SPECULATION ABOUT IGUANODON

There are many things about iguanodon that have not yet been discovered and some which probably never will.

Skin

Apart from a few impressions in fossilized foot-prints we have little evidence about what ***Iguanodon's*** skin was like. However, the texture of the skin of ***Anatosaurus***, a descendant of ***Iguanodon*** from North America, is known from fossilized imprints. The skin was leathery and covered with small bead-like "tubercles", like crocodile skin but without the large scaly plates or "scutes". The detail of the skin would only have been visible close up. From a distance the skin would resemble that of a large pachydermal mammal such as an elephant.

Evidence from ***hadrosaurs*** such as ***Anatosaurus***, ***Ecknontosaarus*** and ***Hypacrosaurus*** suggest a frill of skin running along the back and a series of vertical folds or wrinkles in the skin which were especially prominent at the back of the neck, shoulders and upper arms. ***Iguanodon*** may have had similar features. The three middle fingers of later ***hadrosaurs*** were joined together in a fleshy mitten which left a crescent shaped print in fossil trackways. ***Iguanodon*** had hooves on its middle fingers but they may have been joined by skin along most of their length.

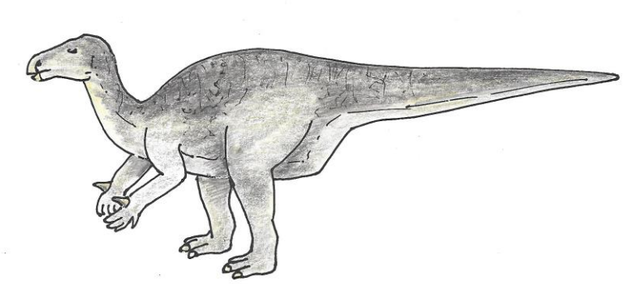
SPECULATION ABOUT IGUANODON (Continued)

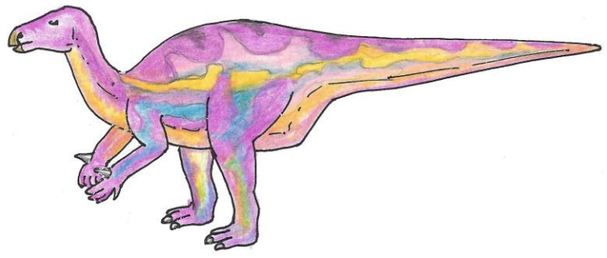
Colour

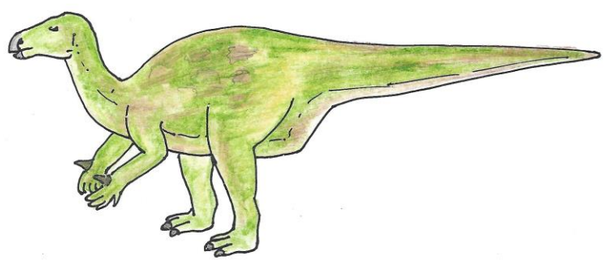
Colours do not fossilize and so this element of dinosaur reconstruction is at best educated guesswork. ***Iguanodon*** may have been drab shades of green, brown or grey or possibly brightly coloured and patterned.

Colours are used in various ways by animals: as camouflage, as a warning or to identify individual animals in a herd. ***Iguanodon*** probably had good eyesight and so colourful markings may have been used for display or for recognising various members of its group.

There are several species of ***iguanodon*** and each may have used colouration in different ways. Smaller species may have relied on camouflage and speed to escape predators while large species may have been boldly coloured and patterned to threaten rivals.

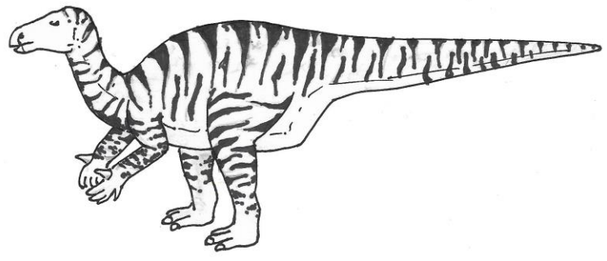




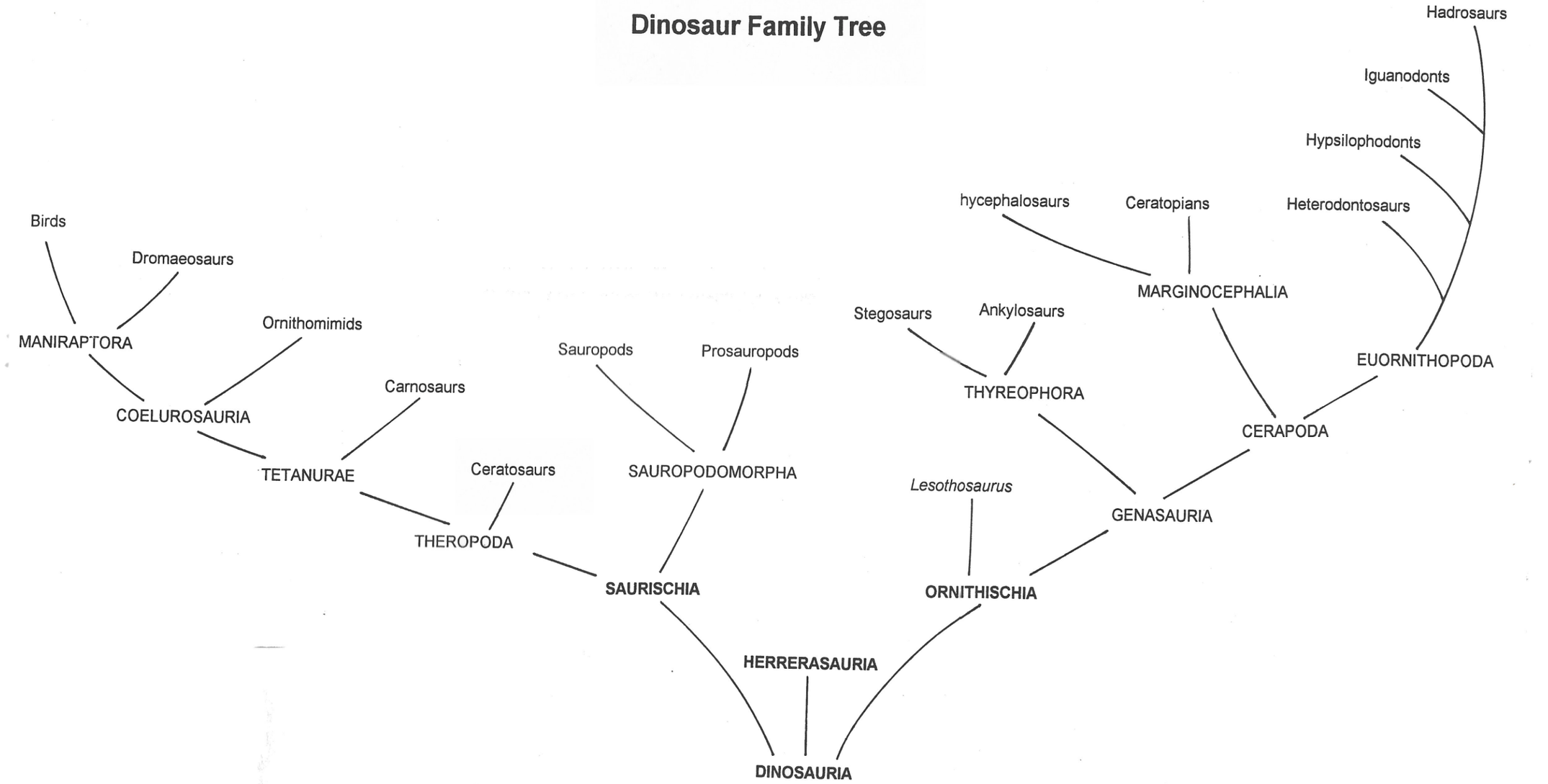


Sound

Recently scientists have attempted to re-create the sounds made by dinosaurs by modelling the air passages within the fossilized skulls and blowing air through them. Most of the work concentrated on ***hadrosaurs*** which evolved from ***Iguanodonts***. Many ***hadrosaurs*** had large crests on their heads which may have acted as resonators to loud distinctive cries. ***Iguanodon*** probably made a low rumbling noise.



Dinosaur Family Tree



THE LOST WORLD by Sir Arthur Conan Doyle

Sir Arthur Conan Doyle visited the Crystal Palace to see the replicas of the dinosaurs. He was interested in palaeontology and in 1909 had found evidence of /gild/70d0/7 footprints in the Wealden beds in the ironstone quarry near his home in Crowborough, Sussex. The find excited him so much that it served as a stimulus for his writing of "***The Lost World***".

"Look at this!" said Lord John "This must be the trail of the father of all birds!" An enormous three-toed track was imprinted in the soft mud before us. The creature, whatever it was, had crossed the swamp and passed on into the forest. We all stopped to examine the monstrous spoor. If it were indeed a bird - and what animal could leave such a mark? - its foot was so much larger than an ostrich's that its height on the same scale must be enormous. Lord John looked eagerly about him, and slipped two cartridges into his elephant gun.

"I'll stake my good name as a shikaree that this track is a fresh one. The creature has not passed ten minutes. Look how the water is oozing into that deeper point! By Jove! See, here is the mark of the little one!"

Sure enough, smaller tracks of the same general form were running parallel to the large ones. "But what do you make of this?" cried Professor Summerlees triumphantly, pointing to what looked like the huge print of a five-fingered human hand appearing among the three-toed marks.

"Wealden!" cried Challenger in ecstasy. "I've seen them in the Wealden clay. It is a creature walking erect upon three-toed feet, and occasionally putting one of its five-fingered fore-paws upon the ground. Not a bird, my dear Roxton, not a bird."
"A beast?"

"No, a reptile - a dinosaur. Nothing else could have left such a track. They puzzled a worthy Sussex doctor some ninety years ago, but who in the world could have hoped to have seen a sight like this?" (From "The Lost World" pg. 163/4)

The "worthy Sussex doctor" may refer to Gideon Mantell who, with his wife, discovered Iguanodon teeth and knew of the footprints. The first Iguanodon footprints had been discovered in Hastings by a Sussex clergyman, Rev. Edward Tagart, who thought they were the prints of giant birds.

The ***"Lost World"*** (pg. 164) described the creatures thus:

"There were...five of them, two being adults, and three young ones. In size they were enormous: even the babies were as big as elephants, while the two large ones were far beyond all creatures I have ever seen. They had slate-coloured skin which was scaled like a lizard's, and shimmered when the sun shone on it. All five were sitting up, balancing themselves on their broad powerful tails and their huge three-toed hind feet, while their small five-fingered front feet pulled down the branches on which they browsed. I do not know that I can bring their appearance home to you better, than by saying they looked like monstrous kangaroos, twenty feet in length, and with skins like black crocodiles.

The following is from "The Lost World", page 167

"What did you say they were?" said Lord John.

"Iguanodons", said Summerlee, "you'll find their footmarks all over the Hastings Sands in Kent and Sussex. The south of England was alive with them when there was plenty of lush green stuff to keep them going. Conditions changed and the beasts died. Here it seems that the conditions have not changed, and the beasts have lived."
Combining fact and fiction, Conan Doyle fired the imagination of the public and the media, his "Lost Earth" later being serialized on the radio and then made into a film.

The success of ***"Jurassic Park"*** indicates that the subject of dinosaurs has not lost its fascination for young and old.

The ***"Lost World"*** was serialized in The Strand Magazine from April through November 1912. Shortly after it was published by Hodder and Stoughton in London and simultaneously by other publishers in New York and Toronto.

THE DISCOVERY OF IGUANODON

In 1822, Mrs. Mary Mantell spotted some large fossilized teeth in a pile of stones by the side of the road. She had been walking near Cuckfield in East Sussex with her husband Dr. Gideon Man-tell.

Although the couple were both keen geologists neither of them knew which kind of animal the teeth would have belonged to. Gideon Mantell found that the source of the stones was a quarry in Tilgate Forest.

Later, in 1822, Gideon Mantell published an account of the teeth in his book “The Fossils of the South Downs”. He showed the teeth to some of the leading British geologists of his time.

Reverend William Buckland suggested that they might be the teeth of a fish while other scientists thought they might be from a mammal and had just been mixed up with older rocks.

Some teeth were taken to the eminent French comparative anatomist Baron Georges Cuvier to be identified.

Cuvier concluded that they were the teeth of a large plant-eating reptile of a type previously unknown to science.

At the Royal College of Surgeons' Hunterian Museum, Mantell met Samuel Stutchbury, a medical student studying the anatomy of South American Iguanas. Stutchbury and Mantell noticed a similarity in shape between the fossilized teeth and those of the modern Iguana.

Following the suggestion of the Reverend William Conybeare, who had already suggested the names for ***Alegalosaaras*** and ***Mosasaurus***, Man-tell called his fossil reptile ***Iguanodon*** which means “Iguana tooth”.

In 1825, Mantell published a paper entitled “***Notice on the Iguanodon, a newly discovered fossil reptile from the sandstone of Tilgate Forest in Sussex***.”

Mantell had thought that ***Iguanodon*** was a very large lizard but Owen’s view was quite different. In the early 1850s Owen worked with Benjamin Waterhouse Hawkins to produce life-size models for the Crystal Palace Park at Sydenham.

The dinosaurs Owen reconstructed looked like large reptilian mammals and walked on all four limbs.

The thumb spike is one of the best-known features of ***Iguanodon***. Although it was originally placed on the animal's nose by Gideon Mantell, the complete Bernissart specimens allowed Dollo to place it correctly on the hand, as a modified thumb, used, it is believed, for defence purposes.

GIDEON MANTELL 1790-1852

Gideon Algernon Mantell was born in St. Mary's Lane, now Station Road, Lewes on 3rd February 1790. His education began in Lewes but he later studied medicine in London and returned to Lewes to practice in 1811.

He married Mary Ann Woodhouse in 1816 and two years later purchased Castle Place, now 166 High Street, Lewes, where he set up his medical practice. He later moved to Brighton and then to London.

In 1833 the family moved to 20, The Steine, Brighton where he converted the drawing room into a museum.

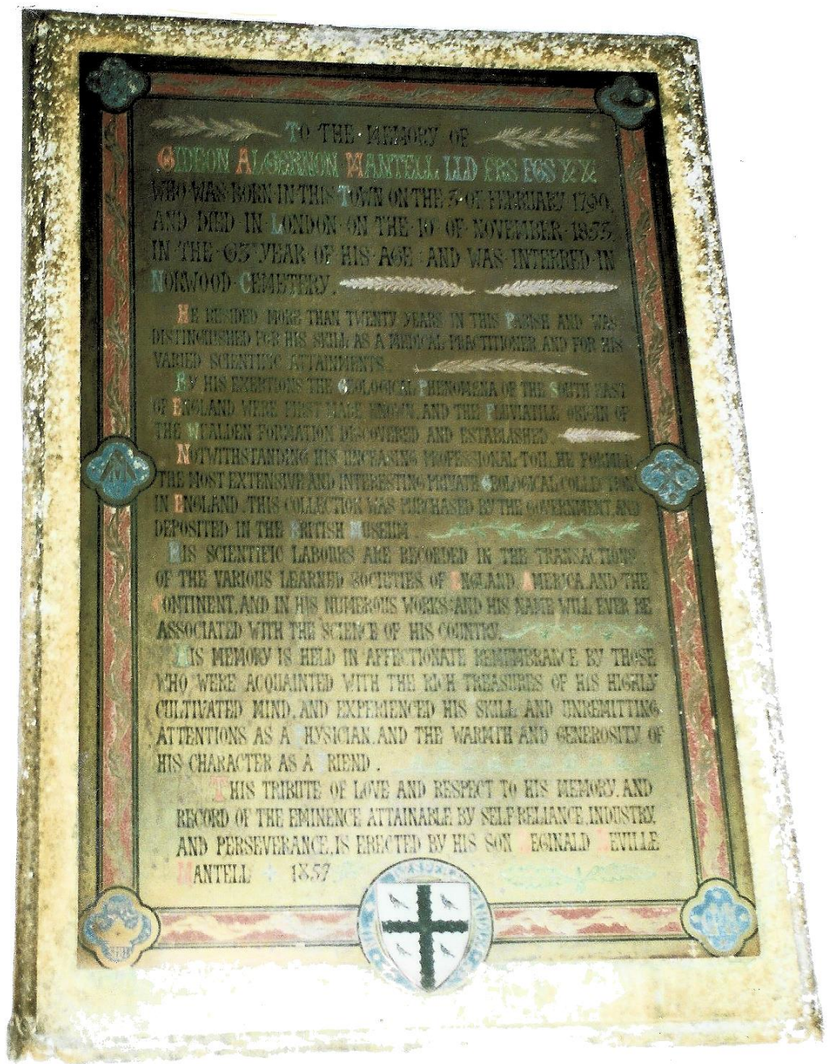
He was recognised as one of the leading geologists of his time and became obsessed with collecting fossils, which, eventually, led to the break-up of his marriage.

In 1838 he sold his very large fossil collection to the British Museum for £4,000 and, from this sum, he bought a medical practice at Crescent Place, Clapham Common. In 1844 he moved to 19, Chester Square, Pimlico.

Always frail, in 1841 Mantell suffered a severe spinal injury in a carriage accident, from which he never properly recovered. He died on 10th November 1852 after giving a lecture at the Clapham Athenaeum. He is buried in Norwood cemetery and a memorial tablet was erected in St. Michaels Church, Lewes.

Gideon Mantell’s House in High Street, Lewes.

The left hand image shows a close-up of the ammonite mouldings at the top of the pillars.



MEMORIAL PLAQUE TO GIDEON MANTELL IN ST. MICHAEL'S CHURCH, LEWES

TO THE MEMORY OF
GIDEON ALGERNON MANTELL LLD FRS EGS & WHO WAS BORN IN THIS TOWN ON THE 3RD FEBRUARY 1790 AND WHO DIED IN LONDON ON 10TH NOVEMBER 1853 IN THE 63RD YEAR OF HIS AGE AND WAS INTERRED IN NORWOOD CEMETERY.

HE RESIDED MORE THAN 20 YEARS IN THIS PARISH AND WAS DISTINGUISHED FOR HIS SKILL AS A MEDICAL PRACTITIONER AND FOR HIS VARIED SCIENTIFIC ATTAINMENTS.

BY HIS EXERTIONS THE GEOLOGICAL PHENOMENA OF THE SOUTH EAST WAS FIRST MADE KNOWN, AND THE PLUVIATILE ORIGIN OF THE WEALDEN FORMATION DISCOVERED AND ESTABLISHED.

