sioux mythology visualized a cosmic battle between Thunder Birds (*Wakinyan*) and their eternal enemies, the Water Monsters (*Unktehi*). The bones of these primeval creatures had turned to stone and still littered the badlands of the western Dakotas and Nebraska. At Agate Springs, the layers of animal bones were so thick and jumbled that destruction on a very large scale



**Fig. 10.** ‘Animal Bones Brutally Scattered About’ was the Lakota Sioux name for Carnegie Hill, Agate Fossil Beds National Monument, Nebraska. The masses of Miocene animal fossils in the butte were identified as the remains of *Unktehi*, monsters destroyed by Thunder Beings, according to Lakota tradition. Photo: A. Mayor.

was imagined by both scientific and pre-scientific observers (Mayor 2005a, pp. 245–249).

*The Racetrack.* Another striking Sioux geomyth accounted for the geology and palaeontology of the Black Hills of South Dakota. The Black Hills area is surrounded by masses of vanished creatures from many eras, from dinosaurs and pterosaurs to mammoths and ‘Thunder Beasts’ (the Sioux name is preserved in the scientific name *Brontotherium*, a rhino-like behemoth). A curious geological depression also encircles the Black Hills. This broad valley of red siltstone erodes from the greenish Morrison Formation sediments just inside a steep ring of Cretaceous hogback ridges. The race-course-like depression rimmed with prolific fossil beds is called the Red Valley by geologists. The feature was also noticed by the Lakota, who called it the ‘Big Racetrack’ (Zimmerman 2003, p. 103).

The tradition of the Big Racetrack was recounted by the Lakota storyteller James LaPointe. In the ‘first sunrise of time’, before the existence of the Black Hills, all the immense and strange creatures, including the *Unkche Ghila*, or dinosaurs, were summoned for a great race. A seething mass of

animals covered the land, the earth shook under the pounding feet of the beasts, and the sky turned dark with circling birds. Around and around the animals raced, and as the weaker creatures were trampled the earth beneath began to ‘sink crazily under their weight’. A huge mound began to bulge in the centre of the Racetrack. The rising mountain burst, spewing fire and rocks, mixing with the clouds of dust thrown up by the feet of the running beasts. The animals were felled by rocks and smothered in ashes and debris. The remains of the great Racetrack are still visible in the Red Valley around the Black Hills and the bones of all the beasts in the race for survival lie buried where they fell (LaPointe 1976, pp. 16–19, 51).

In fact, the Black Hills were formed during the Cretaceous and into the Miocene, when intense volcanic activity and tectonic forces violently uplifted a 346 m dome of granite rock, and then rapid erosion ate away the ash and soil atop and all around the dome. In the Lakota legend of the Racetrack, careful observation of geological landforms and fossils and mythical explanations can yield surprisingly accurate perceptions, in anticipation of modern geological and palaeontological knowledge.

*Grandfather of the Buffalo.* The concept of naming vertebrate fossils of extraordinary size the ‘Giant’ version of a known animal or the ‘Grandfather’ of a species was apparent in names for mastodon fossils, discussed earlier. The concept also appeared among the Blackfeet bands of Alberta, Canada, the Piegiens. For generations, the Piegiens revered an exposure of enormous skeletons in a 91 m deep ravine near the Red Deer River. In about 1860, the French explorer Jean l’Heureux accompanied the Piegiens on their traditional journey to make offerings at the burial place of the ‘Grandfather of the Buffalo’. Among the rocks tumbling down the ravine they pointed out the bones of a powerful animal whose vertebrae measured 51 cm in diameter. The fossil site was marked with numerous dedications of cloth and tobacco.

The bones venerated over centuries by the Piegiens belonged to stupendous dinosaurs, the horned ceratopsians, duck-billed hadrosaurs, armoured ankylosaurs, and towering theropods of the Red Deer Valley. These fossils were first scientifically collected by William Dawson in 1874, Joseph Tyrrell in 1884, and Charles Sternberg and many others in what is one of the most productive dinosaur localities ever studied. The Red Deer River Canyon is now Dinosaur Provincial Park. Archaeologists have found a Piegiens vision quest site overlooking the fossil-laden valley once known as the

burial grounds of the buffalo's ancestors (Spalding 1999, pp. 22–23; Mayor 2005a, pp. 291–292).

Like the Delaware and Shawnee who believed that mastodon bones belonged to the 'Grandfather of the Buffalo', the Piegans associated the big bones of dinosaurs with the largest animal they knew. The Canadian palaeontologist David Spalding has commented that, although their interest was spiritual, their interpretation can be considered 'scientific' in that the Native observers recognized the fossil animal's great antiquity, its disappearance, and its 'possible relationship to a living descendant', impressive insights for a pre-scientific culture (Spalding 1999, pp. 22–23).

