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# The Folklore of Footprints in Stone: from Classical Antiquity to the Present

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Since classical times and earlier, footprints in stone have intrigued humanity. Sometimes the supposed footprints were mere indentations produced by the chances of erosion; sometimes they were invertebrate fossils; and sometimes they were faked; but quite often they were the tracks of extinct creatures. The interpretations resulting from observations of these phenomena included legends of gods, heroes and saints: but, on occasion, the envisioning of the track-maker was remarkably accurate. This account of the folklore of footprints surveys legends from Europe, North and South America, Africa and Australia; it concludes with the beginning of their scientific observation.

*Keywords:* ichnofossils, vertebrate footprints, classical legends, medieval myths, folktales

## INTRODUCTION

Though paleoichnology is a relatively new science, more and more prehistoric animal trackways are being discovered every year and we are now realizing that millions, even billions of tracks are to be found in non-marine sediment layers around the globe. The recent recognition of so many footprints brings up an intriguing question: Who were the first humans to notice them? As Martin Lockley has commented, early people who encountered the unmistakable footprints of vertebrate creatures in solid rock must

have been "fascinated by fossil tracks of animals they could not place" (Lockley 1991, p. 185). The second author has surmised that fossil footprints were recognized as traces of living creatures long before petrified bones were perceived as being organic remains (Sarjeant, 1997, p. 3).

Attributing footprint-shaped marks in rock to once-living creatures, either familiar or fabulous, is a widespread theme in world folklore. The standard *Motif-Index of Folk-Literature* gathers numerous folktales that feature the motif of "indentations on rocks from prints left by man [or] beast," "footprints of gods, thoroughfares of heroes," and footprints of giants, fairies, angels, devils, cows, horses, Jesus, Buddha, and even of King Arthur's dog (Thompson 1989: e.g., motifs A901, A972.1-5, F531.2.1.1, F531.2.4). These tales were collected in Europe, Russia, Siberia, China, Japan, Mexico and Africa—all places where dinosaur and other prehistoric tracks do exist.

Some legends relating to footprints in stone may be based on natural marks that, in the popular imagination, resemble footprints of animals or giants, and others may be explained by marine fossils that look like animal tracks, but some popular traditions are directly associated with observations of actual fossil vertebrate tracks. In a 1995 article on early scientific studies

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of footprints, the second author cited three European and American legends linked to known fossil prints, remarking that “the folklore of footprints is indeed a fruitful field for investigation and speculation” (1995, p. 78).

This paper takes up the challenge, by gathering and analyzing little-known examples of popular explanations for petrified footprints. Our survey traces the written record of the recognition of fossilized tracks back to classical Greece and expands the international body of lore about stone-encased prints. Some of the oral, written, and artistic traditions collected here relate to documented tracksites; others furnish clues that suggest that they might well have been based on observations of fossil tracks; but some so-called footprints may not have been made by feet at all. We attempt to identify the sources – fossil and otherwise – of legendary footsteps in rock, from ancient Greek myth to the Australian Dream-Time.

#### FOOTPRINTS OF GODS AND HEROES: EUROPE IN PRE-CHRISTIAN TIMES

The earliest description of footprints in bedrock appeared in the work of the Greek historian Herodotus, in about 450 BC. Herodotus traveled around the eastern Mediterranean and Black Sea area, reporting on exotic legends, customs, and marvelous sights. On the banks of the Tyras (Dniester) River in Scythia (Moldavia), local guides showed him a huge footprint on a rock said to have been left by the great hero Heracles (Hercules). Herodotus, in book 4 of *The Histories* (4.82) reported that the print, then a major tourist attraction of Scythia, “looked like a man’s” but was about 3 feet (almost 1 m) long. In Greek art, Heracles is often shown barefooted, but it is not clear whether the impression on the rock resembled a bare foot or a sandal sole; elsewhere, in book 2, Herodotus (2.91) cites evidence from Egypt that the sandals worn by the giant hero Perseus were 3 feet (1 m) long.

Indeed, the mark on the banks of the Dniester need not have resembled a human footprint to have been taken for the imprint of a mythical hero. In antiquity, heroes of myth were visualized as giants, yes, but they were not necessarily completely human. Heroes and giants could have animal attributes, extra limbs, and so on. This helps explain why large bones of extinct creatures were often interpreted as those of gigantic humanoids and why fossil animal tracks may have been taken in ancient Greece for those of colossal heroes.

The measurement given by Herodotus may have been exaggerated, in order to conform to the ancient notion that mythological heroes had been about thrice the height of contemporary men. The first author (Mayor 2000, p. 199–201) proposes that this notion may have arisen from archaic discoveries of fossilized proboscidean limb bones of the Miocene to Pleistocene epochs, which were interpreted as “heroes’ bones” in antiquity. An ancient Greek man stood about 5 feet (1.5 m) tall, but ancient heroes were said to have averaged 10 to 15 feet (3 to 4.5 m) in height. A mammoth femur is about three times the size of a human thigh bone.

The Dniester area has Miocene and Pleistocene fossil deposits but, so far, fossil footprints have not been identified in Moldavia (Roman Croitor, Moldavia, *in litt.* to A.M., January 19, 1999). The Dniester footprint may have been a naturally occurring depression shaped like a huge human sole or perhaps a fabrication of the Scythians. The commentators on Herodotus (How and Wells 1967, 1:331) considered that possibility, comparing the Scythian site to the gigantic footprint of Buddha, still revered by pilgrims at Adam’s Peak in Sri Lanka. That print measures 5 feet by 2 feet (1.5 by 0.6 m), so it is probably a natural foot-shaped depression on a rock. However, other surviving descriptions of footprints in stone, in Mediterranean regions now known to be fossiliferous, suggest that at least some classical footprint folklore was based upon fossil tracks. By the late Roman period, sightings of

unexpectedly large footprints in stone were so common that the Roman humorist Lucian satirized the phenomenon in *A True Story* (1.7).

The standard "Olympic foot," 12.6 inches (32 cm) long, was said to have been based on Heracles' foot (*Oxford Classical Dictionary*, 3<sup>rd</sup> ed., s.v. "measurement"). It is possible that this ancient Greek measurement was based either on a fossil footprint attributed to the hero or calculated from his heroic height. While still a boy, Heracles was believed to have stood 4 1/2 cubits tall (6–7 feet or 1.8–2.1 m, since a cubit is about 17 inches; Heracles' stature was discussed by the ancient writer Apollodorus 2.4.9). These figures suggest that a footprint attributed to Heracles or some other hero of antiquity would have been at least a foot long and that a hero's stride would vary between a yard and two yards (0.9–1.8 m), according to speed (up to three yards, or 2.7 m, when running). These rough calculations help us picture the other series of footprints allegedly left by Heracles and other heroes in Italy and what is now Turkey.