NOTWITHSTANDING HIS INCREASING PROFESSIONAL TOIL HE FORMED THE MOST EXTENSIVE AND INTERESTING PRIVATE GEOLOGICAL COLLECTION IN ENGLAND. THIS COLLECTION WAS PURCHASED BY THE GOVERNMENT AND DEPOSITED IN THE BRITISH MUSEUM.

HIS SCIENTIFIC LABOURS ARE RECORDED IN THE TRANSACTIONS OF VARIOUS LEARNED SOCIETIES OF ENGLAND, AMERICA AND THE CONTINENT, AND IN HIS NUMEROUS WORKS: AND HIS NAME WILL EVER BE ASSOCIATED WITH THE SCIENCE OF HIS COUNTRY.

HIS MEMORY IS HELD IN AFFECTIONATE REMEMBRANCE BY THOSE WHO WERE ACQUAINTED WITH THE RICH TREASURES OF HIS HIGHLY CULTIVATED MIND, AND EXPERIENCED HIS SKILL AND UNREMITTING ATTENTIONS AS A PHYSICIAN AND THE WARMTH AND GENEROSITY OF HIS CHARACTER AS A FRIEND.

THIS TRIBUTE OF LOVE AND RESPECT TO HIS MEMORY AND RECORD OF THE EMINENCE ATTAINABLE BY SELF RELIANCE, INDUSTRY AND PERSEVERANCE, IS ERECTED BY HIS SON REGINALD NEVILLE MANTELL 1857

THE WEALDEN

The rocks in which Iguanodons remains have been found in this country are in the area known as “The Wealden” (derived from the Old English word “weald”, meaning "forest"; a term first used by Dr. Gideon Mantell in the 1830s: they are about 130 million years old and were formed in a geological period called the Lower Cretaceous.

These rocks contain the fossilised remains of the plants and animals that inhabited a landscape radically different from that we know today.

The sea, then, was not where it is today. The area was mostly a freshwater flood plain dominated by rivers, lakes and swamps.

There appears to have been a dry season and a wet season. The temperature would have been much higher than it is today and the presence of fossilised charcoal suggests that forest fires broke out occasionally. Floods during the wet season would carry into the lakes and rivers bones that had been lying on the ground. These remains were sometimes preserved as fossils.

Vegetation consisted of coniferous trees, cycads, ferns and fern-like plants. There were as yet no deciduous trees and no grasses. Fossil plant debris is very common in the rocks exposed on the beach at low tide.

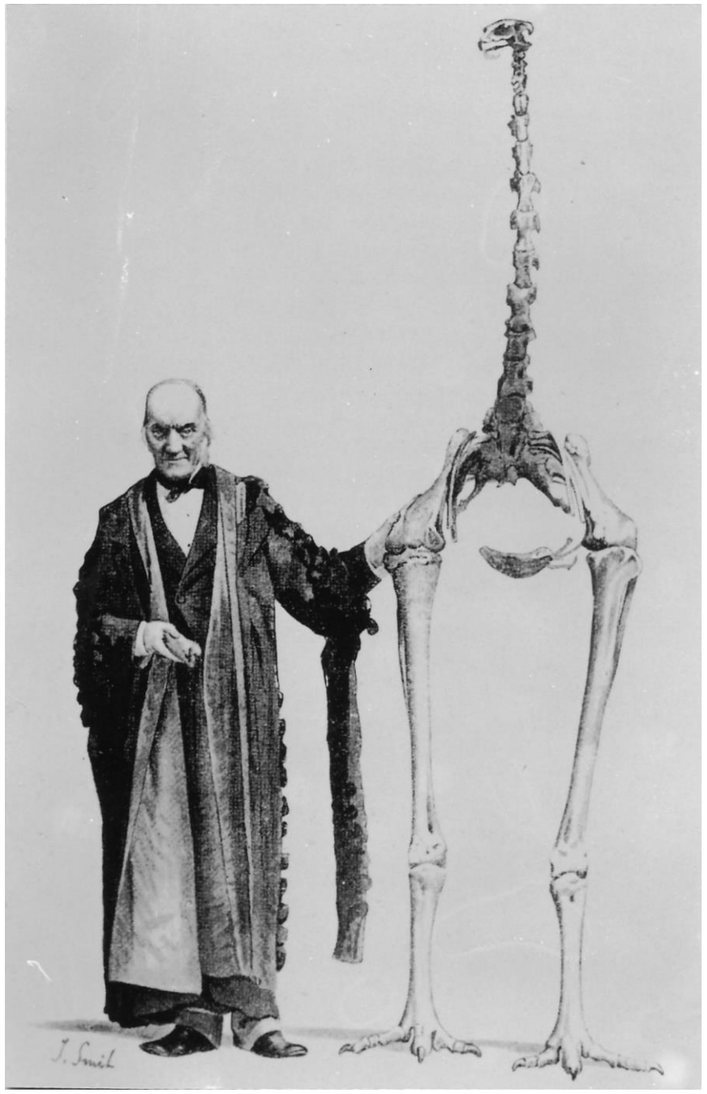
Examples of amber, fossilised tree sap, have been found in Bexhill. As yet no specimen has contained preserved insects. However, remains of insects have been found in the rocks on the beach. As well as the fossilised plant remains, waterlogged wood, roots and nuts are sometimes discovered. These are from a submerged forest which dates back to the Bronze Age, some 4,000 years ago

WHAT IS A DINOSAUR?

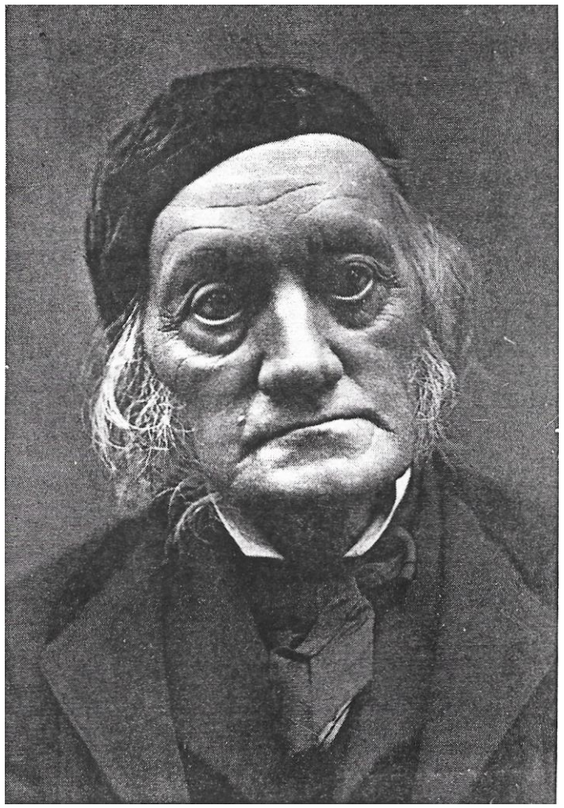
In 1841 Sir Richard Owen invented the word Dinosauria to describe the large reptiles that had been discovered by Rev. William Buckland and Dr. Gideon Mantel!. The group consisted of reptiles with five sacral vertebrae fused to the pelvis and legs held under the body rather than sprawling to the side. Owen realized that dinosaurs were unlike any modern reptile and so created a new group to classify them in.

There are two main orders of dinosaur: ***Saurischia*** (lizard-hipped), which includes all the flesh-eating dinosaurs and the plant-eating dinosaurs with long necks and tails such as ***Apatosaurus*** and ***Brachiasaurus***, ***Ornithischia*** (bird hipped) dinosaurs are all plant eaters with beaks and fleshy cheeks. ***Iguanodon*** belongs to this order as does the armoured dinosaurs such as ***Ankylosaurus***, horned dinosaurs like ***Triceratops*** and plated dinosaurs like ***Stegosaurus***.

Within the group ***Saurischia*** the flesh-eating dinosaurs are called ***Theropods*** (beast feet), and the plant eaters ***Sauropods*** (lizard feet). ***Ornithischia*** is divided into various suborders: ***Ornithopods***, (bird feet), like ***Iguanodonts*** and ***Hadrosaurs***; ***Scelidosauria*** (limb lizards), lightly armoured dinosaurs that may be the ancestors of the ***Stegosaurs*** and ***Ankylosaurus***; ***Stegosauria*** (roof lizards), which had a double row of plates or spines along their bodies; ***Ankylosauria*** (fused lizards), heavily armoured quadrupedal dinosaurs; ***Pachycephalosauria***, (thick-headed lizards), which resemble small ***Ornithopods*** but have thick armoured skulls. ***Ceratopsia*** (horned faces), mainly quadrupedal dinosaurs with a frill at the back of their skulls, most had horns on their noses or over their eyes.



Sir Richard Owen with a mounted skeleton of the giant fossil bird “Dinornis”



SIR RICHARD OWEN (1804-1892)

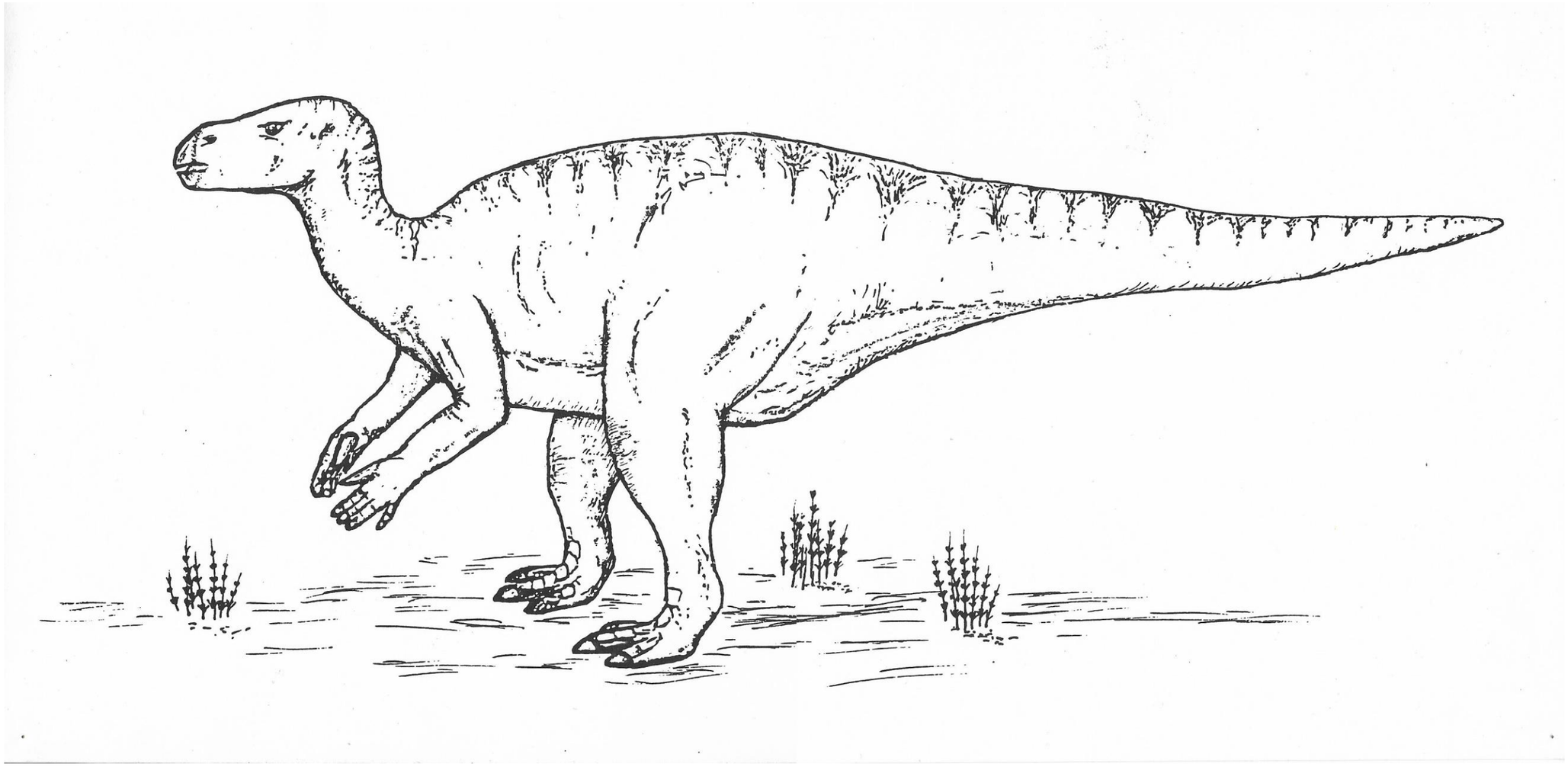
Sir Richard Owen was born in 1804 and studied medicine but his main subject was anatomical research. In 1836 he became Professor at the Royal College of Surgeons. He was to become England's greatest anatomist and palaeontologist. He made a close study of the bones of Megalosaurus, Iguanodon and Hylaeosaurus and it was he who gave the general name of Dinosaur.

Owen was advisor to Waterhouse Hawkins on the dinosaur models for the Crystal Palace Gardens.

REV. WILLIAM BUCKLAND (1784-1856)

An eccentric but brilliant man in his field of science and religion, William Buckland was passionately interested in palaeontology and geology.

Although he took Holy Orders at Oxford, he was appointed Reader in Mineralogy at Oxford when he was 29. In 1819, he became the first professor in Geology. In 1824, he published his description of a Megalosaurus, the first dinosaur ever to be named. He, later, became Dean of Westminster.



IGUANODON'S LIFE SPAN

The life expectancy of an ***Iguanodon*** is not known. Studies on the bones of other dinosaurs have given a probable age of death as 120 years. Birds and reptiles, dinosaurs' closest relatives, are often long-lived. Tortoises and parrots can live longer than humans and this may also be true of ***Iguanodon***. Large animals such as elephant whales also tend to be long-lived and to reproduce slowly, small animals reproduce faster but do not live for so long.

It is unlikely that old-age was a common cause of death, for Iguanodon, due to the presence of large flesh-eating dinosaurs.

MALE AND FEMALE *IGUANODON*

It is not possible to tell the sex of a fossilized remains of ***Iguanodon***. It was thought that the large ***Iguanodon bernissartensis*** and the smaller ***Iguanodon atherfieldensis*** were male and female but it is now known that they are different species

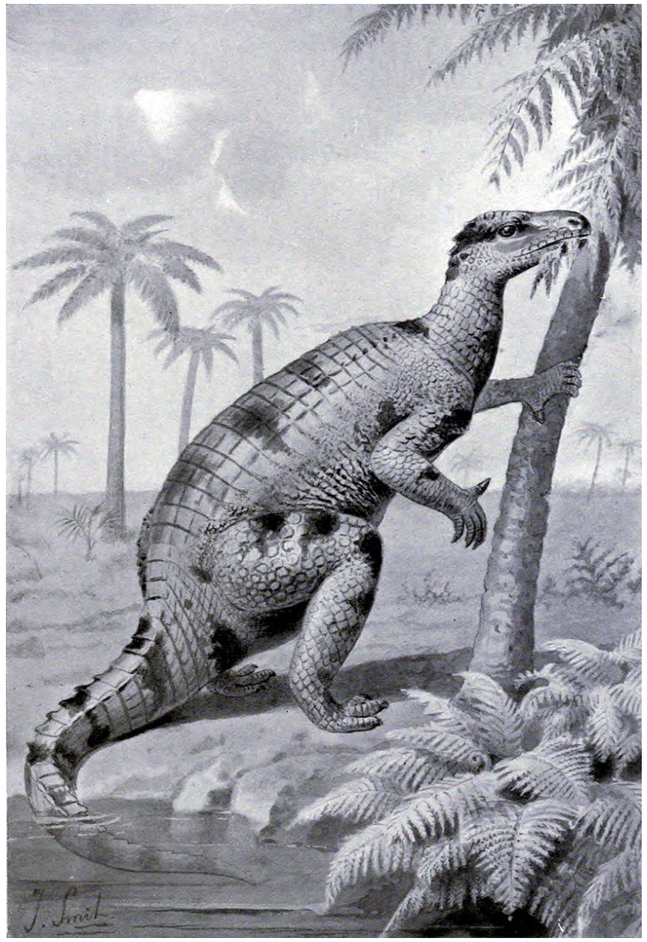
Recent studies have suggested that female dinosaurs were larger than the male.

DISPLAY

The way in which ***Iguanodon*** attracted a mate or threatened a rival or predator can only be guessed at. Birds, which are dinosaurs' closest surviving relatives, may provide some clues. Display behaviour probably involved bobbing movements of its head combined with bellowing and chattering noises made with its beak. Display could have been enhanced by bright colouration or bold patterns. ***Iguanodon*** had good eyesight and, unlike many mammals, probably could see in colour. This suggests movement and colour played an important role in display.

The image above is of a nineteenth-century painting that shows ***Iguanodon*** in a tripod pose as it was believed its posture to be, however, representations published as recently as 1976 still depicted ***Iguanodon*** as upright, dragging its tail behind, as in the above painting and still modelled on the reconstructed skeletons of ***Bernissart***.

All still show the characteristic features of the wide-mouth and five-fingered hand with the thumb-spike. This is shown as very similar to a human hand and was thought to be used in feeding and grasping.



The image above is of a nineteenth-century painting that shows ***Iguanodon*** in a tripod pose as it was believed its posture to be, however, representations published as recently as 1976 still depicted ***Iguanodon*** as upright, dragging its tail behind, as in the above painting and still modelled on the reconstructed skeletons of ***Bernissart***.

All still show the characteristic features of the wide-mouth and five-fingered hand with the thumb-spike. This is shown as very similar to a human hand and was thought to be used in feeding and grasping.

THE BERNISSART *IGUANODON*

By far the most important find for the advanced reconstruction of ***Iguanodon*** was made at Bernissart, in Belgium, in 1878 when coal miners came across what were later found to be the fossilised remains of thirty nine ***Iguanodon***, along with a great cross-section of other Early Cretaceous life.

In 1882, Louis Dollo at the Royal Museum of Natural History in Brussels was given the task of describing the fossil reptiles and he was to devote the rest of his life to this undertaking.

The completeness of the Bernissart ***Iguanodon*** record meant that Dollo and his assistant De-Pauw were able to reconstruct the dinosaur with a great deal more accuracy than any previous attempts. A photograph of Dollo's workroom at this time shows him using the skeletons of a wallaby and an emu to guide his reconstruction of ***Iguanodon***. This final version showed the dinosaur on its hind legs with its massive tail trailing behind.

It was Dollo who was able to conclude firmly that the infamous nose-spike belonged, not to the hind foot as had been suggested latterly by Owen, but to the hand, where it served as a defensive weapon. The pose of the head and neck resulted from Dollo's belief that would reach high up into the trees for food.

THE ORIGIN OF THE NAME “DINOSAUR”

Although ***Iguanodon*** had been named by 1825 the animal's appearance was unknown as only a few teeth and bones had been discovered.