*Giant Marmot tracks and monster's hip bone.* In the summer of 2004, geologists surveying an isolated area in British Columbia discovered the first scientifically studied dinosaur tracks in Canada west of the Rocky Mountains. The Early Cretaceous dinosaur footprints were found in Bowser Basin north of Terrace on the Skeena River. The discovery was announced by the Royal British Columbia Museum in Victoria in September 2004, as the first evidence that dinosaurs once roamed western British Columbia. But, as reported in the *Vancouver Sun*, the tracks and bones of giant creatures no longer seen alive had long been known to the First Nations people of the region, the Gitksan (or Gitksan). As the report relates, the traditional Native knowledge and 'wonderfully evocative names' preceded the scientific discovery of the dinosaur traces (Boswell 2004).

Those names were first recorded in writing in the 1970s, when about 100 Gitksan elders, including Walter Blackwater, David Green, James Morrison, and David Gunanoot, identified the eminent geographical features—rivers, ridges, mountains, and valleys—of their ancestral territory. Neil Sterritt, a former Gitksan leader and geologist who was the manager of Ksan Historical Village near Hazelton, BC, recorded and mapped the names.

Two of the Gitksan topographical names referred to the presence of dinosaur fossils and tracks in the area. South of Panorama Lake, a mountain was named *Wii gwii kw* 'Giant Marmot', sometimes mistranslated as 'Giant Groundhog'. A ridge extending from the mountain to Muckaboo Creek NE of Meziadin was called *Wil maxhla dox hla genx wii gwii kw*, 'Where You Find the Tracks of the Giant Marmot'. The 2004 discovery of dinosaur tracks is in similar terrain just north of Panorama Lake.

The elders who told Sterritt about the tracks identified them as the prints of a giant 'Whistler', the tribe's nickname for the hoary marmot (*Marmota caligata*), a large (up to 14 kg) rodent with long curved claws and a bushy tail that thrives in the Yukon, Alaska, and the northern



**Fig. 11.** Hoary marmot, a large rodent that inhabits the northern Rockies, Alaska, and the Yukon. The Gitksan place name for a set of dinosaur tracks in British Columbia, 'Where You Find Tracks of the Giant Marmot', suggests that they associated the tracks with a gigantic relative of the living species.

Rocky Mountains (Fig. 11). Unfortunately, we do not have the full myth about the *Wii gwii kw*, but the place names designating the mountain and ridge with Giant Marmot tracks show that the Gitksan imagined that colossal relatives or 'grandfathers' of the hoary marmot had once lived. They may have perceived some similarity between tracks left by living marmots and some Cretaceous creature's footprints in stone.

Many other First Nations geomyths refer to finding the remains of very large, extinct versions of smaller living species. For example, several Canadian First Nations traditions describe the 'Giant Beaver' as the extinct ancestor of the familiar living beaver, and tell of discoveries of its bones or teeth. This accurate perception was based on observations of fossilized giant beaver species of the Pleistocene, *Castoroides* and *Palaocastor*, which reached the size of a bear.

Another Gitksan place name, *Gi'gai'a*, means 'Hip Bone'. A landmark in a canyon near the headwaters of the Skeena River, *Gi'gai'a* was described by the elders Gunanoot, Green, and Morrison as the pelvic bone of a 'big monster', so large that a man 'could walk right through it'. Skerritt, who mapped the traditional geography in the 1970s, believed at the time that *Gi'gai'a* was an exposure of a dinosaur skeleton. He now remarks that 'science has verified his people's oral history' (Boswell 2004; Gitksan elders 2004). The Native observers recognized the pelvis of a dinosaur as an animal hipbone of extraordinary dimensions, but its unusual morphology led them to assign it to the anatomy of a monster unlike any known creature.

Carol Evenchick, leader of the geological crew that made the 2004 find, noted that 'the elders' accounts provide a rare and spine-tingling correlation between traditional aboriginal knowledge and scientific research'. The place name *Gi'gai'a*

generated excitement among palaeontologists over the possibility that other sensational fossil discoveries will be made in the region (Boswell 2004; Gitxsan elders 2004).

## Conclusions

As this brief survey of traditional folk place names describing prehistoric remains demonstrates, many pre-scientific cultures around the world observed significant fossil remains of extinct creatures over time and attempted to describe and explain them. In some cases they attempted to imagine the appearance, behaviour, and disappearance of the creatures. Some compared the anatomy to known species and thought of the vanished creatures as ancestors or giant versions of living creatures. The study of place names in fossiliferous localities helps to illuminate early evidence for human curiosity about palaeontological remains. It also helps scholars discover previously unknown geomorphology and may indicate locations of important geological sites to scientists.

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