What kinds of extinct creatures left tracks that would fit the foot and stride of an ancient hero? Near Pandosia in Iapygia (the heel of Italy), "the footprints of Heracles are shown and no one is allowed to step in them," wrote the author of *On Marvelous Things Heard* (838a29–35), a compilation of natural wonders (once thought to be by Aristotle, but now attributed to Pseudo-Aristotle). Roman authors, including Virgil (in his poem *Georgics* 1.494–97) and Suetonius (*Augustus* 72), remarked on the giant bones that came to light in various locations in Italy; these were most likely discoveries of Italy's rich Pleistocene mammoth and cave bear remains. Those footprints of Heracles may have been Pleistocene animal tracks, perhaps those of a cave bear, since bear prints can readily be mistaken for human (Fig. 1).

Fossil footprints occur widely in Italy; they were first reported from Triassic strata by A. Fucini (1915: see also Tongiorgi, 1980), subsequently from Permian strata by Piero Leonardi (1940, 1959) and from the Jurassic by his son

Giuseppe (Leonardi and Lanziger, 1992; Psihoyos, 1994, p. 147–150; Leonardi, 1996). Perhaps a dinosaur or other large reptile left the supposed footprints of the Greek hero? The central digit in tridactyl tracks is quite often more deeply impressed than the lateral digits and may be especially conspicuous in subtraces; to an undiscriminating eye, it would look very much like a sandal print.

According to the first-century BC historian Diodorus of Sicily, in book 4 of his *Library* (4.24.1–4), at least two different sets of footprints embedded in stone were known in ancient Sicily. One of the labors imposed upon Heracles was to kill Geryon, a giant ogre who kept a fabulous herd of cattle. Heracles drove Geryon's cattle from Spain to Italy and Greece. Diodorus says that one could still see Heracles' footprints and the hoofprints of Geryon's cows, preserved in the bedrock of Sicily. Sicily has rich remains of pygmy elephants and other Pleistocene vertebrates; the mysterious hoofprints might have been fossilized tracks of Pleistocene and Holocene animals, perhaps the giant ox *Bos primigenius*. However, there are as yet no records of fossil footprints, of any age, from that island. Consequently, we are left uncertain as to what kind of tracks were taken as those of Heracles.

An alternative explanation for the supposed cattle tracks is likelier. The distinctive hoof-shaped impressions of giant megalodontid bivalve shells are to be seen embedded in Late Triassic limestones at outcrops across southern Europe; the deposits look like hardened mud that has been trampled by a herd of large hoofed animals. Indeed, as Erich Thenius reported (1973, p. 32–34, figs. 22–23), such fossil shell impressions still figure in modern-day European folklore about legendary cows or horses (Fig. 2). According to Derek Ager (1980, p. 433n.), deposits of the bivalve *Congerina unguilacaprae* ("goat-hoof") around Lake Balaton, Hungary, are said to be the tracks of a flock of goats drowned along with their goatherd because the youth had "dared to love the same lady as the god of the lake."



FIGURE 1 The likelihood of misidentifying bear footprints as human is made evident by this sketch of North American bear tracks (from Seton, 1958, p. 128)

In the second century AD, the Greek travel writer Pausanias visited two springs in Greece, at Troezen and in Boeotia, where locals boasted that the hooves of the winged stallion of myth,

Pegasus, had struck the limestone bedrock (Pausanias, *Guide to Greece* 2.3.12; 9.31.3). Were these also marine fossils that resembled hoof-marks or might fossil animal prints have been



FIGURE 2 Fossil mollusk shells as sources of legend. Upper: a cast of the megalodont bivalve of *Conchodus infraliasicus*, from the Late Triassic of Pass Gschütt, near Salzburg, Austria. Lower: a block of Dachsteinkalk from Thal, East Tyrol, Austria, showing how such megalodont casts and moulds can simulate cattle tracks (Photos by R. Gold and E. Thenius, from Thenius, 1996) (See Color Plate I at the back of this issue)

visible at those sites? Troezen is in an area of flysch and alluvium; Boeotia has Triassic-Jurassic limestone mountains with Miocene-Pleistocene grabens (Higgins and Higgins 1996, p. 41). In

such circumstances, the occurrence of vertebrate footprints seems highly unlikely; natural cavities, consequent upon erosion, are a more probable explanation.

In *On Heroes*, written in the early third century AD, Philostratus mentioned a series of “footprints large enough to fit a 15-foot-tall giant, sunk into a race-course” on the Gallipoli Peninsula (northeast Turkey). These were supposedly made by Protesilaus, the great hero-athlete from the Trojan War, as he jogged around the course (*On Heroes* 13.3). The Gallipoli Peninsula, across the Dardanelles from ancient Troy, is a tongue of Palaeogene and Neogene sediments and alluvial deposits (Higgins and Higgins, 1996, p. 115). Miocene and Pleistocene vertebrate fossils occur there in abundance, so it seems feasible that a series of numerous, regularly spaced footprints, resembling the “race-course” of a giant, may well have been a fossil track. However, no such footprints have yet been reported from this region.

The ancient Persian epic *Shah Nama* (ca. AD 1000) features Rostam, a giant hero so mighty that he killed an elephant with a single blow and successfully fought dragons. It was said Rostam had such strength and “density” that his feet sank into rock as he strode across the land (Davidson 1993, translation of *Shah Nama* 2.242.960ff). It is tempting to speculate that this vivid image was based on observations of fossil footprints in the Middle East. This is perfectly possible; early Jurassic dinosaur tracks have been described from the Kerman region of central Iran (Lapparent and Davoudzadeh, 1972) and, more recently, Eocene mammal tracks have been reported from the area north of Birjand, eastern Iran (Mirzae Ataabadi and Sarjeant, 2000). Certainly the sight of vertebrate footprints, sunk into solid rock, would be enough to imbue the marks with both a superhuman or mythological aura and a sense of extreme antiquity.

The prints of a human foot in what was once sticky mud can look larger than life. Were some of the footprints attributed to mythological heroes actually left by Pleistocene or Holocene humans? Human prints have been found in Turkey (Ozansoy, 1969) and widely in French caves (e.g. Vallois, 1931; Casteret, 1945) – most recently in Chauvet Cave (southern France), where they were dated to 20–30,000 years ago (Anon. 1999, p. 18).

## FOOTPRINTS OF SAINTS AND DEVILS IN EUROPE IN THE ERA OF CHRISTIANITY

In the Christian era, footprints in stone were revered as relics of saints and even Jesus himself – or as vestiges of Satan. In 1566, priests claimed that during St. Paul's brief visit to the island, he had blessed Malta with his *Pedate*, “footsteps that we still see impressed in our rocks.” St. Paul was also credited with petrifying the dangerous animals of the island; Maltese folklorist George Zammit-Maempel (1989) takes this as a reference to the fossilized Pleistocene animal remains common on Malta. These animals may have left tracks that the pious Maltese interpreted as saintly footsteps.