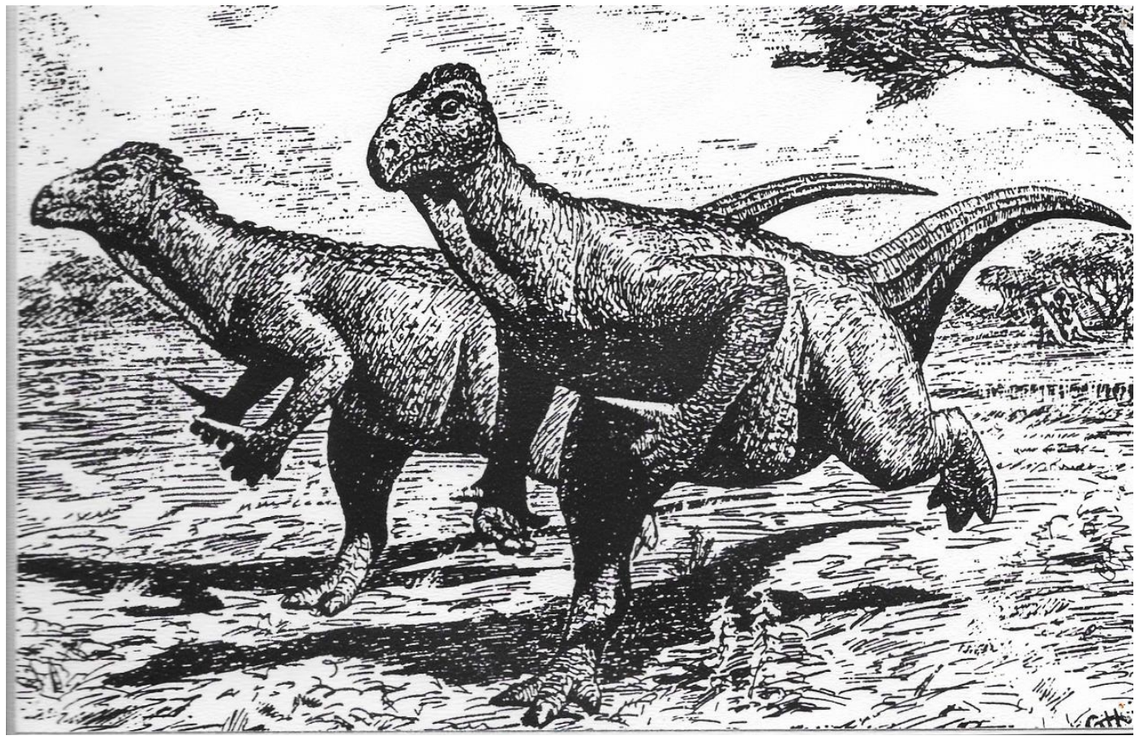
Mantell discovered the remains of another species of large reptile in 1833. It was smaller than iguanodon and had spines on its back. Mantell named it Hylaeosaurus meaning "forest lizard".

In 1834 more bones were discovered at a quarry in Maidstone, Kent. They were bought for Mantel! by some of his friends for the sum of £25.

From studying this new material Mantell, with the help of William Clift, curator of the Hunterian Museum, was able to produce the first reconstruction of ***Iguanodon***.

Sir Richard Owen realized that the fossil reptiles that had been discovered by the Reverend William Buckland and Dr. Gideon Mantell – Megalasaurus, Iguanodon and Hylaeosaurus – were unlike any modern reptiles.

In1841, during a lecture to the British Association, Owen referred to the group of extinct reptiles as Dinosauria, which means “Terrible Lizard” - this was the origin of the word “Dinosaur”.



This drawing by Gerhard Hellmann, of 1916, shows a fast moving, alert and agile interpretation of Louis Dollo’s bipedal reconstruction.

This interpretation gained little credence and, until recently, the genus *Iguanodon* was represented as cumbersome and slow, akin to elephants in many respects.

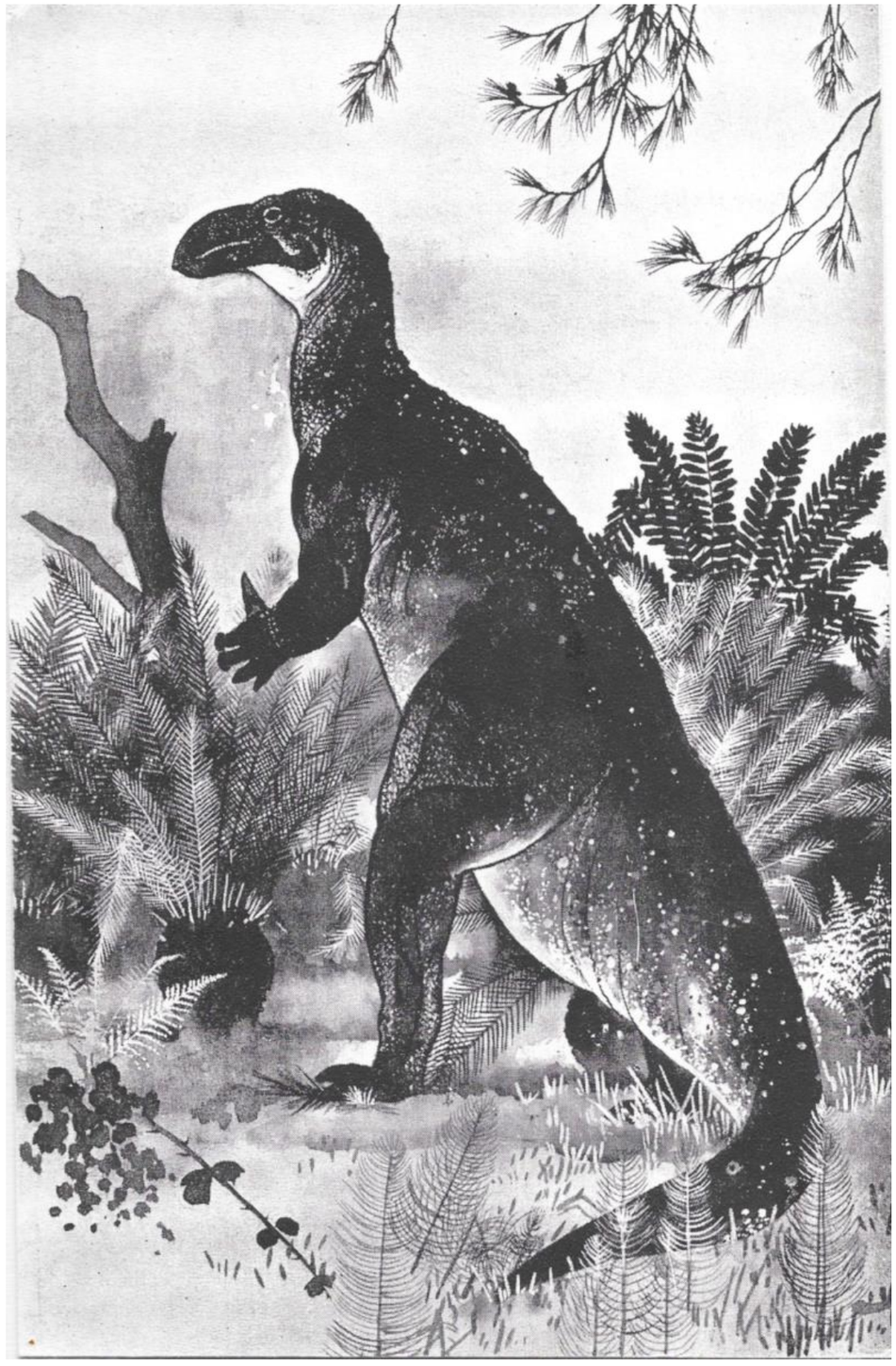
THE CHANGING SHAPE OF IGUANODON

The first attempt at reconstructing the iguanodon was made by Gideon Mantell in this informal sketch of the mid 1830s. It follows the discovery of ***Iguanodon*** teeth by Mary Mantell, in 1822.

The highlighted bones were those Mantell had deciphered from the so-called "Mantell-piece", the ***Iguanodon*** bones found in a slab of rock in Maidstone, in 1834.

His reconstruction most resembles the lizard-like creature that he assumed ***Iguanodon*** to have been - a huge four-legged plant-eating reptile with a horn on its nose, like a rhinoceros.

Later discoveries suggested ***Iguanodon*** may have lived in herds and the nose-horn was actually a huge thumb-spike that may have been used in feeding, or for defence.



SKULL

From ***Iguanodon's*** skull we can find out a lot about its lifestyle.

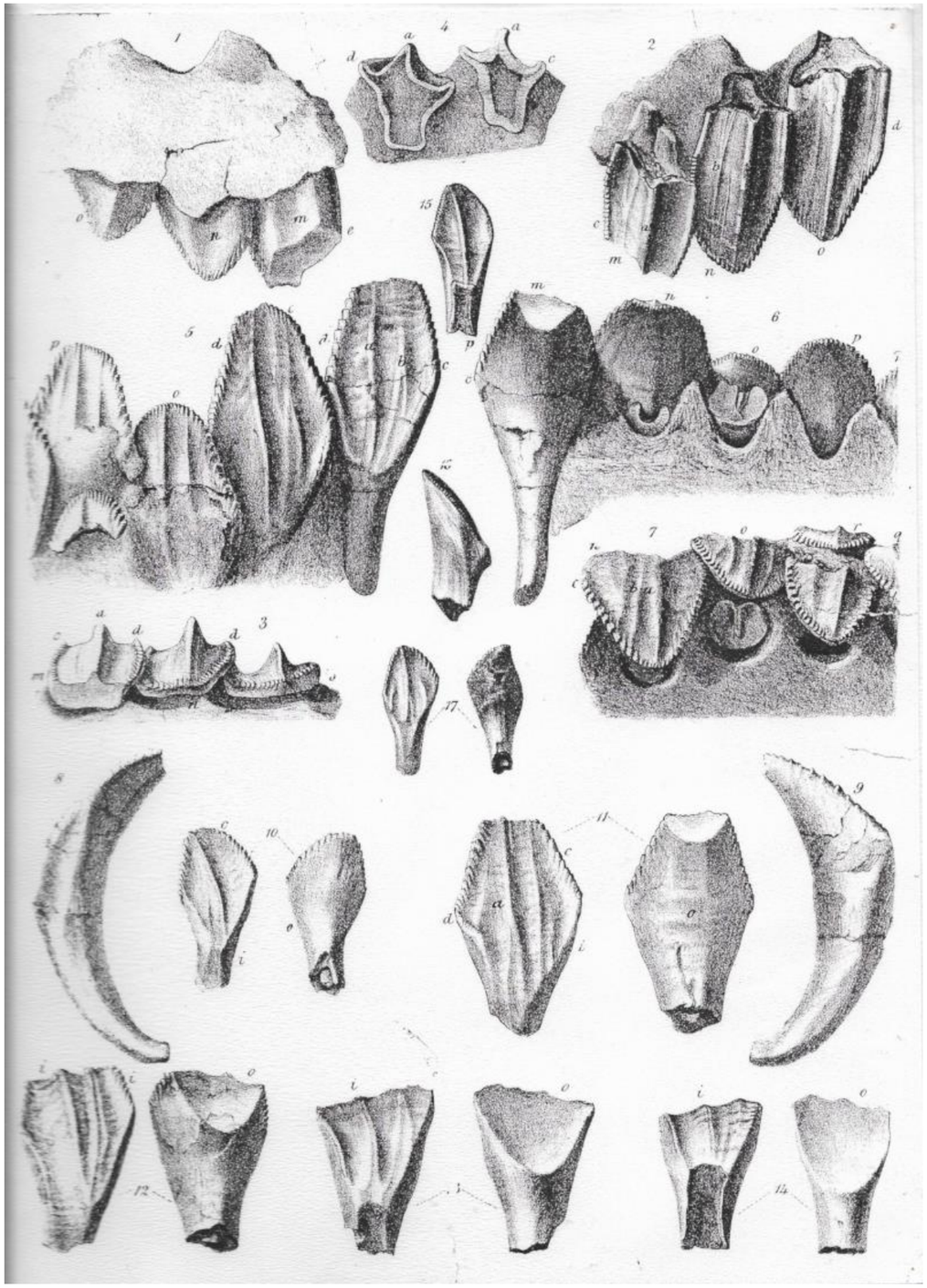
At the front of its mouth was a horny beak which would have been used for biting off tough vegetation such as horsetails and pine needles. The beak would continue growing throughout the animal's life and so would never wear out.

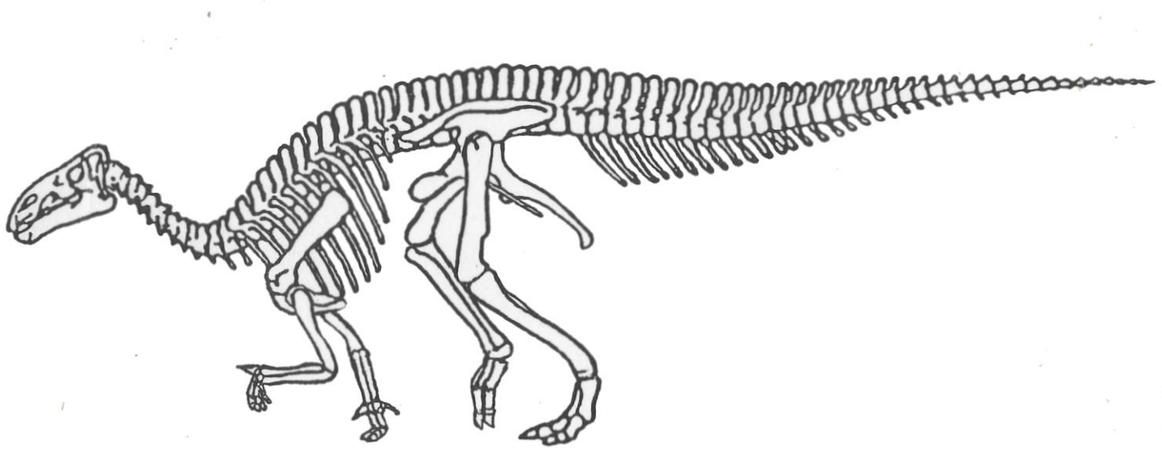
Behind the beak the jaw was lined with teeth, these locked together to form a continuous cutting edge. Iguanodon's teeth were very specialized, the surface was angled and ridged and the leading edge sharp for chopping up plants. When the animal bit, the teeth would meet at a steep angle.

Iguanodon, like most reptiles, could not move its lower jaw from side to side as mammals do, making chewing effectively impossible. However ***Iguanodon*** could chew and it accomplished this by moving its upper jaw. The upper jaw was attached to the rest of the skull by a hinge that allowed it to swing out slightly when the jaw closed, this caused the angled grinding surfaces of the teeth to rub together and produce a chewing action.

The skull also contains information about the animal's brain. Even though the soft tissue does not survive, the cavity that once held the brain does.

From studying casts from this cavity it was revealed that ***Iguanodon*** had a relatively large brain for a reptile and was probably capable of quite sophisticated behaviour as well as having sharp senses. This contradicts preconceived ideas of dinosaurs being stupid and clumsy.





TWO LEGS OR FOUR?

Iguanodon was a biped - that is to say it walked on its hind legs. However it could also walk in a quadrupedal or four footed way. The structure of the hands and the strength of its arms show that they could be used as front legs.

The smaller species of ***Iguanodon,*** and the young of the larger species, probably acted as bipeds most of the time, going down on all fours only when grazing on low growing plants or resting.

The larger iguanodon may have been quadrupedal most of the time as this would help to support their greater weight.

Iguanodon bernissartensis is the largest known species. Its front legs continued to grow as it aged giving it the proportions of a quadruped when mature. When young it was probably a swift biped but became quadrupedal when fully grown.

DIET

Iguanodon was a plant eating dinosaur with an efficient combination of beak and grinding teeth to process vegetations. Many of the fossilized ***Iguanodon*** teeth that have been found are quite worn showing that the plants it ate were tough. ***Iguanodon*** had over 100 teeth and they were continuously replaced as they wore down. Another clue to ***Iguanodon's*** diet comes from the fossilized stomach of the hadrosaur, ***Anatosaurus***, which included the remains of pine needles and other woodland plants.

The tough horsetails, that grew abundantly 130 million years ago, probably made up a large part of ***Iguanodon's*** diet.

EGGS, NESTS AND BABIES

No ***Iguanodon*** eggs have ever been found.

Some dinosaurs had sophisticated nesting habits. ***Maiasaura***, "good mother lizard", a hadrosaur of the Upper Cretaceous, nested in colonies in a similar way to some sea turtles, iguanas and birds. The spacing between the nests was approximately the length of an adult dinosaur.

Clutches of about 25 eggs were laid although only about 15 would survive.

The young were not fully developed and about the size of a cat when hatched. They stayed in the nest until they had trebled in size.

During this period they were looked after and fed by an adult.

No other reptile takes so much care of its young.

HOW FAST?

It has been estimated that ***Iguanodon*** could have run at about 35 km/h (22 m.p.h.) when fully grown. Smaller species or young ones may have been even faster.

Most of the fossil trackways, in the Bexhill area, are from ***Iguanodon*** that were walking slowly. Speed would have been used to escape from carnivorous dinosaurs such as Megalosaurus.

SELF DEFENCE

Iguanodon was not defenceless. Its thumb-spikes were dangerous weapons and it also had a powerful beak to bite with, strong hind legs to kick with and a large tail to batter its attackers.

Fighting may well have taken place between rival ***Iguanodon*** when competing for resources.

SWIMMING

Iguanodon could certainly paddle as its fossilized footprints have been found associated with shells that would have been living in shallow freshwater conditions. Most animals can swim for short distances and there is no reason to think ***Iguanodon*** was an exception.

Its powerful hind legs and broad tail could have been used to propel it through the water.

FLOCKS OF IGUANODON

It is quite difficult to prove social behaviour in animals known only from their fossil remains.

Dinosaur footprints provide valuable information that cannot be found from bones alone. In 1926, a trackway of ***Iguanodontid*** footprints was discovered at Bulverhythe. There were a large set of prints and a small set to the side. This could be interpreted as a young animal following an adult.

Footprint evidence, from other parts of the world, suggests many ornithopod dinosaurs such as ***Iguanodon*** travelled in small groups.

In Western Montana, in the U.S.A., a deposit of fossilized bones of the 7 metres-long, ornithopod dinosaur ***Maiasaura*** was found. It was estimated that there were up to 10,000 individuals in the bone-bed.

One possible explanation is that a migrating herd of Maiasaura was killed by poisonous gases from a nearby volcano.

There is very little direct evidence for social behaviour in ***Iguanodon*** although it could be inferred from the study of similar types of dinosaur that they may have lived in herds or flocks and perhaps even migrated.