The Devil is also claimed to have left his mark in Malta: locals point out grooved five-point impressions known as *il-passi tax-xitan*, or *sieq ix-xitan* (the Devil's footsteps or footprints). These bird-like marks, which are seen in great numbers on the surface of limestone outcrops, were neither demonic nor even fossil footprints, but the ambulacra of the fossil sea urchin *Schizaster parkinsoni* (Zammit-Maempel 1989, p. 12, 22, plate 2.2).

On the Aegean island of Samos, Miocene beds with abundant fossils have been known since the fifth century BC (Mayor 2000, p. 54–60). A few kilometers west of the fossil deposits, on a mountain (mostly marble and schist) known as Vigla (“The Lookout”), old maps indicate the placename “Christ's Footprints.” No fossil footprints from Samos are yet known to paleontologists, but the name may reflect traditional folklore based on fossil animal tracks or natural depressions. In Portugal, genuine dinosaur tracks were the inspiration for another religious legend. The church of Nossa Senhora da Mua (our Lady of the Mule) is found on Cabo Espichel, just south of the small bay of Lagosteiros. Trackways of several species of dinosaur are found in the Upper Jurassic (Portlandian) and Lower Cretaceous (Hauterivian) strata that surround the church (Antunes, 1976). The trackways nearest the church, attributed to



FIGURE 3 "The Devil's Toenail," a footprint of *Chirotherium* placed above the porch door of Christ Church, Bebington, Cheshire

Portlandian sauropods, are particularly impressive and likely gave the church its name. Local legend explains the trackway as the hoofprints of a gigantic mule that carried the Virgin Mary from the base of the cliff to the summit. (Eric Buffetaut, *in litt.* to A.M., Sept. 9, 1999; Giuseppe Leonardi *in litt.* to A.M. December 8, 1999 and to W.A.S.S. February 15, 2000). Early pagan and Christian cults involving man-made footprints have been discussed by Guarducci (1942–43).

Footprints of a saint have also been reported from the Isle of Man in the Irish Sea. Andrea Spalding (*in litt.* to W.A.S.S.) wrote:

As a young child I was always fascinated by what was purported to be St. Patrick's footprints on a walk from Port Erin over the hills to the Sound, a strip of water between the southern tip of the Isle of Man and the Calf of Man. If my memory serves me, this phenomenon was just before we climbed up to Mull circle, an ancient stone circle of graves.

The footprints were covered by a concrete bunker in which you placed a penny, peered down an opening and a dim light went on. I seem to remember that they did look like footprints,

but as a teenager I also remember being very suspicious that despite the dim light it looked as though St. Patrick had obligingly stepped into some concrete. My friend and I had endless arguments about it. Was it genuine or not? The upshot was always the same. We found another penny to take a further look!

However, legends do not always relate to saints. Early Jurassic dinosaur footprints in the Holy Cross Mountains (Gory Swietokrzyskie) of Poland were, according to Karol Sabath (*in litt.* to A.M., March 2000), regarded as the Devil's imprints. It was considered that they had been left on rocks while the Devil was traveling to participate in occult gatherings or to places where a satanic temple was to be built. (There are areas where rocks crop out in the middle of forests, which would be viewed as suitable for either activity by the Devil and his disciples).

A slab of red sandstone, displaying a hindfoot print of *Chirotherium*, is set into the wall above the porch-door of Christ Church, Bebington, Cheshire (Fig. 3). When the second author lectured on footprints to the Liverpool Geological Society in 1971, a gentleman in the audience told





FIGURE 4 The dragon of the Drachenfels, Germany. (Illustration from Athanasius Kircher, *Mundus subterraneus* Book VIII, Amsterdam 1665)

him of that footprint and stated that it was known locally as “The Devil’s Toenail.” Such an odd name implies a legend, but its nature has not been discovered and Geoffrey Tresise (*in litt.* to W.A.S.S., March 1999) tells us that even the name is now forgotten.

Interpretations did not necessarily have scriptural bases. A German palaeontologist, H. Kirchner (1941), speculated that the observation of dinosaur tracks (*Chirotherium* and *Saurichnites*) in the red Triassic sandstones at Seifriedsburg in the Rhine valley served as the well-spring for the legend of the slaying of the dragon Fafnir by the hero Siegfried (Fig. 4).

Some folk explanations for dinosaur tracks are more mundane than fantastic. In northern Spain, for example, Late Jurassic dinosaur tracks on

outcrops in the center of the ancient settlement of Bretun are explained as a corral, where the pueblo’s earliest inhabitants kept their pigeons and livestock (Aguirrezabala and Viera, 1980).

#### TALES FROM AFRICA

In North Africa, legends grew up around a set of Cretaceous dinosaur tracks in a limestone bedrock of Algeria. The Arabs believed that a mythical bird of colossal size had left the three-toed prints in the stone in ages past. The tales may have been related to the Arabic legend of the great Rukh or Roc-bird, whose kick could kill an ox and whose feathers were the size of palm-fronds: its supposed eggs – actually those

of the recently extinct, ostrich-like *Aepyornis* – had been found in Madagascar by Arabic travellers. In 1880, the French geologist Le Mesle heard about the native beliefs from a French officer stationed in the area and hiked 27 miles (43 km) to the remote Algerian site, where he found thirty footprints. As Eric Buffetaut remarks, Le Mesle's "interpretation was not much different from that of the local Arabs," since he thought that a gigantic prehistoric bird had made the tracks. These so-called ornithichnites were actually the first evidence of the presence of dinosaurs in North Africa (Buffetaut 1987, p. 180–81).

In southern Africa, about a century after Le Mesle's find, anthropologist Paul Ellenberger discovered that, in a region of Lesotho where early Mesozoic dinosaur tracks were abundant, the Bushmen had depicted in cave paintings not only the footprints but also their conception of the creatures that made them. Ellenberger reported that some of their reconstructions are remarkable likenesses of iguanodonts; even the forefeet are in correctly reduced proportion to the body (quoted in Mossman 1990).

## LEGENDS FROM NORTH AMERICA

In the United States, the discovery of ancient rock art close to sediments containing footprints demonstrates that, very early in human history, people were aware of tracks made by extinct creatures. For example, Palaeo-Indian petroglyphs appear on outcrops a few feet from two notable dinosaur tracksites near Moab and Monticello, Utah (Lockley 1991, p. 185). Near Joseph City, New Mexico, a petroglyph was inscribed 800 to 1,500 years ago above a slab of the Moenkopi formation exhibiting footprints (Fig. 5). The petroglyph (Fig. 6) appears to be a schematic depiction of the Triassic *Chirotherium* tracks visible on that slab, the combination of the genuine track and rock art perhaps marking a special meeting place (Leszek Pawlowicz, *in litt.* to A.M., April 18, 1999).

A pictograph (painted rather than picked) on a rock art panel at the Flag Point tracksite near Kanab, Utah, appears to represent a tridactyl dinosaur footprint (*Eubrontes*); these are the most obvious prints at the site, though there are also *Grallator* tracks. The footprints are in the Kayenta Formation of the Lower Jurassic in the Grand Staircase-Escalante National Monument. The pictograph dates to the Formation Period of the Ancestral Puebloan (Anasazi) culture, between AD 1000 and 1200. Several birds are also included in the panel, hinting that the Anasazi people may have associated the fossil prints with those birds (Alden Hamblin, *in litt.* to A.M., October 12, 1999 and Marietta Eaton, October 13, 1999; photo and description in unpublished 1999 report on a paleontology inventory by the Utah Geological Survey).

Many observers – ancient and modern – of tridactyl dinosaur tracks are struck by the resemblance to oversized avian footprints. A dinosaur trackway near Cameron, Arizona, was traditionally known to the Navajo as "the place with bird tracks" (Lockley 1991, 185). When a farm boy named Pliny Moody observed a series of footprints in the red sandstones of the Connecticut valley at South Hadley, Massachusetts, in 1802 (Fig. 7), the local people believed them to be the footprints of Noah's raven – clearly a substantial bird! Their first scientific descriptor, Edward Hitchcock, may not have accepted that legend but did accept that they were avian footprints, calling them *Ornithichnites tuberosus* (Hitchcock 1836, 1858). This was understandable, since the concept of bipedality in dinosaurs was still unformulated. Only later did he perceive that they were dinosaur prints, calling them instead *Eubrontes tuberosus* (1845).

The Central Valley, running from western Massachusetts to southern Connecticut, contains a rich collection of dinosaur footprints. These were noticed by the Indians of the region. Petroglyphs of large tridactyl footprints carved in granite, known as "Devil's footprints," are scattered across New England, from Connecticut



FIGURE 5 *Chirotherium* track on a slab of the Triassic Moenkopi Formation, near Joseph City, New Mexico. (Photograph courtesy of Chris Schur, with thanks to Sterling Nesbitt and Tom Olsen) (See Color Plate II at the back of this issue)

and Rhode Island to Montauk, New York. (Indeed, legends originating from these footprints gave their name to the New Jersey Devils of the National Hockey League!) Some of the

man-made impressions are a foot (30 cm) long and about 4 inches (10 cm) deep (Doug Schwartz, *in litt.* to A.M., January 17, 2000). In 1866, Frances Caulkins described a granite out-



FIGURE 6 Ancient petroglyph found on rock face above the dinosaur track in Fig. 5. (Photograph courtesy of Chris Schur, with thanks to Sterling Nesbitt and Tom Olsen) (See Color Plate III at the back of this issue)

crop in what is now the center of the city of New London, Connecticut. This was a place “where people resorted for the sake of the prospect, and children to pursue their sports, or to look for the prints of enormous feet ... which were said to exist among the rocks” (Caulkins 1866; p. 627). New London is underlain with granite, so these tracks can only have been artificially created, apparently by local Indians.

In 1882 giant footprints, supposed to be made by “pre-Adamite man,” were discovered in the Nevada State Prison yard at Carson City, Nevada (Gibbes, 1882; Harkness, 1882: Fig. 8). Workers cutting sandstone blocks to build the state prison had uncovered a 2-acre area of shale and sandstone with fossil bones and shells and with numerous animal tracks. Crowds came to

view this wonder. The presence of what looked like the prints of a giant human among the trackways of Pliocene-Pleistocene deer, wolves, large wading birds, extinct horses and mammoths caused especial excitement. The mammoth tracks were 5 inches (13 cm) deep and 22 inches (55 cm) across, with the hind foot and forefoot tracking together; the so-called human prints were considered to be those of sandaled feet and were of truly Herculean proportions: 18–20 inches long and 8 inches wide (45–50 cm by 20 cm), with a stride of 3 feet (0.9 m) and a “straddle” (trackway width) equal to that of the mammoth tracks (about 19 inches or 48 cm). Six such tracks were observed (Harkness, 1882 p. 3), the footprints in them numbering between 8 and 17. Though they were more curved than normal

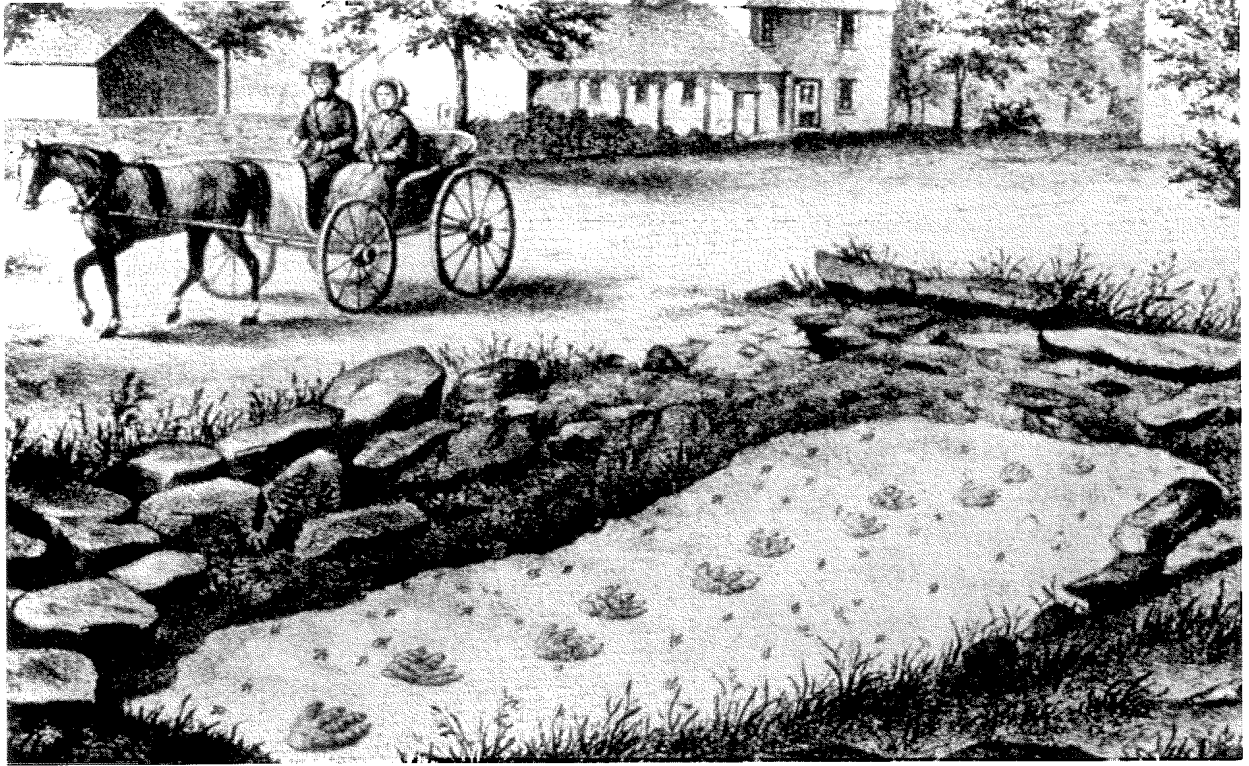


FIGURE 7 The "Moody Foot Mark Quarry," South Hadley, Massachusetts. (Illustration from Edward Hitchcock, *Ichthyology of New England*, Boston 1858)

human prints and turned outward, giving no indications of toes or claws, many scientists – among them the great palaeontologist Edward Drinker Cope – accepted that they were human, the imprints of "probably the ancestor of existing man" (Cope 1883, p. 70).