HOW DO FOSSIL FOOTPRINTS FORM?

Fossils are rare and fossil footprints are even rarer. Footprints do not usually survive very long, other animals walk over them or water washes them away. For a footprint to survive 130 million years something unusual must happen.

The footprint must be quickly filled in by sediment such as sand or mud to prevent it being destroyed. If sediment continues to build up on top they will be compressed and may, over millions of years, turn to stone.

The fossil footprints that are found on the beach are either moulds or casts. Locally the moulds tend to be in clay deposit and the casts in sandstone. Moulds look like the original footprint; they are depressions in the rock.

Casts are where sediment has filled the footprint and it is the infill that survives.

Casts stick out of the rock surface instead of being a depression, giving the same effect as making a cast of a modern footprint using plaster.

The difference in hardness of the rock determines whether it is the mould or cast which survives.

THE HISTORY OF FOSSIL FOOTPRINTS

The first fossil footprints of vertebrates were discovered in 1802, in Massachusetts, by a boy called Pliny Moody. An account of these was published in 1836 by Professor Edward Hitchcock who named them ***ornithichnites*** “bird footprints”.

In 1846 The Reverend Edward Tagart reported fossil footprints near Hastings and presented a specimen to the Geological Society of London. In the letter he sent them it was mentioned that “Dr. Harwood suspects them to be the footmarks of the Iguanodon.”

In 1850 the casts and impressions of “Reptilian footprints” was noted at Bexhill by Frederick Dixon in his "Geology of Sussex".

Samuel Beckles described fossil footprints near Hastings in 1851, St. Leonards in 1852, Bexhill in 1854 and the Isle of Wight in 1862. Members of the Geological Association visited "iguanodon footprints" at Hastings in 1862.

Also, in 1862, a paper was published by Alfred Taylor that suggested that Rev. Tagart’s fossil footprints were indeed made by iguanodon. In that same year new discoveries of footprints at Hastings prompted T. Rupert Jones to write that they too were probably made by iguanodon.

On the right are diagrams of fossil dinosaur footprints from Fairlight Cove. (With permission from Ken Woodhams and John Hines)

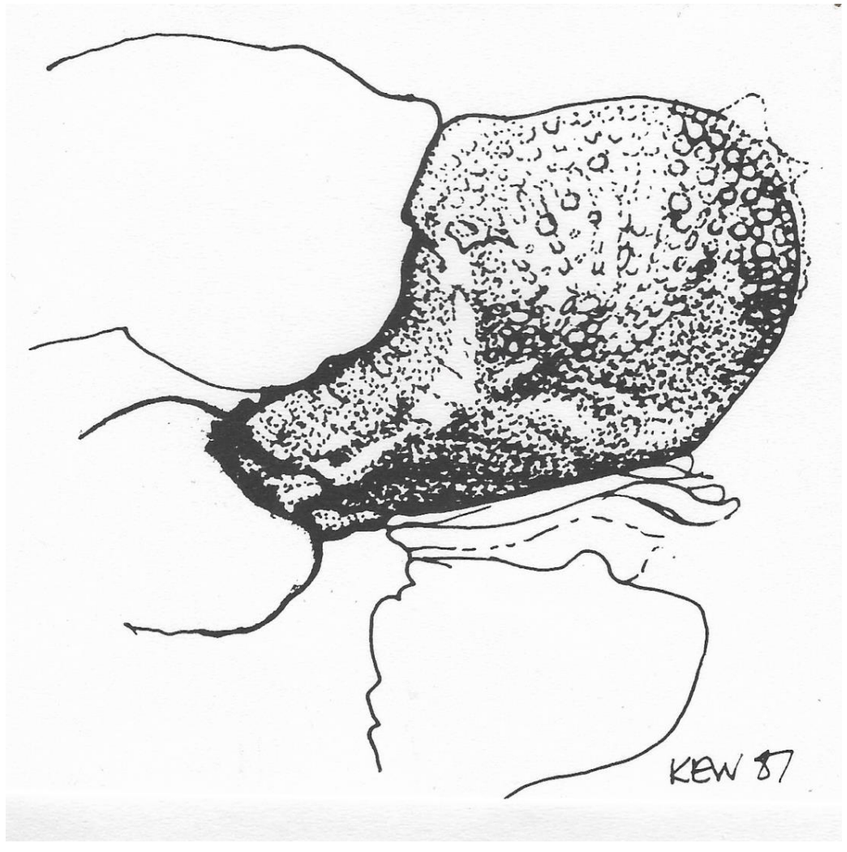
Type 1-3 Iguanadont

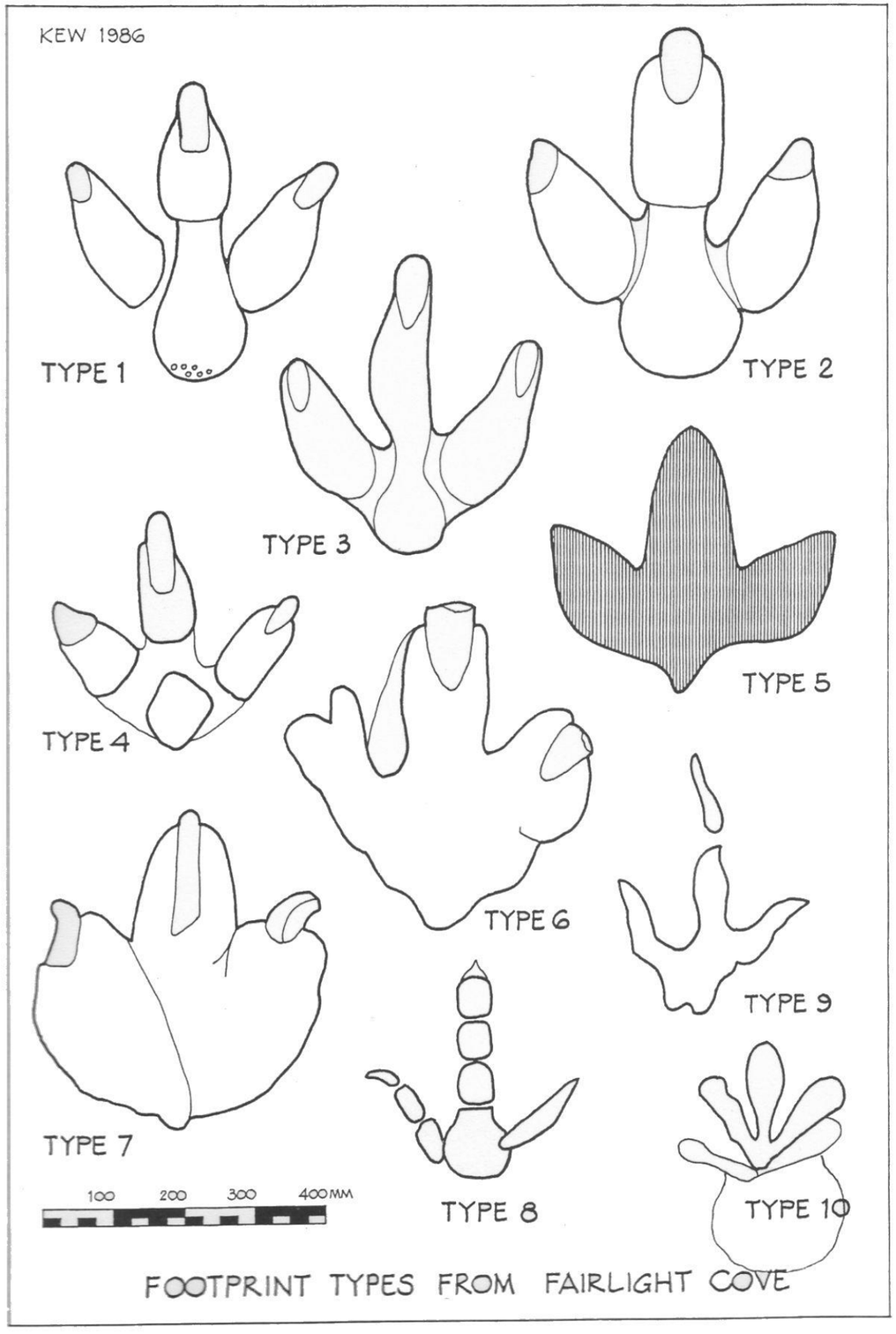
Type 4 Unidentified ornithopod

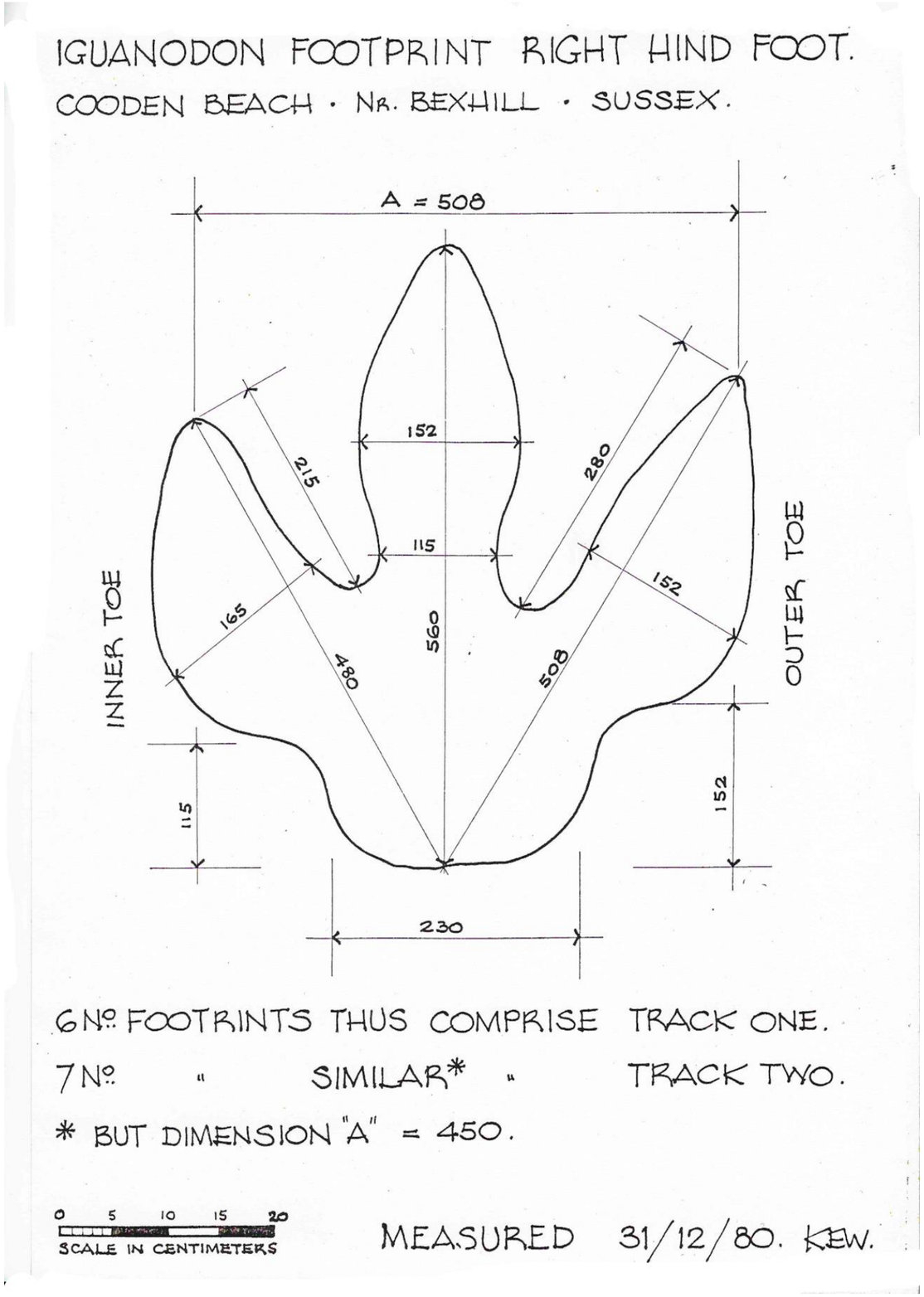
Type 5-7 *Carnosaurs* (Large Theropods)

Type 8-9 Small Theropods

Type 10 Unidentified quadruped







IGUANODONTID FOOTPRINTS

Most of the fossil footprints found in this area are ***Iguanodontid***, which means they were made by an animal very much like ***Iguanodon***

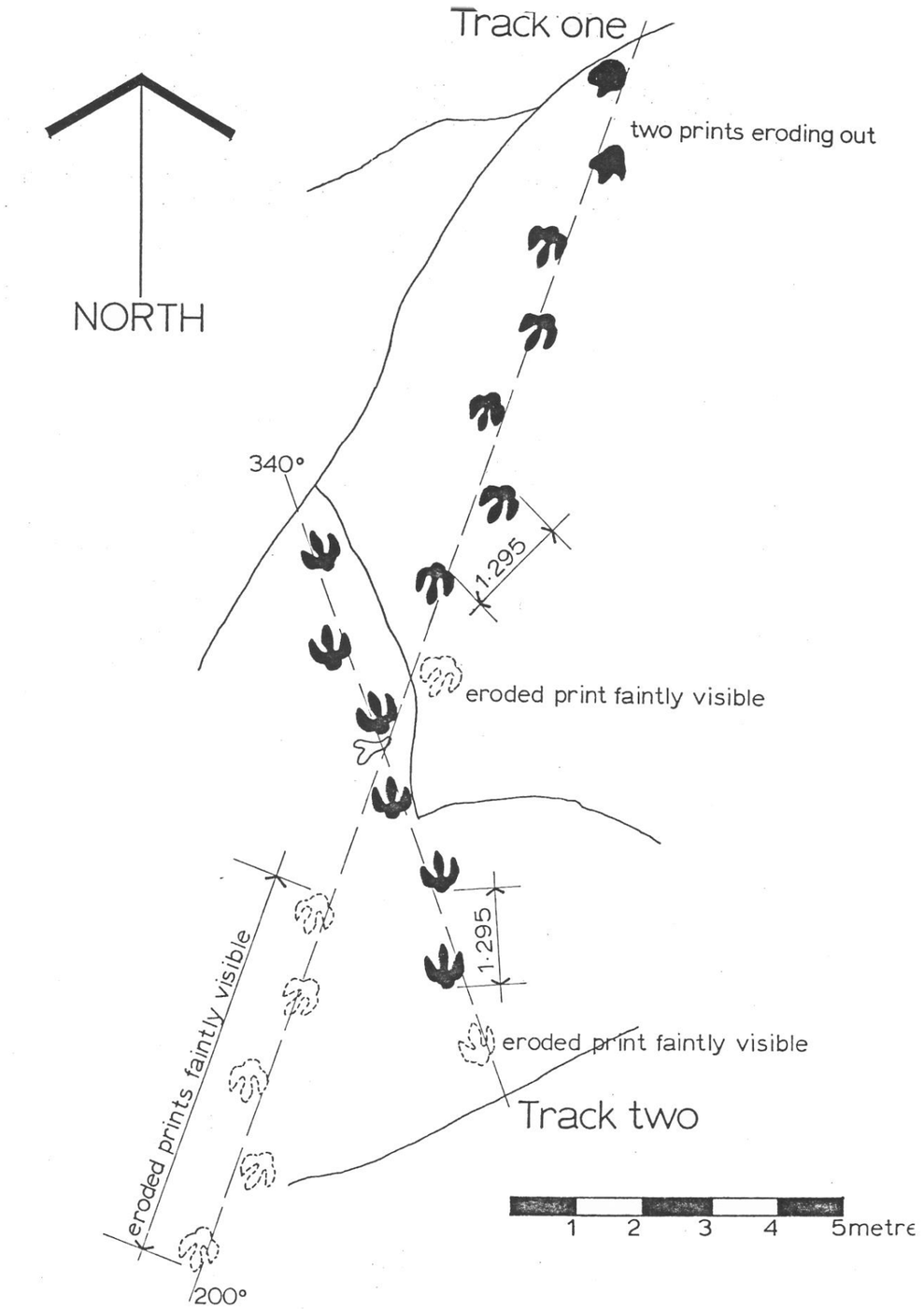
Most were probably made by ***Iguanodon*** but it is impossible to be certain as we only have the animal's toe bones to work from – we don't have the fleshy foot and many of the footprints that we have are imperfectly preserved.

THEROPOD FOOTPRINTS

These are less common than ***Iguanodontid*** foot-prints.

Theropods are flesh eating dinosaurs such as ***Megalosaurus*** and *Allosaurus*.