It was perhaps inevitable that Cope's arch-rival, Othniel C. Marsh, should disagree with that judgment. Rejecting the popular notion of a gigantic primitive man, Marsh suggested that the tracks were made by a giant ground sloth, *Myiodon*, whose remains are found in Nevada (1883). Joseph Le Conte, writing in *Nature* (1883, p. 102), agreed, though he noted that the "many who have seen the tracks and think them human" were entitled to their "honest difference of opinion" He explained the

absence of claw marks as "the result of the clogging of the feet with mud." The question of their identity was settled by Chester Stock, whose detailed comparison of them with the hind foot of *Myiodon harlani* (1917) left no reasonable doubt as to their character. This was confirmed when osteological remains of that ground sloth were found in the Pleistocene deposits of Carson City (Stock, 1920; 1936).

Around 1883, at the headwaters of the Tennessee River near Braytown (also called Braystown), in Campbell County, Tenn., people marveled over a multitude of tracks visible on the surface of a flat rock. Among the prints of "turkeys, bears, and horses" were several human footprints of monstrous size – and, sometimes, shape. The giants' footprints were 16 inches long

# GEOLOGIC FOOT-PRINTS IN NEVADA SANDSTONE.

AN ILLUSTRATIVE CHART AND DESCRIPTION,

By Addison Coffin, Hadley, Hendricks Co. Indiana. - Published by the Author.

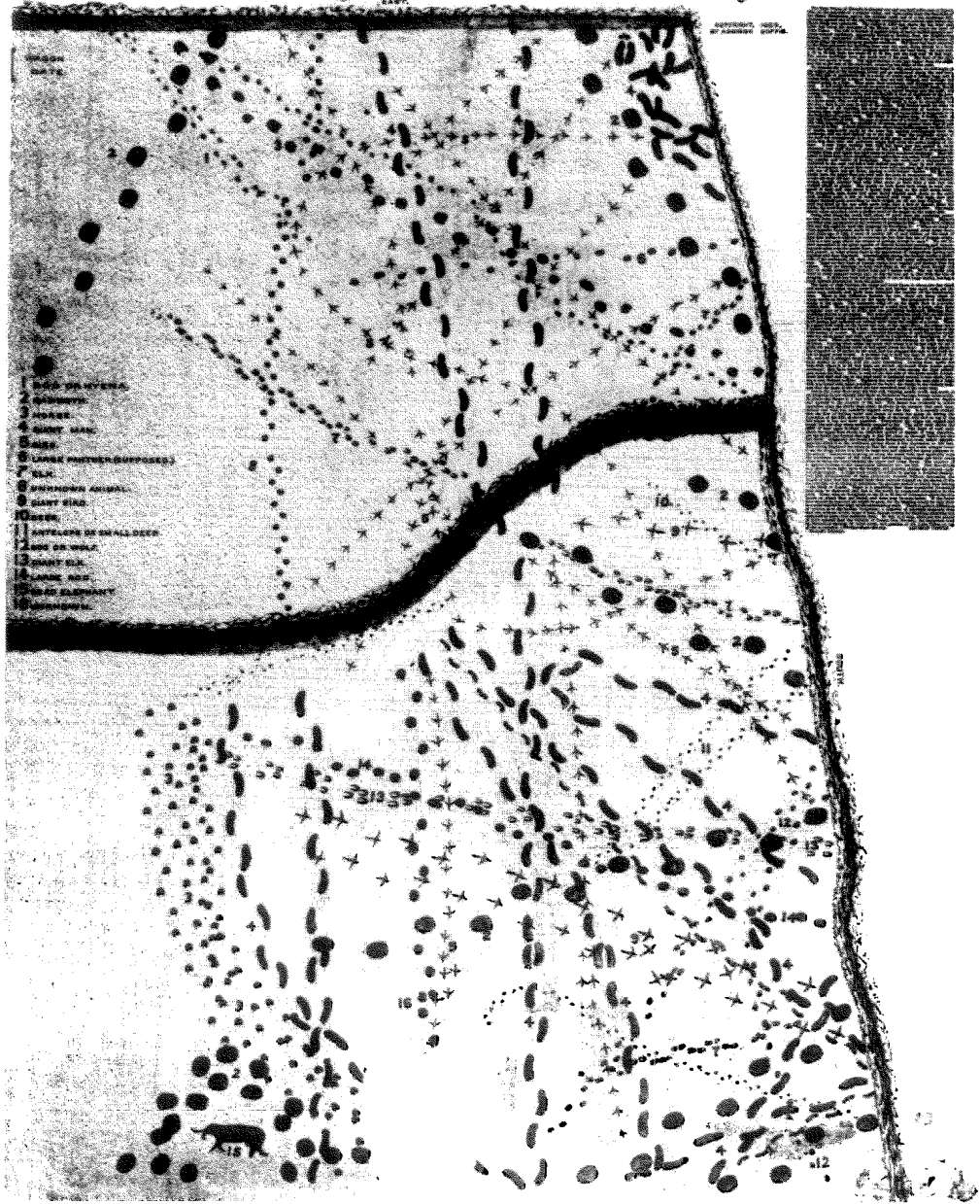


FIGURE 8 Footprints in the Nevada State Prison Yard, Carson City, Nevada (Coffin, 1889)

and 13 inches wide (40 cm by 33 cm) at the ball of the foot, narrowing to 7 inches at the instep and 5 at the heel (18 and 13 cm). Moreover, some footprints "were remarkable for having six toes each," just like Goliath's giant brother in the Old Testament! One of the giant Philistines defeated by David and the Israelites was distinguished by six fingers on each hand and six toes on each foot, according to 2 Samuel 21.20–22. Palaeo-Indian petroglyphs of six-toed feet have also been reported (Cunkle and Jacquemain 1995, 101–6). However, there are no fossil records of mammals with six digits. The observers in Tennessee also claimed to distinguish a set of prints made by a "Negro's foot." (The idea that race could be identified in a footprint is paralleled by the confidence with which scientists at Chauvet Cave announced the sex–male–and age–eight–of a human footprint in 1999; see above). The horse's hooves were also huge, measuring 8 by 10 inches (20 by 25 cm). All the tracks were headed in the same direction, as on a trail. One skeptic scoffed that perhaps a "circus" parade had left the marks. He noted that elsewhere in Tennessee, people were puzzled by large "turkey prints" on vertical rock faces and on the walls and ceilings of caves, leading him to propose that all the "gobbler" and other tracks must have been man-made (McA. 1885). Tim Gaudin (a paleontologist at the University of Tennessee, Chattanooga, *in litt.* to A.M., 21 Jan. 2000) comments that these footprints were almost certainly amphibian tracks of early to middle Pennsylvanian date, since such tracks have been reported from the Cross Mountain Formation in Campbell County, Tennessee (Kohl and Bryan, 1994). In contrast, there are no consolidated Pleistocene sediments at outcrop in this region.

A Shawnee Indian tradition about mammoth fossils found along the Ohio River was recorded by James Wright in 1762. The Indians imagined that supermen of the olden days used to hunt the mammoths, whose huge petrified bones were so abundant in their territory. These giant hunters left distinctive impressions in the rocks where

they sat down to rest, "like the marks made by a man sitting in snow" (Wright cited in Simpson 1942, p. 140). Surprisingly, the identification of buttocks-prints on stone is not unique to the Shawnee. Similar marks figured in Aztec, Delaware, and Aborigine traditions.

The Florentine Codex is a collection of Aztec folk beliefs preserved by the Spanish explorer Bernardino de Sahagun in 1535–80. One section (13<sup>th</sup> ch., book 3, part iv, p. 35) relates the legends of the great feathered god Quetzalcoatl. At a place called Temacpalco (ca. 6 miles from Mexico City), the god left marks on a stone where he sat down to rest. "As he supported himself on the rock by his hands, they sank deeply; as if in mud did the palms of his hands penetrate. Likewise his buttocks" pressed down into the rock. These hand and seat prints "are clearly visible, so deeply are they" sunk into the stone. This is the earliest written record of fossil prints that look like hands. Might they have been left by a giant sloth or other large mammal of the Pleistocene? Pleistocene fossil remains are abundant around ancient Aztec sites near Mexico City.

In 1781, Thomas Jefferson preserved a Delaware legend about the seat- and footprints of their god. According to the Delaware elders, the huge animals whose bones were at Big Bone Lick on the Ohio River had been destroyed in "ancient times" by the Great Spirit because they were killing off the smaller game – bears, deer, and so on. The "Great Man above" descended to earth, sat on a neighboring mountaintop and hurled lightning bolts. The Delaware claimed that "his seat and the print of his feet are still to be seen" (Jefferson 1995, p. 43).

The Delaware tradition of footprints received support a century later in a note in the *American Antiquarian* (Allen 1885). Professor J. Brown of Berea College, Kentucky, exploring an old Indian trail over Big Hill, a spur of the Cumberland Mountains east of Berea, found a sandstone ledge with distinct series of tracks. Among the "bear pawprints and hoofmarks" were two prints of a "good-sized" human being, with

"toes well spread." The ledge is about 100 miles south of Big Bone Lick. It seems likely that this tracksite, or a similar one, corresponds to the Delaware legend of the earthly footprints of the Great Spirit. Tim Gaudin notes that the ledge is just north of a reptile trackway in early Pennsylvanian sandstone recently described by Chesnut *et al.*, 1994 (Gaudin, *in litt.* to A.M., January 21, 2000). As for buttock-prints of dinosaurs, they have been scientifically recorded by Gierlinski (1996).

The stories of "Bigfoot," the fabulous ape-man-like creature of the U.S. northwest, were strongly bolstered when apparent footprints of this creature were discovered. It transpired that they were fake; in 1930 Mr. Rent Mullins of Toledo, Washington, had whittled a pair of nine-by-seventeen inch (23-by-43 cm) wooden "feet" and had proceeded to make footprints, in lakeside roads and forest floors. The hoax was such a success that eventually Mr. Mullins made eight pairs, giving them to friends in Washington, Oregon and California. Only in April 1983 did he admit to his practical joke – and, by then, the "evidence" for Bigfoot, from those tracks, was so widely accepted that the stories have not yet died down (Krishtalka, 1989, p. 238–239). Indeed, the International Society of Cryptozoology, which investigates Bigfoot reports, sells "for educational purposes" plaster casts of Bigfoot prints supposedly found at Gray's Harbor, Washington, in 1982.

The Bigfoot footprint hoax has an analogue in Arizona around 1952, when University of Arizona palaeontologist Edwin McKee and others heard reports of a series of "fresh, unweathered dinosaur tracks" about 5 miles (8 km) west of the known dinosaur prints in the Navajo Sandstone near Tuba City, in an area of joint use by Navajo and Hopi tribes. According to a geologist who was mapping the Navajo reservation at the time, the party of palaeontologists found a series of prints in the Moenave Formation and "eagerly followed the trail across bare rock for a quarter-mile or so," until the prints ended abruptly.

They searched in vain for more tracks. "Returning to the last print, they then noticed that some Navajo or Hopi had carved his 'signature' beside the mark" (Charles A. Repenning, *in litt.* to A.M., October 9, 1999).

## HUMAN TRACKS IN CENTRAL AMERICA

In 1883, heated debate erupted over a series of apparently human footprints found in Managua, Nicaragua, by quarry workers. The initial theory suggested that the tracks were made by "a people fleeing an inundation" (an allusion to the biblical flood). Acrimonious controversy raged in the pages of *American Antiquarian* and *American Naturalist* from 1884 to 1889. Earl Flint investigated the six rows of impressions for the Peabody Museum. The prints of several individuals covered a slab of volcanic rock overlying black sand. Flint measured the "highly arched" footprints at 10 inches long and 4 inches wide (25 by 10 cm), with a stride of 17 inches (43 cm). The "people making them were going both ways" said Flint, who fancied that one limping individual was leaning on a staff. He compared them to another human footprint in volcanic rock on the banks of the Grand River at Pinon, west of Jinotepe, next to a tiger pawprint. Flint envisioned "cavemen" and animals escaping a volcanic eruption, rather than Noah's Flood. He found petroglyphs of "sea monsters" chiseled inside caves in the region, which he believed had gone extinct in volcanic eruptions preceding the era of mastodons (although he admitted that no bones of the monsters had turned up).

Subsequent writers took exception to Flint's proposed Eocene date for the human tracks; others argued that the prints were not barefoot but moccasined, and therefore made by "modern" man. One writer suggested that the prints were actually petroglyphs created by the same people who had made the rock-carvings of sea monsters, observed by Flint, in the local caves. He noted that a controversial pair of human foot-



prints impressed on fossiliferous blue limestone on the banks of the Mississippi near St. Louis appeared to be the work of a skilled artist, especially since the relief of a scroll accompanied the prints (Flint 1884, 1888, 1889; Anon. 1885, 1889; McA. 1885). In 1947, R. W. Brown assigned the footprints of Nicaragua a Pleistocene date.