Only a few theropod bones and footprints have been found in this area which suggests there were fewer of them than ***Iguanodon.***

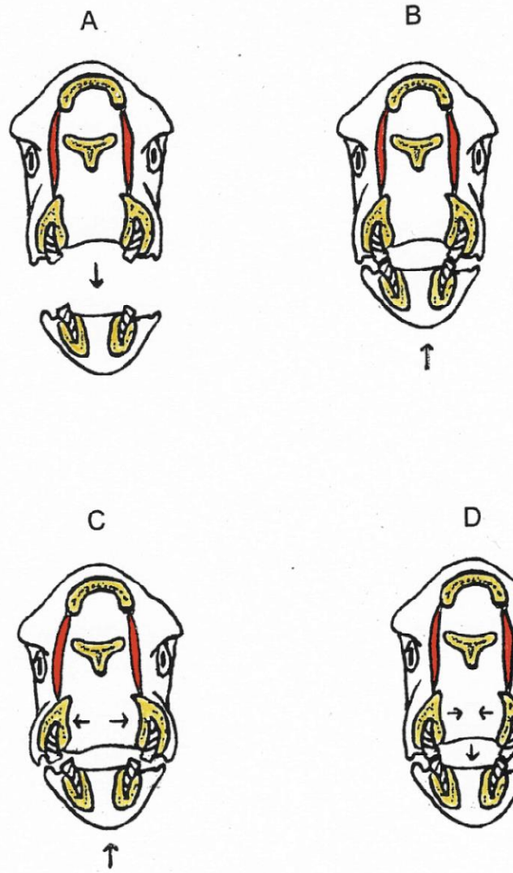


MULTIPLE TRACKWAY · COODEN · SUSSEX

All dimensions in metres

kew / jsh 1981

Iguanodon chewing



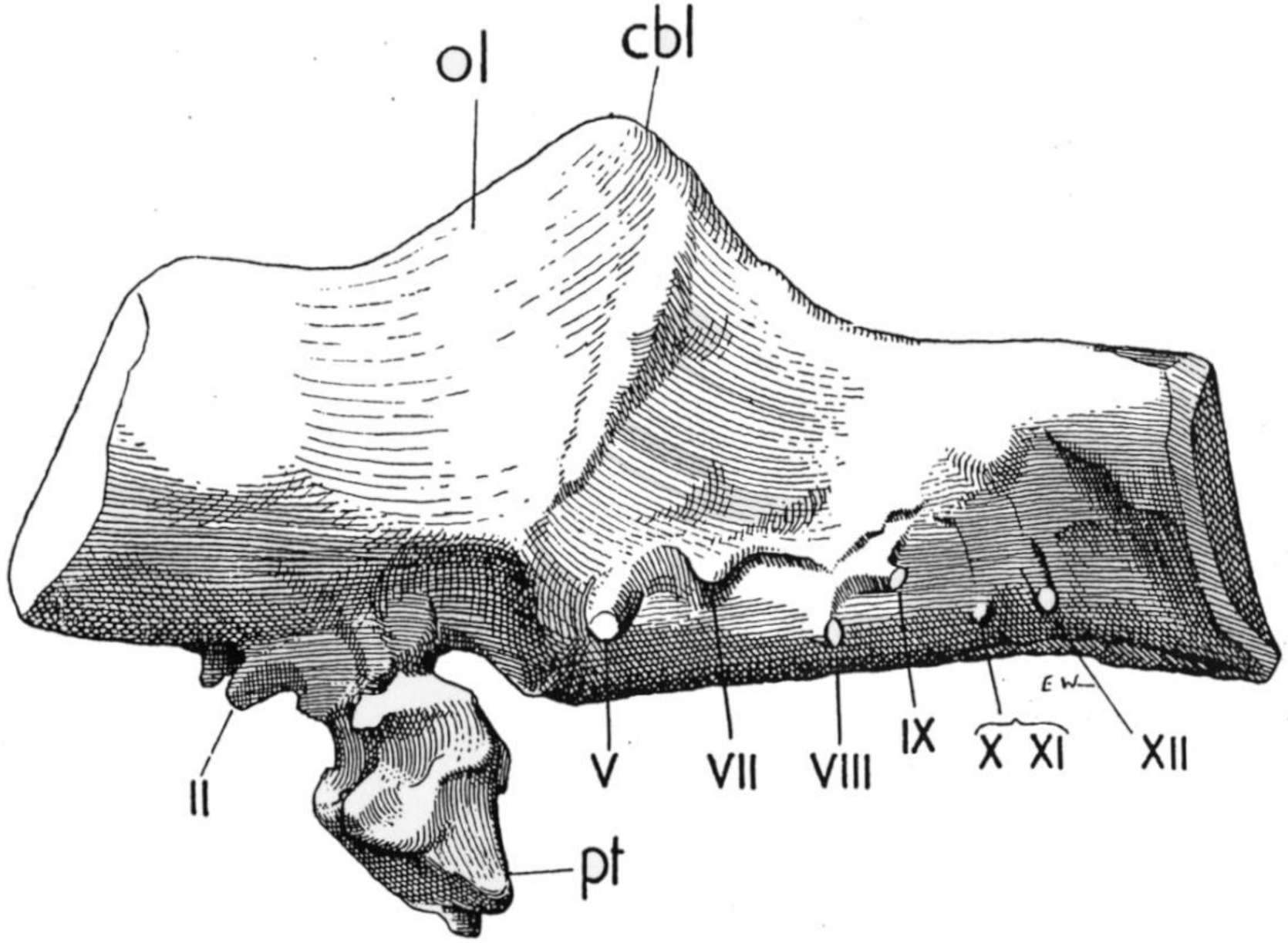
The diagram shows a cross section through Iguanodon's skull, the bone is coloured yellow and the muscles red.

A. Iguanodon opens its mouth.

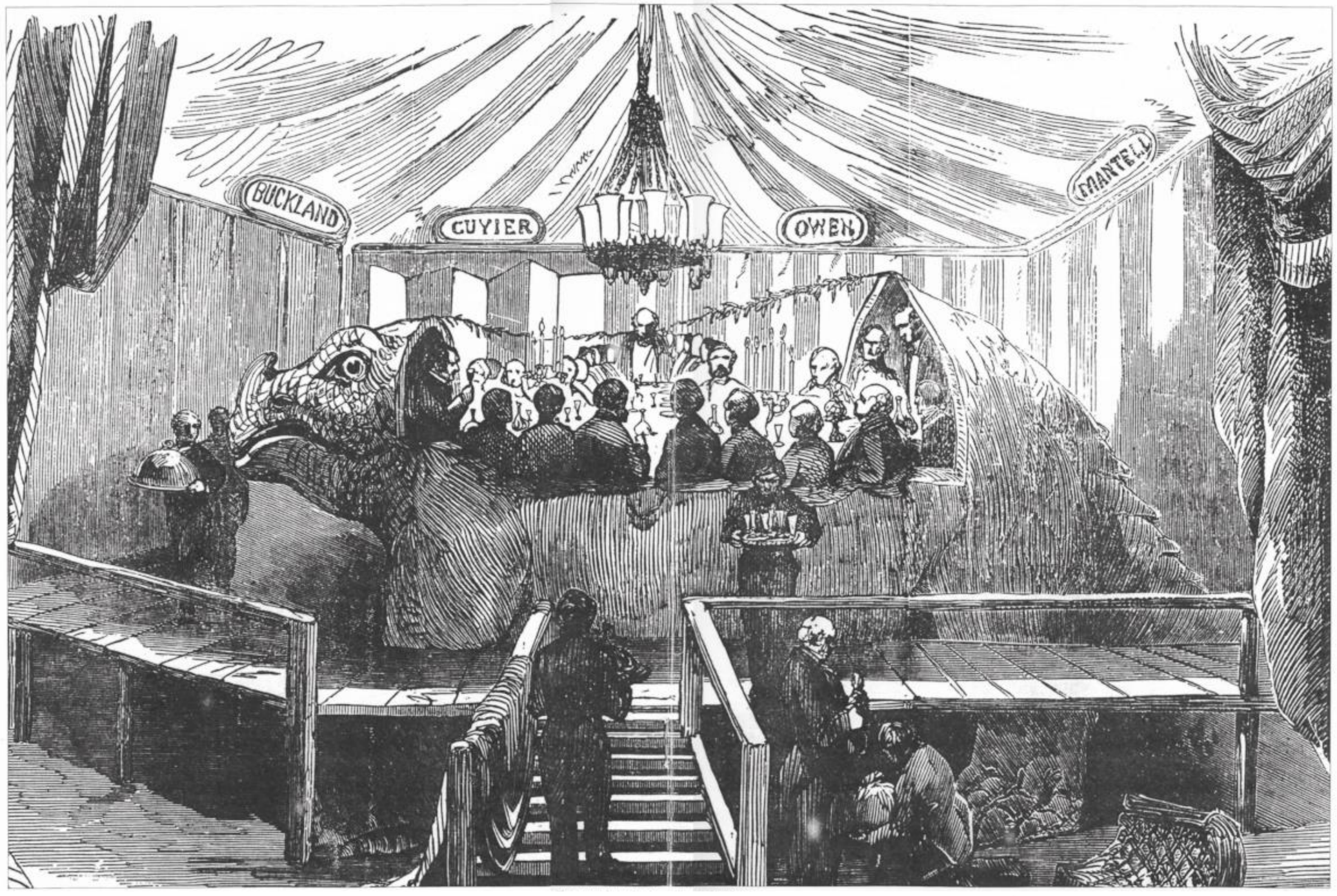
B. It bites bringing its teeth together at an angle.

C. The upper jaw flexes out slightly allowing the teeth to rub together.

D. The mouth begins to open again and the jaw moves back to its original position.



Brain cast of *Iguanodon*. cbl, cerebellum; ol, optic lobes; pt, pituitary; II–XII, cranial nerves. natural size.



On New Year's Eve, 1853, Owens and Hawkins hosted a dinner party, inside the mould used for the ***Iguanodon*** model.

CRYSTAL PALACE PARK

The making of the monsters by Benjamin Waterhouse Hawkins

The Crystal Palace, centrepiece of Britain’s Great Exhibition of 1851, was moved to a permanent site in Sydenham.

Albert, the Prince Consort, who regularly attended meetings of scientific societies in London, wanted the grounds to be landscaped and to contain models of prehistoric animals.

Benjamin Waterhouse Hawkins, sculptor and artist with an interest in naturalist subjects, was given the task of reconstructing the dinosaurs.

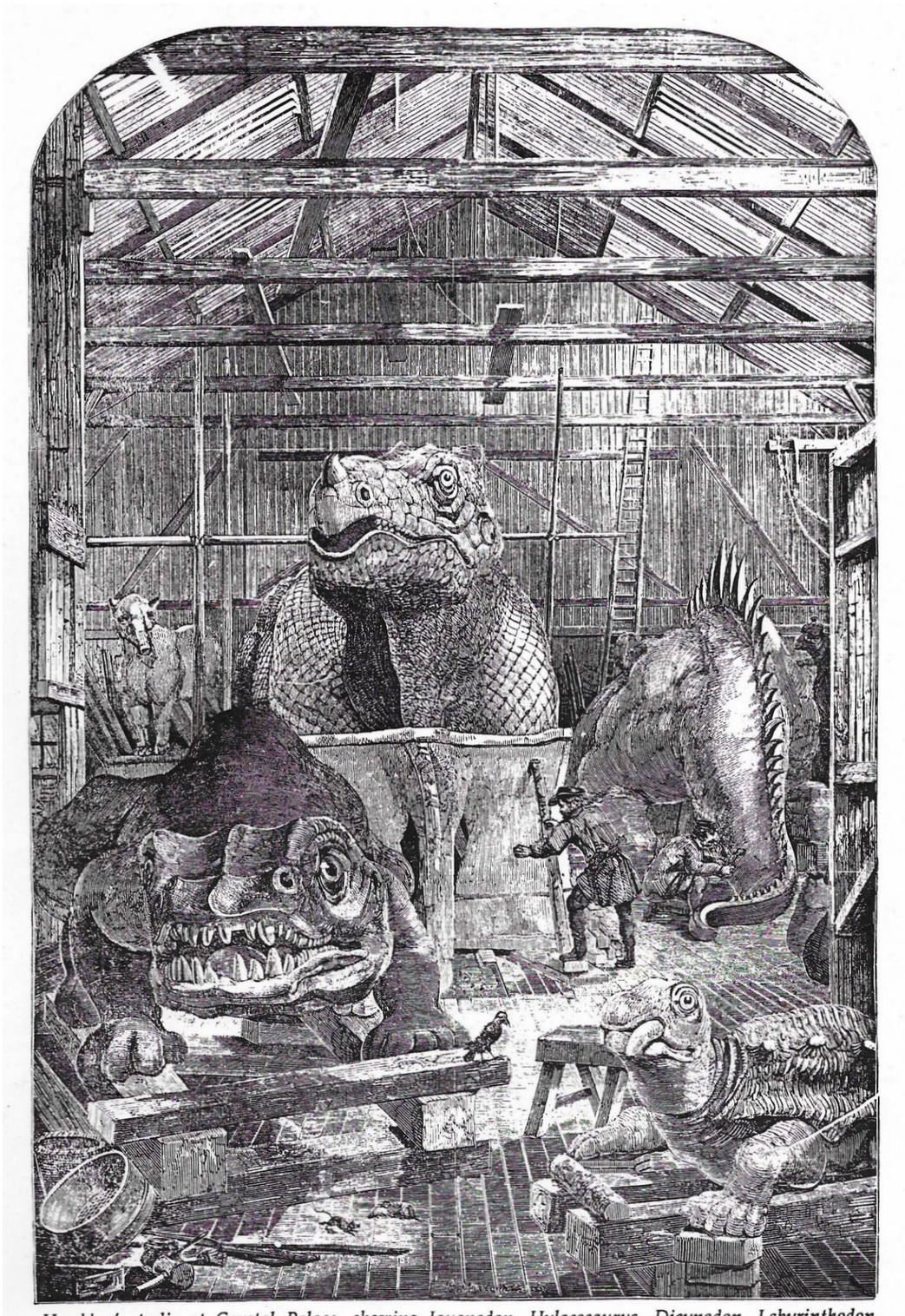
Professor Owen was appointed Hawkins' scientific advisor.

Miniature models were constructed first and, when all agreed that the details were correct, life-sized models were built in Hawkins' workshop.

When ready ready, these models were moved to Crystal Palace Park.

On New Year's Eve, 1853, before the models made their journey to the park, Owens and Hawkins hosted a dinner party consisting of twenty-one scientists and local dignitaries.

The event gained much publicity as the banquet was held inside the mould of the model of ***Iguanadon***. [See previous page]



Hawkins' studio at Crystal Palace, showing Iguanodon, Hylaeosaurus, Dicynodon, Labyrinthodon and Palaeotherium. The figure standing in the centre is usually assumed to be Hawkins himself.

T. XI.

Fig. 2.

a

b

Fig. 5.

Fig. 6.

Fig. 8.

Fig. 10.

Fig. 7.

Fig. 9.

Fig. 12.

Fig. 3.

Fig. 4.

Fig. 11

b

c

Fig. 1.

Fig. 2.

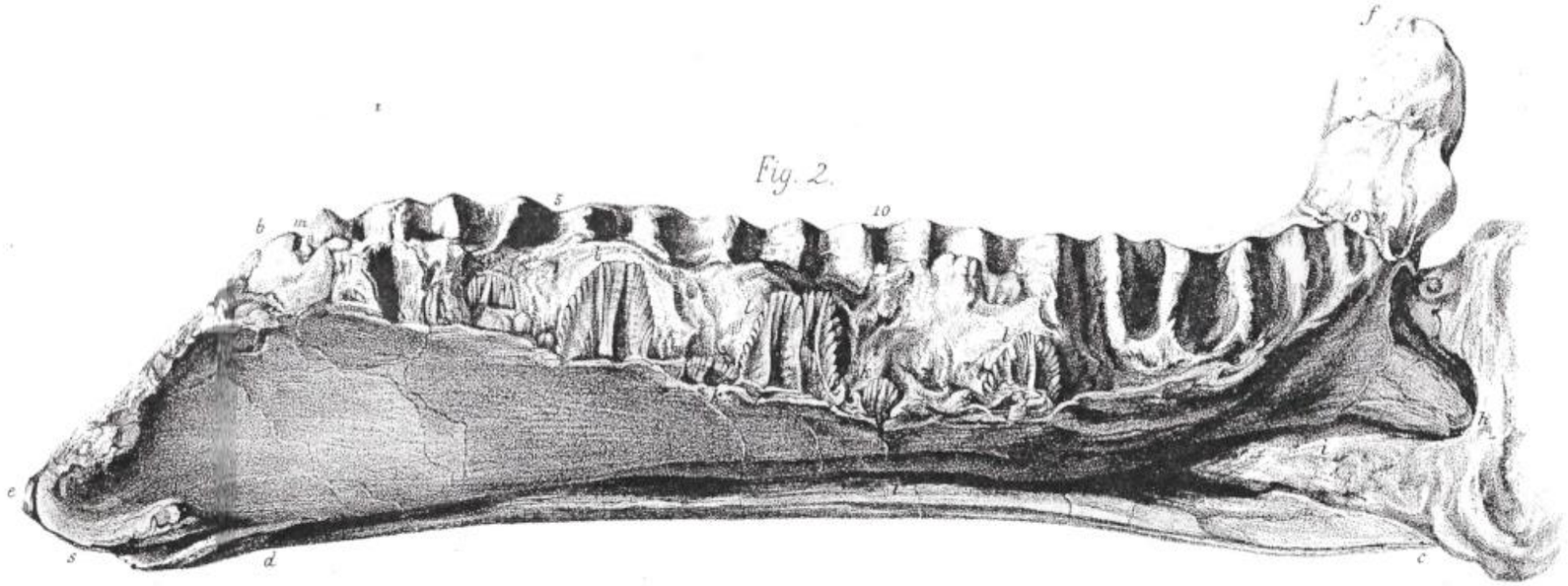
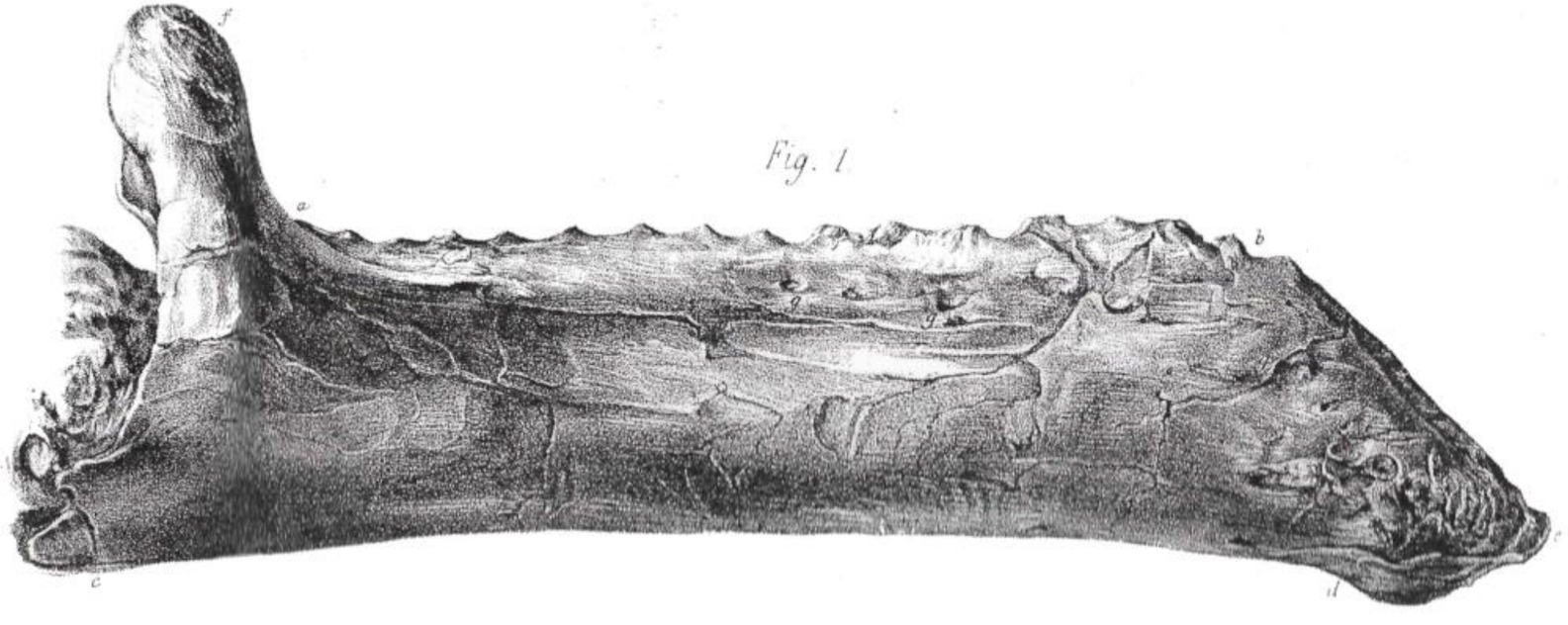


Fig. 1



T. XX.

Drawn from Nature by Miss Holmes. on Stone by J. Erxleben.

Day & Son Lith^rs to The Queen.

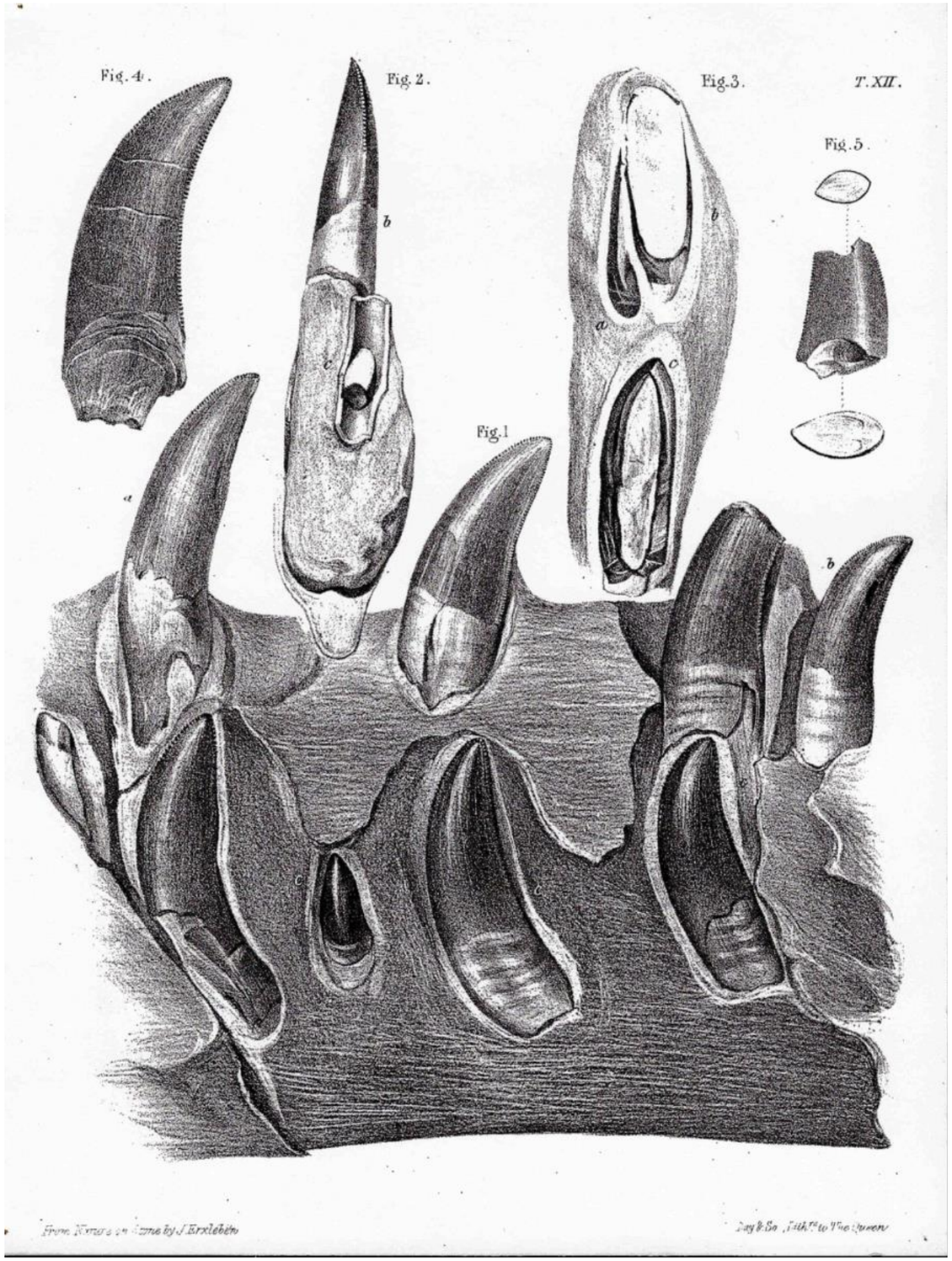
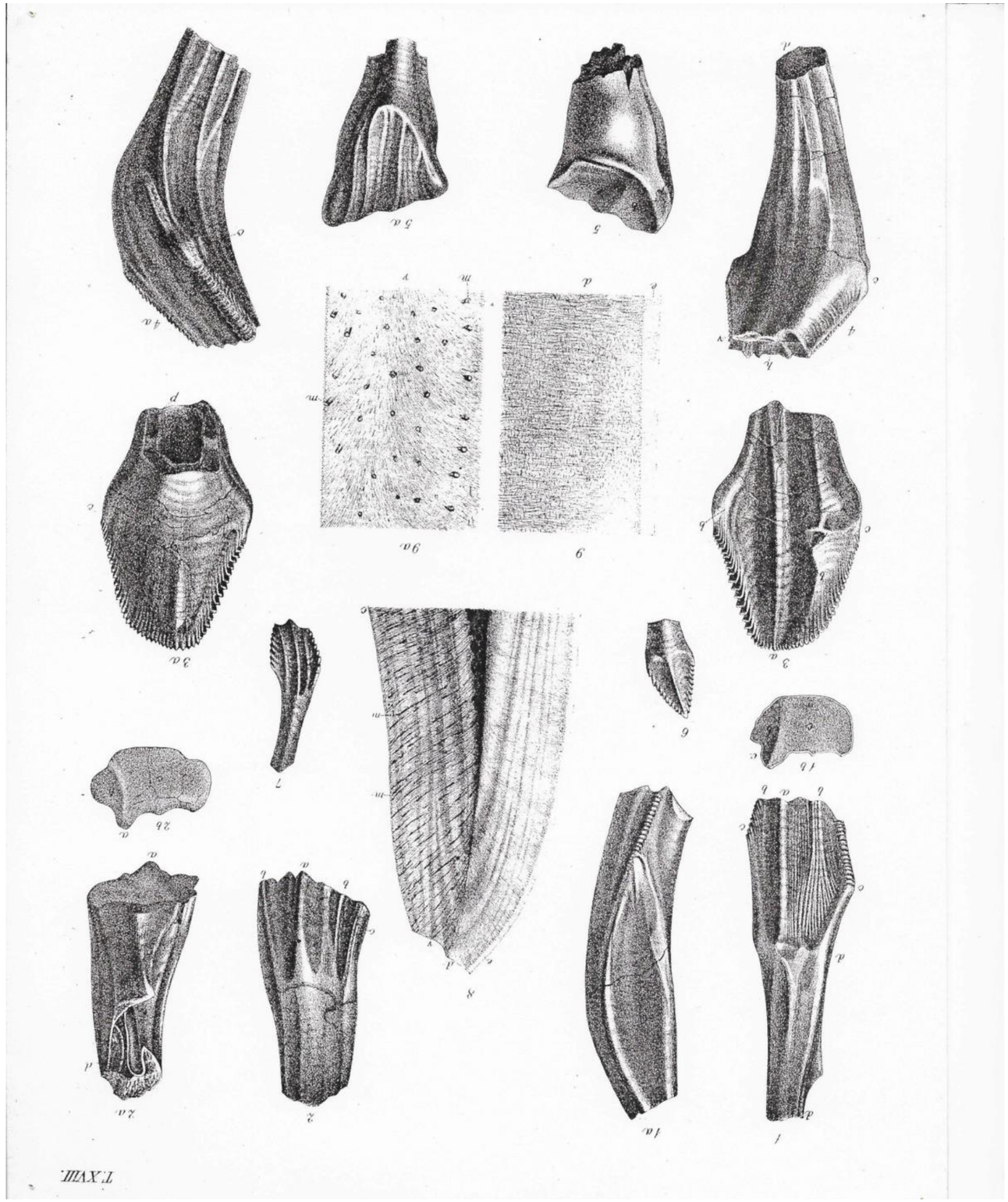
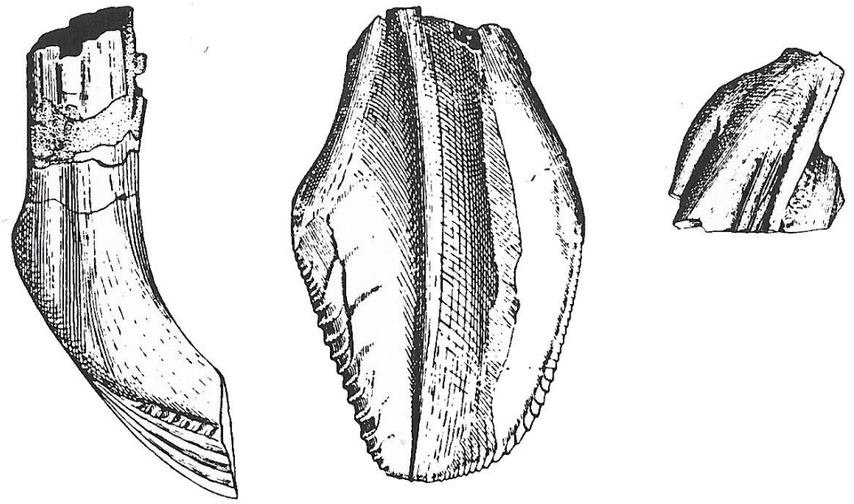


Fig. 4.
Fig. 2.
Fig. 3.
T. XII.
Fig. 5.
Fig. 1
a
b
c
b
a
c
b
c
c
From Nature & on Stone by J. Erxleben
Day & So. Lith.rs to The Queen



T. XVIII.

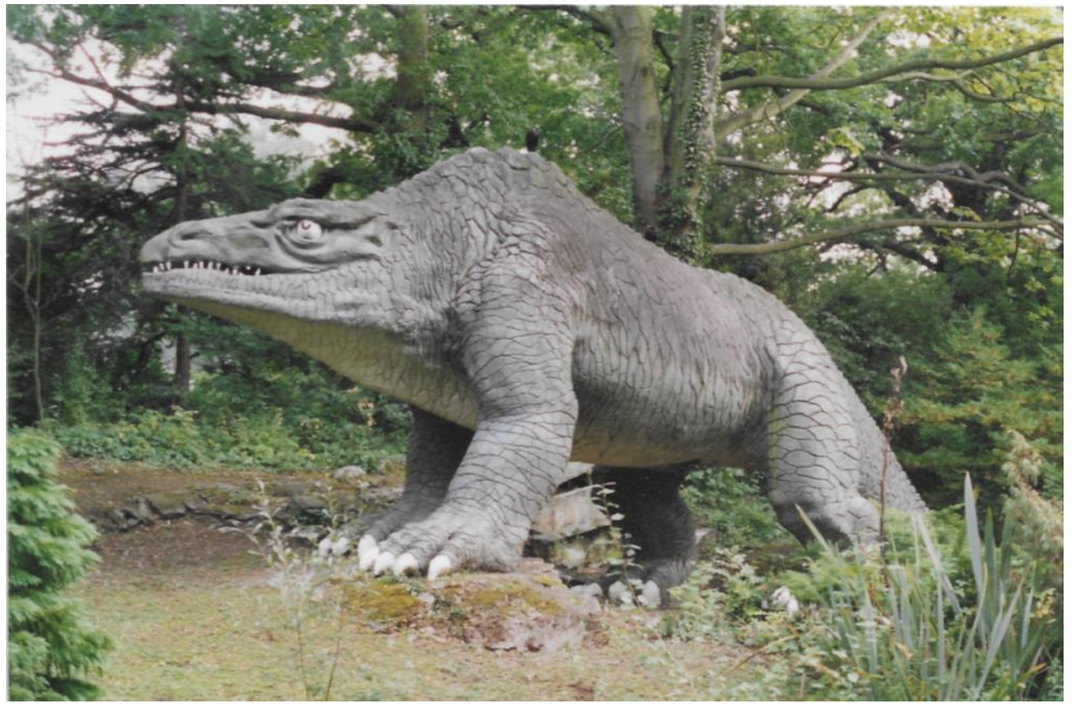


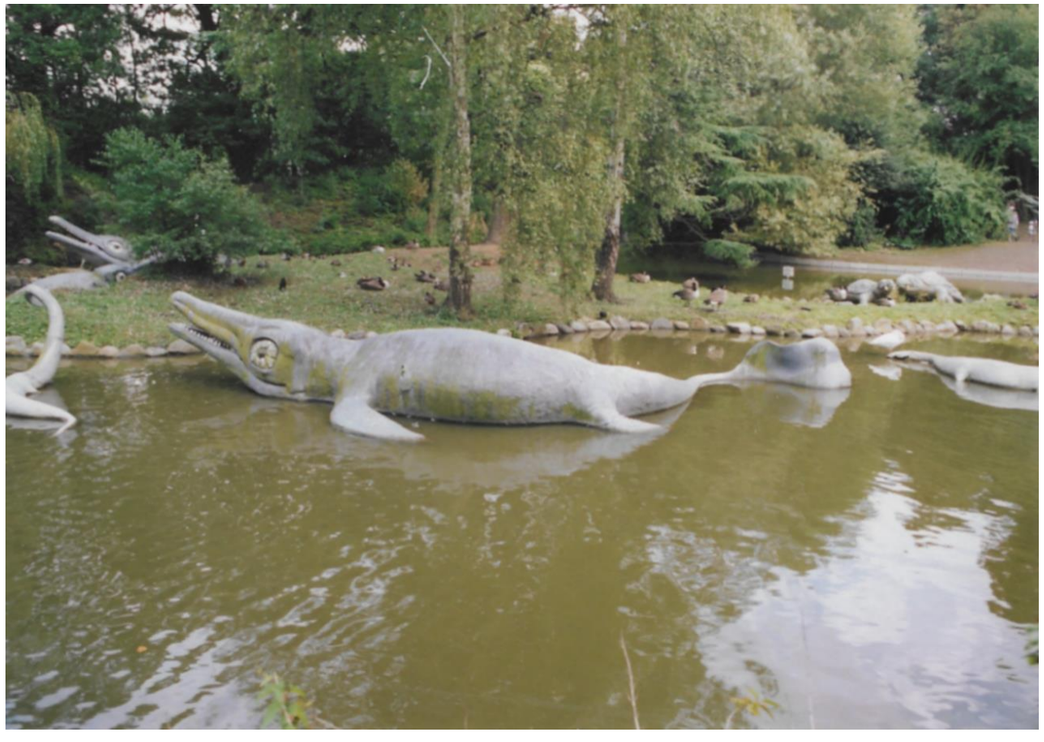
The Model Dinosaurs at Crystal Palace

Richard Owen, the celebrated comparative anatomist, worked with the same material to put forward his far-reaching theories on dinosaurs and the question of evolution in the 1890s.

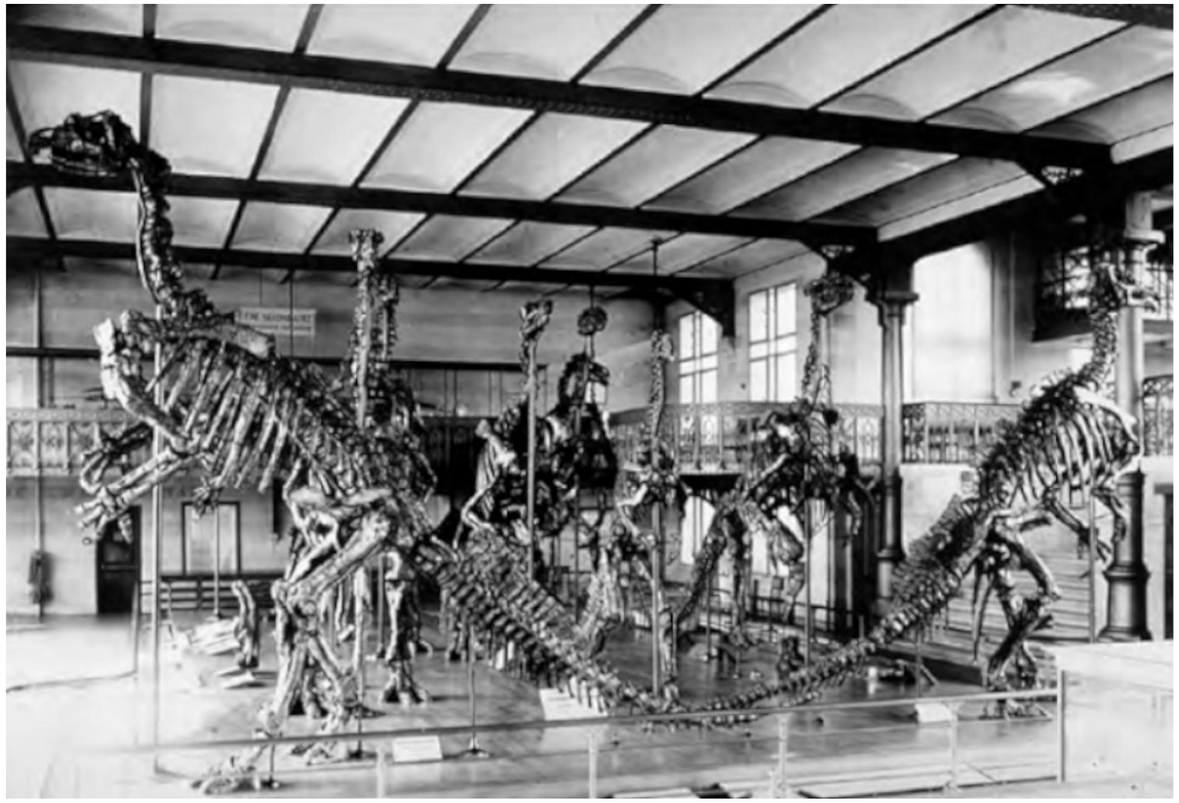
His work with Benjamin Waterhouse Hawkins to produce the full-scale concrete models at Crystal Palace has provided a long-lasting memorial to the early reconstruction of ***Iguanodon***. They show heavy, quadripedal, lizard-like creatures with wide mouths and, of course, the nose spike.

These can still be seen, to-day, in Crystal Palace Park, in the London borough of Bromley.