### TALES FROM SOUTH AMERICA

Rock-carved images engraved by indigenous people of Brazil alongside the footprints of theropod dinosaurs, exposed at Paraíba in northeastern Brazil, indicate that the three-toed prints were interpreted as those of giant running birds (G. Leonardi *In Li Centro Studi Recherche Ligabue* 1994, pl. 98). That notion was logical for people who knew the giant living bird of northeastern Brazil and Argentina, the rhea. The three-toed rhea, a distant relative of dinosaurs, stands about 5 feet tall. This example and many other instances of rock art related to known trackways suggest that non-writing cultures devoted considerable time and speculation to the meaning of foot impressions on stone.

The later folklore concerning footprints in South America parallels that of mediaeval Europe, in that they were most often given a Christian interpretation. Giuseppe Leonardi (*in litt.* to A. M., December 8, 1999) reported:

At the site "Dois Coqueiros," on the road from Indianópolis to São Manuel, municipality of Indianópolis, State of Paraná, Brazil, I was searching for (and finding) fossil tracks in the red sandstones of the Caiuá Group (Middle Cretaceous), when I met a farmer who told me there was a place where there were "the paces [or strides] of a saint" (*Os passos de um santo*). I went there and found a small quarry with some bad quality theropod tracks of small dimensions, some early mammal trackways and invertebrate trails, many of them also seen on the flagstones of the

nearby town of Cianorte, that came from the quarry. I did not find large footprints that might have suggested by their dimensions, for the lay people, "the paces of a saint," but they possibly had been discovered, as I found some in the same formation in the field at Cianorte in another site.

I had notice of a local legend of the State of Bahia in Brazil of the "pegadas do Pai Sumé (or: Pai Tomé)" (=footprints of Father Sumé or Tomé) in the Reconcavo Basin around Salvador da Bahia, which is of Jurassic-Cretaceous age. Pai Sumé or Tomé would be a popular corruption of the name of St. Thomas the Apostle, of whom in the apocryphal gospels many tales were told, that he had preached the Gospel in India, in many other places, and, why not, in the Western Indies. I tried to localize the place of this legend but I could not find more data. The basin is large, but Brazil is even larger and, although I have surveyed afoot and in detail most of the many NE basins, I never visited the Reconcavo. So, it is just a possibility. There are many sediments very good for tracks in that basin.

What local people in Colombia thought were the imprints of deer's hooves turned out, in the 1840s, to be the first dinosaur prints ever recorded in South America (Buffetaut 2000). Villagers at Aranpamyá, near Potosí, Bolivia referred to an extensive trackway of Cretaceous footprints, probably of bipedal dinosaurs, as the vestiges of a large herd of llamas (L. Branisa, quoted in Leonardi, 1994, p. 40).

### FOOTPRINTS ON THE HAWAIIAN ISLANDS

Hawaiian history and legend combine in the story of the high chief Keoua. In the course of combat with the new King Kamehameha, during the year 1790, Keoua and his people needed to

cross the Kau Desert close to the volcano Kilauea, then entering a phase of high eruptive activity. Keoua considered that there was need to appease the goddess Pele. After attempting this, he divided his people into three companies. As they undertook the crossing, a new phase of eruption began, producing darkness and causing an electrical storm, with rain and intense lightning. The first company suffered losses, and the second was entirely destroyed, by hot falling ash and volcanic gases. The third company crossed in safety, but was horrified to discover the corpses of their comrades – men, women and children – and of the hogs they were driving, only one of which survived (Westerveldt, 1963, p. 139–143). The King's prophets announced that it showed Kamehameha had the gods' favor and that they had wrought vengeance on Keoua for his impiety.

Some 120 years later, footprints of naked human feet, and of hogs' trotters, were observed by Mr. R. H. Finch; they were imprinted into a pisolithic ash, along with raindrop impressions. The footprints were studied by volcanologist Thomas Jaggar (1932), who was able to follow the trail of the unfortunate Hawaiians for about four miles, along a route from Hilo, where Keoua had launched his attack, toward his destination, Kau (Fig. 9). Thus palaeoichnology confirms history – though perhaps not legend.

## LEGENDS FROM AUSTRALIA

The footprints of carnosaurus occur in the early Cretaceous Broome Sandstone of north Western Australia. These were first reported by Glauert (1952) and were subsequently described and named, as *Megalosauropus broomensis*, by Colbert and Merrilees (1967). Footprints of stegosaurus are also considered to be present.

For the Aborigines of northwest Australia, these trackways are part of a "song-line" of sacred sites from the Dream-Time. According to the Bardi people, they constitute the ancient trail

of a mythological creature named Marella, a giant "emu-man." Marella left numerous footprints in the Cretaceous sandstone seashore around Broome. In one place the tracks head out to sea and in another they head in, so the Bardi legend tells of him walking out into the ocean and returning. Wherever Marella sat down to rest, his feathers became stuck in the mud. The image of the giant "emu-man" sitting down to rest and leaving behind huge feathers is reminiscent of the Aztec feathered god, whose resting place in stone was venerated, and the Roc of eastern Africa, whose great feathers likened to palm-fronds.

Around Broome, this detail may well refer to fossil ferns embedded in the sandstone, which do look like large feathers (John Long, Western Australian Museum, *in litt.* to A.M., October 11, 1999). However, the recent discovery of feathered dinosaurs in China, and the recognition of the impressions of feathers on a pubic-abdominal resting trace of an Early Jurassic dinosaur from Connecticut (Gierlinski, 1996) may mean that the observation of the Aborigines had greater validity than hitherto supposed.

In western Victoria, a Tjapwurong tradition tells of giant birds (*mihirung paringmal*), much larger than the ordinary emu – so large, indeed, that their heads were as high up as the hills and so formidable that a kick would be fatal to a man. These monster birds were said to have existed in the Dream-Time when volcanoes were active in the Western District of Victoria, perhaps more recently than 6,000 years ago (Rich, 1985, p. 191–193). Discoveries at Riversleigh, Queensland, have shown that very large, flightless birds – dromornithids – inhabited Australia in mid to late Tertiary times. One of these, *Dromornis stirtoni*, stood over 9 feet (3 m) tall and would have weighed 880 pounds (400 kg: see Archer *et al.* 1991, p. 80). Might some of these dromornithids have survived long enough to have been hunted to extinction by the Aborigines, their memory surviving as legend? This suggestion has been made by Vickers-Rich and