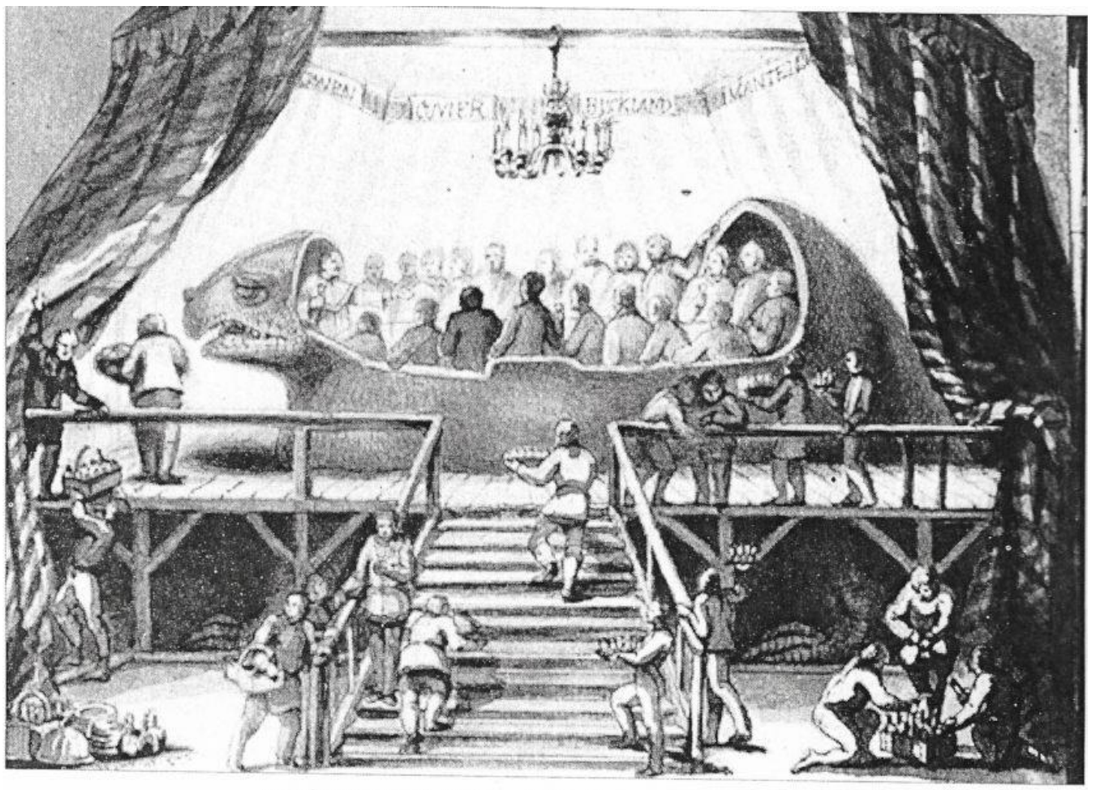


Mounting of the first complete Iguanodon specimen in the St. George's Chapel by Louis Dollo, of the ***Musée Royal d'Histoire Naturelle de Belgique*** (***Belgium Royal Museum of Natural History)***, in Brussels).



The Bernissart ***Iguanodons***, mounted in the ***Musée Royal d'Histoire Naturelle de Belgique,*** (the ***Belgium Royal Museum of Natural History)***, in Brussels in the early 1930s.

Benjamin Waterhouse Hawkins and his own depiction of the dinner.



Hawkins' own depiction of the dinner, painted in 1872.

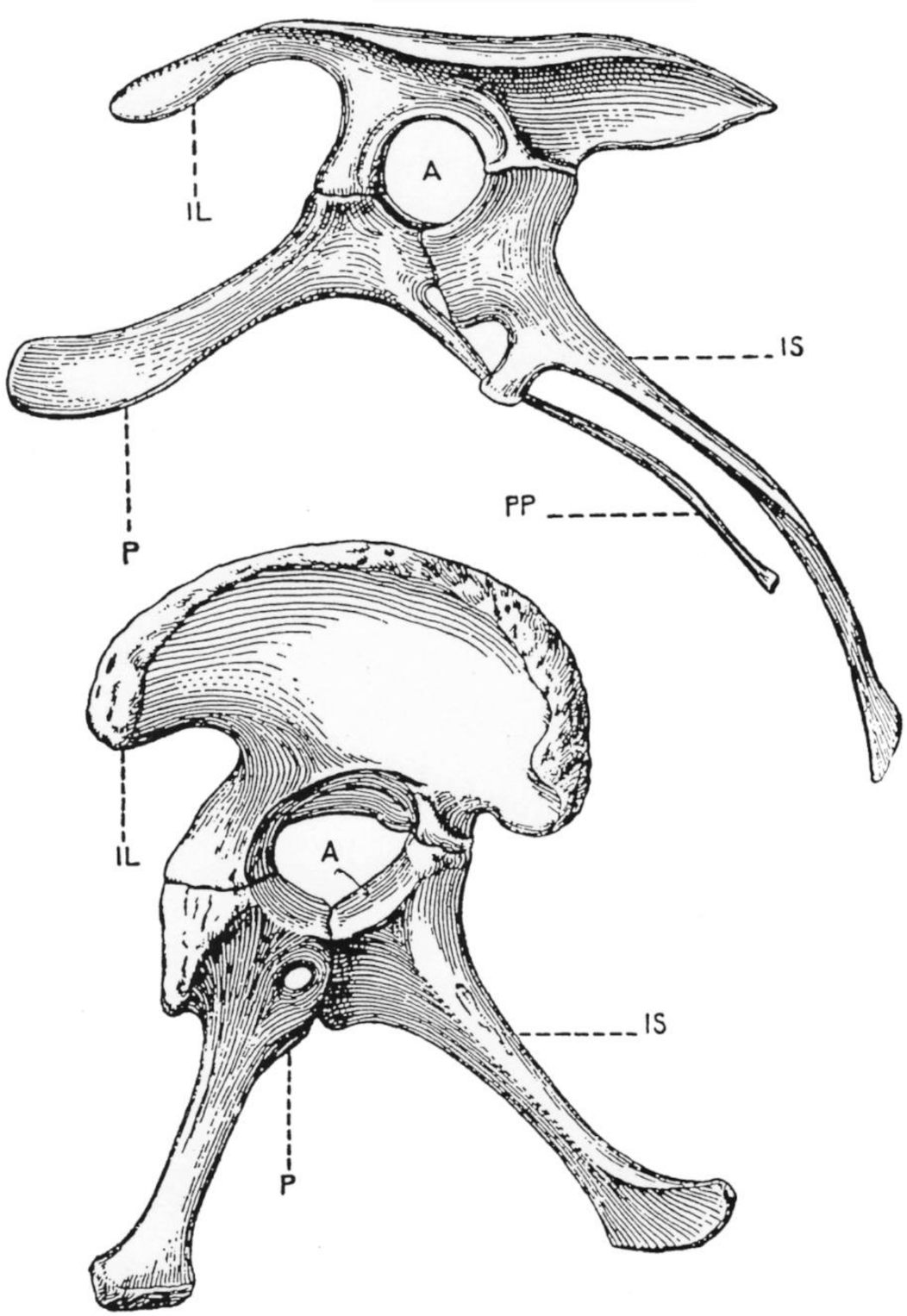
THOMAS HENRY HUXLEY 1825-1895

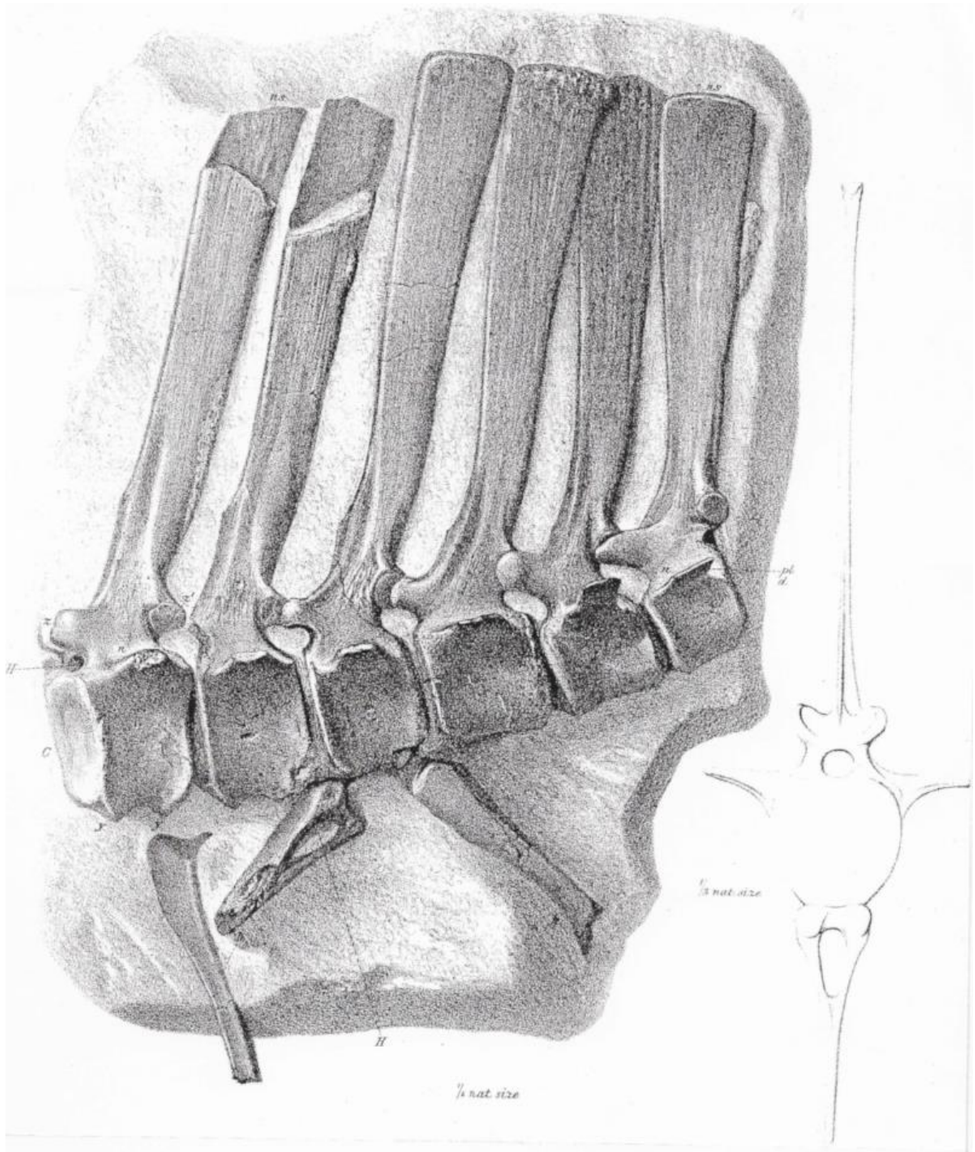
Thomas Huxley was born at Ealing on 4th May, 1825. He studied medicine in the Medical School at Charing Cross Hospital.

In 1846 he entered the medical service in the Royal Navy. During the course of his duty surveying the coastline he became interested in marine animals and was author of many papers on the subject.

In 1851 Mr. Huxley was elected member of the Royal Society and was soon presented with one of the Society's medals.

In the 1870s Mr. Huxley's interest in evolutionary biology and palaeontology enabled him to demonstrate the similarity between dinosaurs and birds in the construction of the hip bones and hind legs.

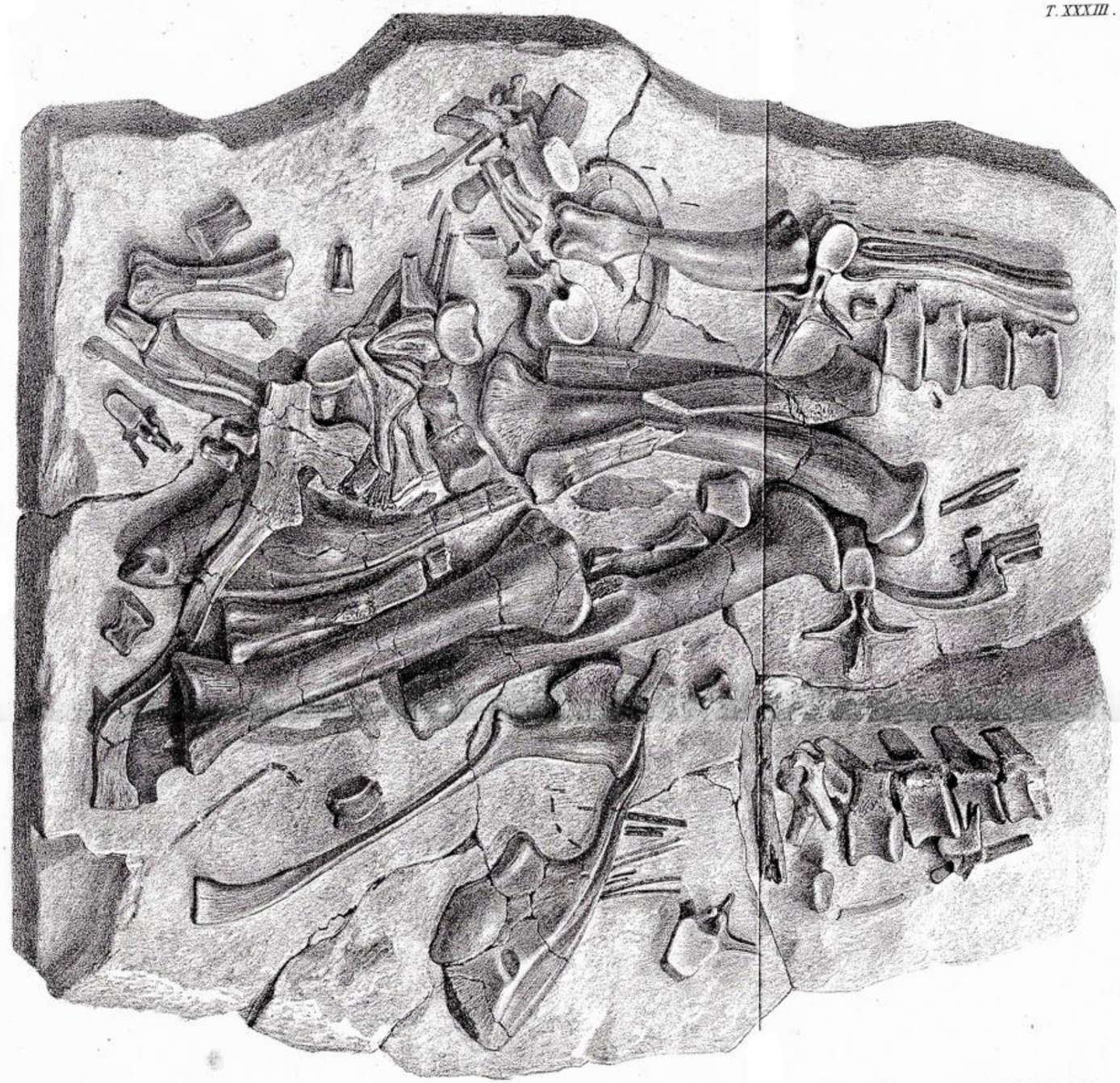




TAB VIII

Six consecutive vertebrae from the fore part of the tail of the Iguanodon Mantelli (one third natural size). An outline of a front view of the first of these vertebra, restored and joined. *From the Wealden at Cuckfield, Sussex – In the British Museum.*

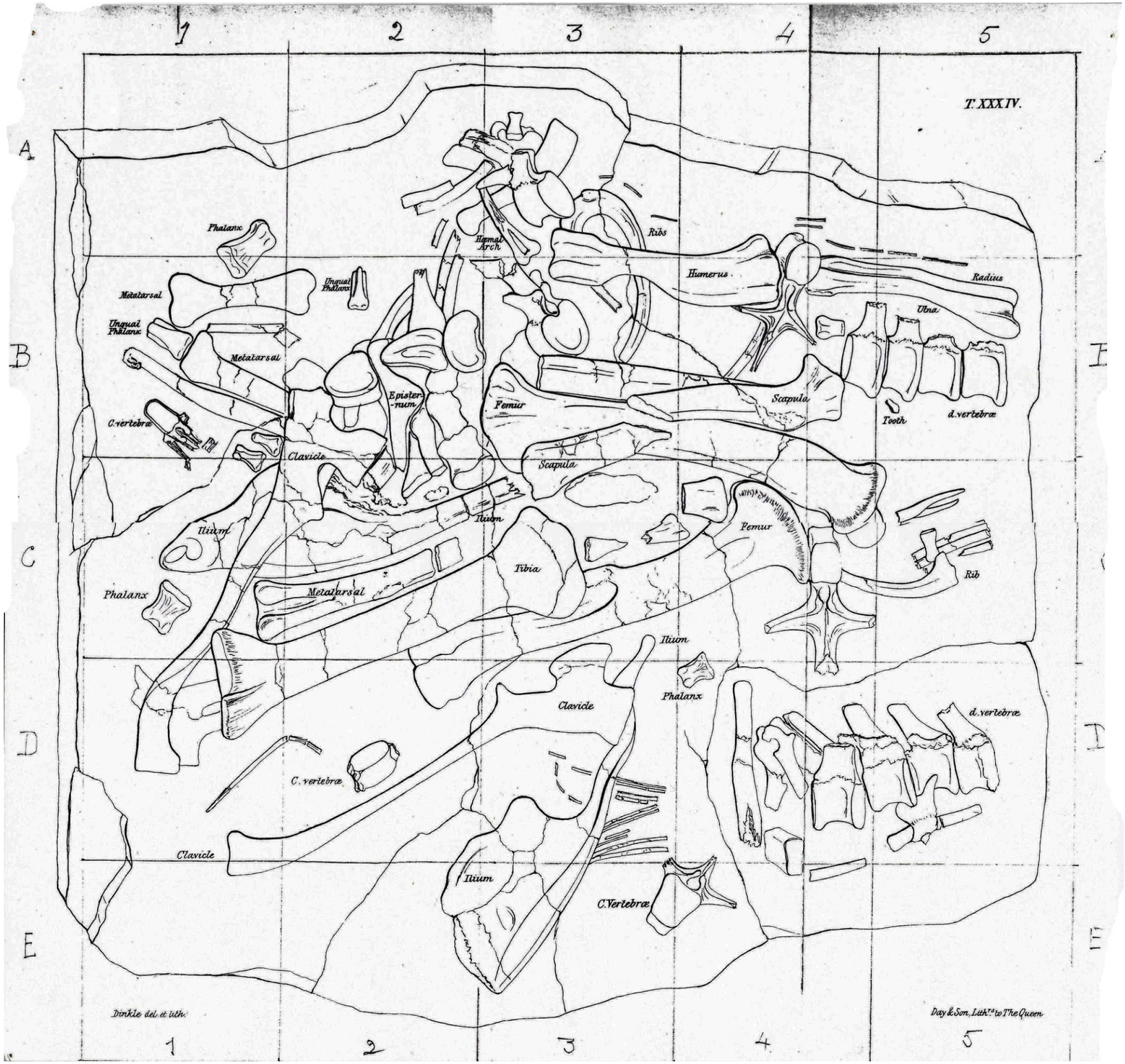
T. XXXIII.