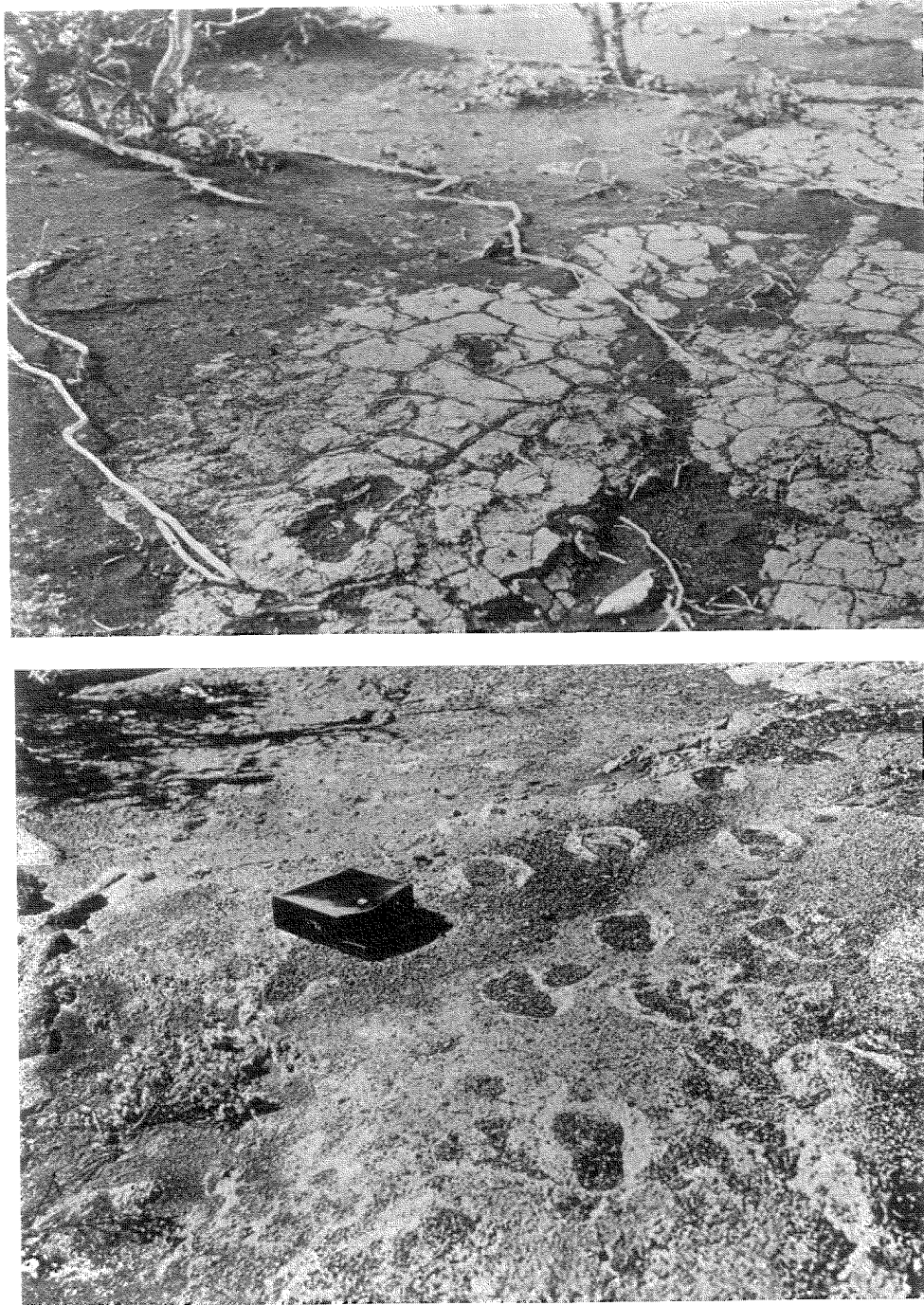


FIGURE 9 Fossil human footprints preserved from the eruption of Kilauea in 1790 (from Jaggar, 1934). Upper: footprints in the lower of the two ash layers. Lower: footprints in pisolitic ash west of Mauna Iki

Archbold (1991, p. 3) who reproduce Aboriginal art from the Quinkan Gallery Cave in Cape York Peninsula, Queensland, which depicts a bird very like a dromornithid.

Carved representations of the footprints of giant birds are to be seen at Pimba, South Australia. These may be based upon dromornithid footprints; however, as Tindale (1951) has pointed out, they compare well with bipedal dinosaur tracks. The Aboriginal interpretation of such tracks as those of a huge emu is reasonable, since emus make large tridactyl prints that resemble the tracks of large theropods. Indeed, such large ratites (running birds) have proved important to the work of dinosaur trackers like James Farlow; his studies of emu and ostrich footprints in mud (Psihoyos 1994, 150–56; Farlow 1989) have aided palaeontologists in understanding how dinosaur posture and speed might produce various track patterns.

The Broome coast also has human prints, made about 7,000 years ago. In 1996, Aborigines visiting tracksites at Crab Creek and Lombardina for rituals were angry to discover that thieves had used power tools to steal slabs containing human and dinosaur prints. "It's a very sacred thing to me," said Joseph Roe, the Aboriginal guardian of the footprints. According to "our tradition, whoever has taken them has placed themselves in great danger," he declared. "The thieves may fall sick, or illness may strike the Aborigines." Under Aboriginal law, the thieves should be killed at spearpoint. In 1997, police recovered a stolen stegosaurus print and arrested two men, but the human footprints are still missing (Anon., 1996, 1998). The incident demonstrates the profound meaning that fossil footprints hold for traditional cultures, as well as for modern science.

In recent years, dinosaur tracks have been reported in abundance from northern Queensland (e.g. by Thulborn and Wade, 1979). None of these accounts mention Aboriginal legends concerning the tracks, but it is likely that such legends exist.

## THE BEGINNINGS OF MODERN STUDIES

The attempt to replicate tracks and identify the maker ushered in the scientific study of fossil footprints in the 1820s, when the Reverend William Buckland tried to duplicate tracks of an extinct reptile in red sandstone (now known to be of Permian date) from Dumfries-shire, Scotland. Since it had a broad trackway and short stride, he identified the track-maker as a turtle – quite reasonably, on the basis of information then available: however, it was later shown to be the track of a sphenacodont (an early synapsid reptile). Other nineteenth-century investigators suggested that Triassic tracks, inappropriately named *Chirotherium*, "hand-footed beast" (i.e. mammal!), which were widespread in Europe and America, might have been made by a variety of creatures – colossal birds, giant apes, cave bears, kangaroos, giant toads, or "hand-footed" labyrinthodont amphibians (Sarjeant 1998). In truth, they were tracks of rauisuchian thecodonts. A more complete history of the scientific study of vertebrate footprints has been published by the second author (Sarjeant, 1987).

## CONCLUSIONS

Since earliest times, humans have been curious about tracks and prints, made so long ago that they had turned to stone. Such wonders have always demanded explanations. Imagination and rational speculation, the twin well-springs of creative storytelling and scientific curiosity, are evident in this brief survey of the history of paleoichnological folklore. In theories that range from naturalistic to fantastic to surprisingly perceptive, the traces of extinct species have been attributed to gods, demons, heroes, primitive men, familiar game and fowl, and bizarre mythological animals and birds. For scientists and pre-Darwinians alike, the physical evidence of footprints allows humans to visualize the corporeal substance and daily activities of creatures that once walked the earth, but will never be seen alive.

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