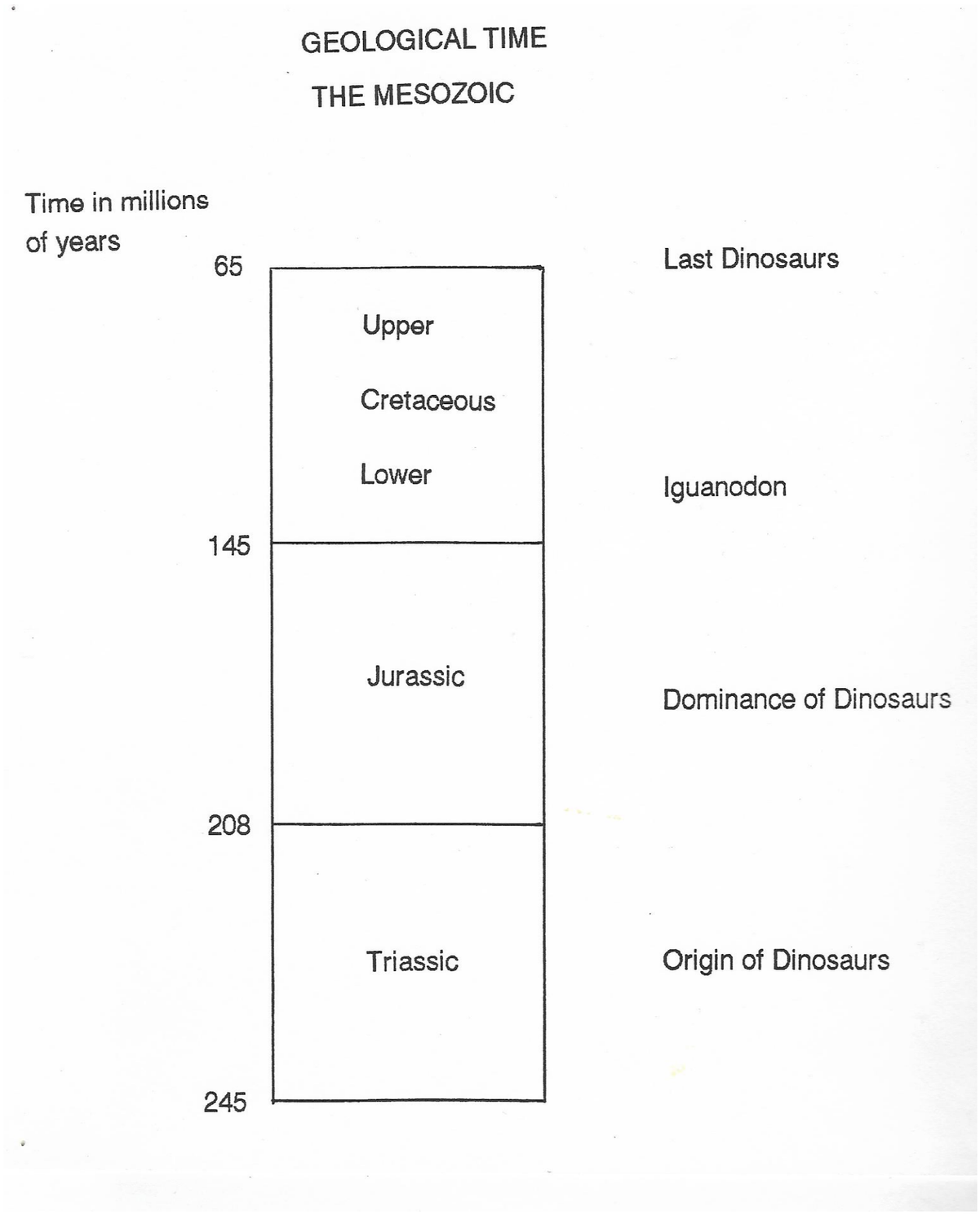


J. Dinkel, del. et lith.

Day & Son, Lith.rs to The Queen

T. XXXIV.


1
2
3
4
5
A
B
C
D
E
Phalanx
Metatarsal
Ungual Phalanx
Ungual Phalanx
Metatarsal
C. vertebræ
Clavicle
Ilium
Phalanx
Metatarsal
Tibia
Epister-num
Femur
Scapula
Haemal Arch
Ribs
Humerus
Radius
Ulna
Tooth
d. vertebræ
Ilium
Femur
Rib
Ilium
Phalanx
Clavicle
d. vertebræ
C. vertebræ
Clavicle
Ilium
C. Vertebræ
Dinkle del. et lith.
Day & Son, Lith.rs to The Queen



CLIMATE

The latitude of what is now southern England was 300 N in the lower Cretaceous, some 200 further south than it is today. Therefore the climate was considerably warmer. There was also a higher global climate during the Lower Cretaceous. The Wealden Basin moved from a semi-arid climate during the Jurassic Purbeck to a warm temperate climate during the Lower Cretaceous, when the mean annual temperature was above 100 C and the mean annual rainfall probably between 600 and 1200 mm.

Seasonal conditions - wet and dry seasons marked by floods and forest fires.

GEOLOGY

The_**Lower Cretaceous Wealden Series** includes several cycles of sandstones, mudstones and clays with subordinate shelly limestones and fossil root horizons.

These sediments were deposited in predominantly freshwater nm n (evidence : beds entirely composed of the little snail 1414earus) with sional brackish conditions (evidence some *Ostracod (Cypreae*) species)

The sediments derived essentially from the North-East : London Uplands but maybe also from the West : Cornish Peninsula and even from the South : Armorica (Brittany).

The same environment existed in the Hampshire Basin to the West and extended eastwards into the Paris Basin.

SALINITY OF WEALDEN SEDIMENTS

Clays have higher salinity than sands, reflecting :

- transgression of sea through breaches in the sea defence

- evaporation during long dry periods

Reduced salinities could reflect :

- long term increase in rainfall

- higher run-off resulting from changes in upland relief through tectonic uplift

WEALDEN PHASES AND ENVIRONMENT

Sand deposits

- Source lands	high relief high temperature heavy rainfall much vegetation.
• Basins	low undulating relief strong coastal defence

Clay deposits

- Source lands	lower relief moderate climate light rainfall forest fires ignited by lightning
- Basins	watery mud flats sandy channels numerous lakes, lagoons breaches in the coastal defence

THE WEALDEN BASIN MODEL

The Wealden basin model is composed of:

- outwash plain
    - low angle fan deltas and flood plains
    - wet periods mobilize fine sands

- lake - lagoon - bay estuary
    - shallow water environment
    - clay formations with fluctuating salinity

The provincial model for the **Wealden of South England** is bordered by three tectonically active source-lands:

- Lonctinia : - the London Uplands linked with Brabant

- Cornubia :- the extended: Cornish Peninsula

- Armorica:- Brittany - N France

(after P. Allen)

JURASSIC PURBECK BEDS

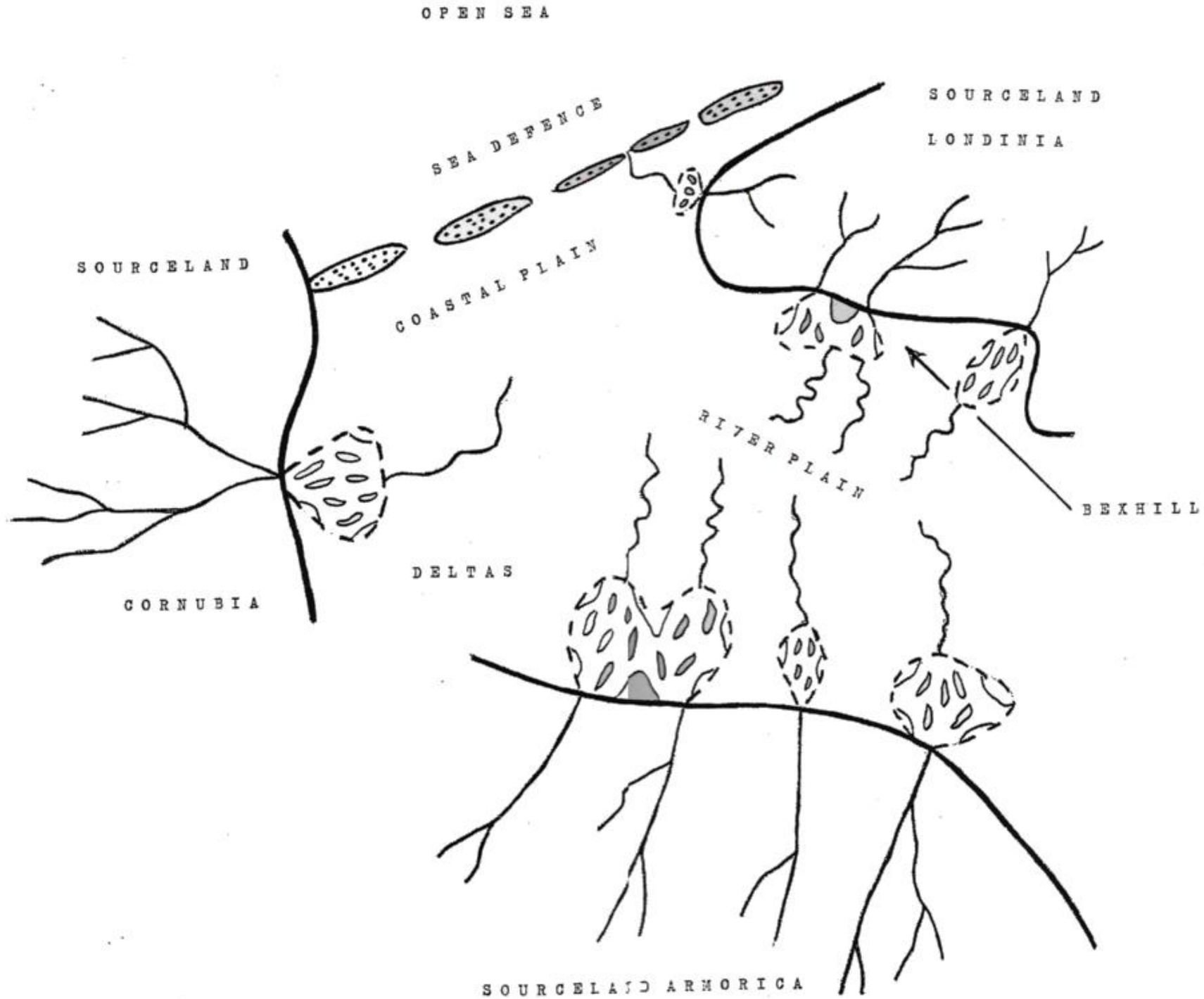
The Jurassic Purbeck Beds are the oldest rocks to outcrop in the Wealden District.

They mark the highest structural level within the core of the Wealden anticlinorium and consist largely of bluish grey calcarceous mudstones.

Their basal part contains valuable gypsum deposits. An economically important mine is in operation in Brightling.

During the **Tertiary Period**, mountain building created the Alps in Europe. A more gently uplift and folding process took place in South East England resulting in a dome-shaped anticlinorium overlying the Weald basin of Cretaceous sediments.

Subsequent sub-aerial erosion of this anticline produced the present day structure and topography.


OPEN SEA
SEA DEFENCE
SOURCELAND
LONDINIA
SOURCELAND
COASTAL PLAIN
RIVER PLAIN
BEXHILL
DELTAS
CORNUBIA
SOURCELAND ARMORICA

IGUANODON FOOTPRINTS FOUND SOUTH OF 27 HARTFIELD ROAD BEXHILL

NOV. 1980

TQ 72020661

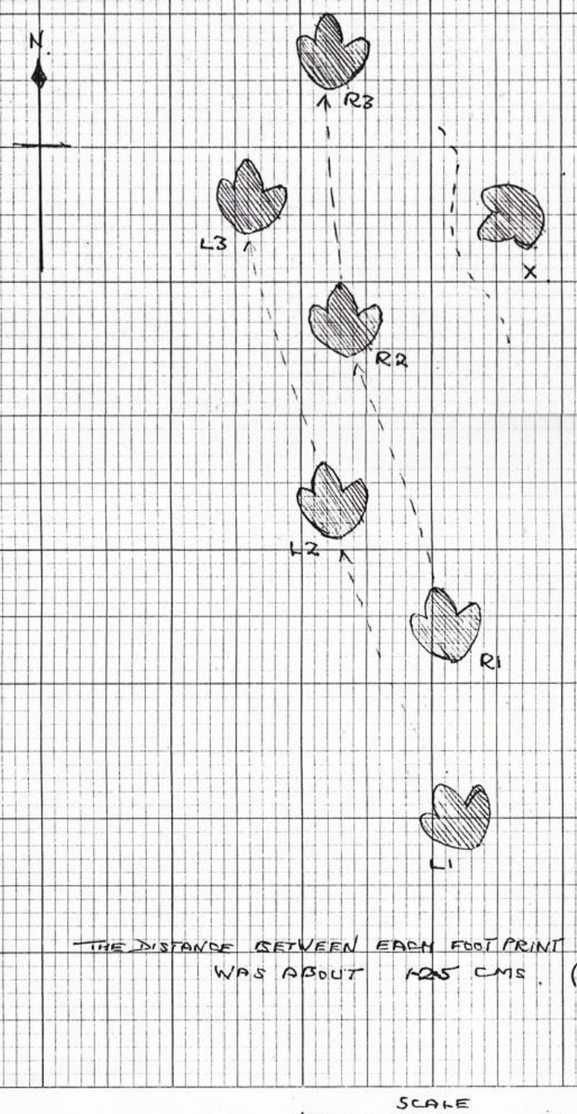
PRINT.	SIZE (LXW)
L1	45 X 45 CMS
L2	50 X 45 "
L3	50 X 50 "

PRINT	SIZE (LXW)
R1	50 X 45 CMS
R2	50 X 50 "
R3	50 X 50 "
X	55 X 55 "

STRIDE TOE TO TOE	
L1 — L2	255 CMS
L2 - L3	240 "
R1 - R2	240 "
R2 - R3	255 "

SIZES APPROX. ONLY

X = PRINT IN A LOWER STRATA

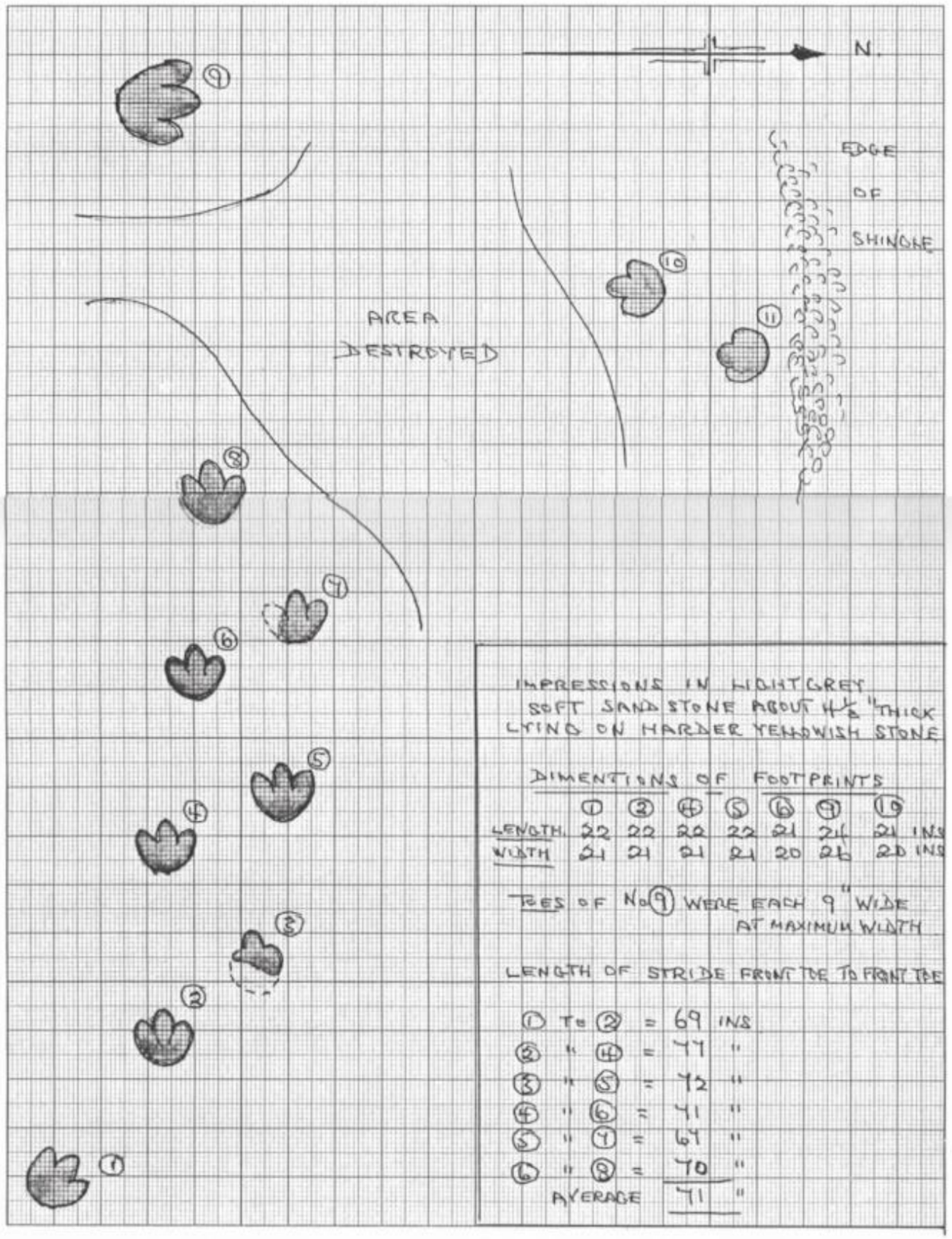


THE DISTANCE BETWEEN EACH FOOT PRINT CENTRE TO CENTRE WAS ABOUT ~~225~~ CMS. (3Ft-4")

SCALE 200 CMS

I.B.C.

IGUANODON FOOTPRINTS BEXHILL BEACH NGR TQ 743070



IMPRESSIONS IN LIGHT GREY SOFT SAND STONE ABOUT ½" THICK LYING ON HARDER YELLOWISH STONE

DIMENTIONS OF FOOT PRINTS

	①	②	④	⑤	⑥	⑨	⑩	
LENGTH	22	22	22	22	21	21	21	INS
WIDTH	21	21	21	21	20	21	20	INS

TOES OF No ⑨ WERE EACH 9" WIDE AT MAXIMUM WIDTH

LENGTH OF STRIDE FRONT TOE TO FRONT TOE

①	TO	②	= 69	INS
②	"	④	= 77	"
④	"	⑤	= 72	"
⑤	"	⑥	= 71	"
⑥	"	⑦	= 69	"
⑦	"	⑧	= 70	"
	AVERAGE		71	"

I.B.C. 21-1-78