



### **Square & Compass Fossil Fayre 2016**

Anyone who has studied geology in the UK or who has an interest in fossils will be familiar with Purbeck's Jurassic coastline. Where fragments and larger fossilized remains of sea creatures can be found at places like Kimmeridge, Durlston Bay and Chapmans Pool. In sedimentary rocks from the late Jurassic and early Cretaceous periods. Evidence of dinosaurs and trace fossils of their footprints are regularly uncovered in the local quarries.

EARTH'S HISTORY IS ALMOST A MILLION TIMES LONGER THAN  
HUMAN HISTORY OF 5,000 YEARS

#### **Cretaceous period**

145 - 66 million years ago.

Ending with the extinction of non-avian dinosaurs and three-quarters of plant and animal life when an huge asteroid the size of Mt Everest collided with earth.

#### **Jurassic period**

201 - 145 million years ago

#### **500 million Years**

The time of abundant fossils allowing the detailed understanding of Earth's History - Trilobites index fossils of the time

#### **Oldest living life forms**

3,500 million years - fossilized Stromatolites

#### **Creation of Earth**

4,500 million years ago

#### **The Fossil Record**



Trev Haysom & Paul Ensom uncover fragments of trees from the lower Purbeck beds that silicified into stone 130 million years ago. *Lander's Quarry, 2016*

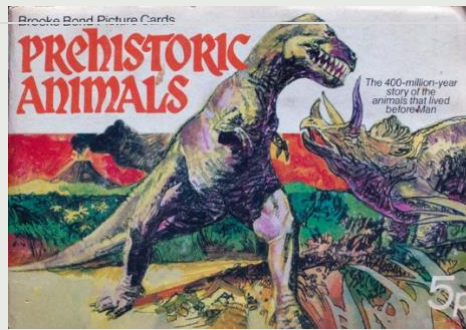


## The Fossil Record

Copyright© Jed Corbett Photographs from Purbeck's Limestone Plateau 1976 - 2018



Tree fragments, *Lander's Quarry*, 2011



It was long believed by geologists and palaeontologists that non-bird dinosaurs died out gradually over millions of years. Until the 1970's when space travel started producing images of planets across the solar system strewn with ancient impact craters.

Evidence on Earth in the Cretaceous-Tertiary KT boundary - a layer of clay - led geologists and scientists to identify a *mass extinction event* after discovering an irregular level of the metal iridium. A large impact crater was first discovered in 1978 in the Gulf of Mexico by geologists surveying for oil but it was not until 1991 the joint detective work of geologists, palaeontologists, astronomers, geophysicists and geochemists pieced together all the evidence and located the precise point of impact.

It was universally agreed in 2010 that the impact of an asteroid colliding with earth at Chicxulub underneath the Yucatan Peninsula in Mexico, its vast crater hidden by nature, had caused the *mass extinction* and not radiation from a supernova or volcanism.



*A trace fossil an impression of a Iguanodon's footprint, a number of which have been discovered by the quarrymen over the years. Blacklands Quarry 1992*

## The Fossil Record

## The first dinosaur discovery

The first recorded discovery of dinosaur bone was mentioned by the Rev. Robert Plot in his *Natural History of Oxfordshire*, published in 1677. The specimen described in the lower end of a gigantic thigh-bone, found in a quarry at Cornwell (near Chipping Norton). In those days, of course, the idea of 'dinosaurs' did not exist, and Plot believed that his thigh-bone must have belonged to a giant human being. The specimen has since been lost, but we recognise in Plot's illustration (over) as probably belonging to the dinosaur *Megalosaurus* shown on card 16.



This was one of the dinosaurs, which were bipedal. Both eating and hunted like the omnivorous but larger and heavier *Megalosaurus* lived in England and France throughout the Jurassic (180-140 million years ago). The earliest recorded dinosaur bone was probably *Megalosaurus*; it was the first dinosaur to be named, the first described in 1842 and one of the three upon which Owen originally based the concept of 'Dinosauria' in 1842. The animal was over 20 feet long and weighed perhaps a couple of tons; the head was especially large and heavy and the neck very short. The rocks of southern England have yielded not only many bones of *Megalosaurus* but also its footprints.



The tracks of three dinosaurs, probably *Megalosaurus*, in Meers Sand's, Purbeck Stone quarry at Dorset, near Dorchester. Each print is 12-14 inches long. Photographed in early 1960s.

A few years ago, in one of these quarries, a whole series of *Megalosaurus* footprints was found, making a trackway which ran for some considerable distance. The series, shown in the photograph, consisted of two parallel lines of prints, close together and more or less alternating, and it was at first thought that they had been made by one animal walking along with its legs apart. Further investigation revealed that:

- alternate prints in each line were inclined slightly to the left and to the right of the general direction of the line itself,
- when the series was traced further the apparently regular alternation between the prints in the two lines was lost,
- when it was traced further still the two lines began to separate, and
- there was another single line of closely similar prints not far away.

We are therefore forced to the conclusion that each single line of prints was made by one bipedal animal, placing each foot in front of the other. The only other explanation of (c) is that the animal was doing the splits and that of (d) is that it was hopping on one leg!

These trackways were carefully lifted in 1963 and brought to the Natural History Museum in London. Part of the 'double' trackway can be seen in the Dinosaur Gallery and part of the single trackway in the garden.

## Dinosaur footprints



Dinosaur footprints from the Purbeck quarry at Dorset. A. Probably made by the carnivorous *Megalosaurus*. B. Probably made by the herbivorous *Iguanodon*. The toe-marks of A are more widely separated than those of B and have more pointed ends. *Megalosaurus* had claws and *Iguanodon* had hooves.

Coastal mud-flats of 140 million years ago, now transformed into Purbeck Stone, are quarried extensively around Swanage (Dorset) for building. As they split the slabs the quarrymen often find the impression of a great three-toed foot, maybe 12 inches across. There are, in fact, at least two different types of these impressions, one probably made by the carnivorous *Megalosaurus* (card 16) and the other by the herbivorous *Iguanodon* (card 22); their different shapes are illustrated on the left.

## Use of fossils in dating rocks

It might be thought that the study of fossils, interesting though it may be, has little practical value. This is far from true, for the comparative dating of the various layers in the Earth's crust was originally based on the fossils which they contain; this method is still the most widely used. One of the basic principles of palaeontology is that rocks from different parts of the world which contain the same or very similar fossils were laid down at about the same time. Thus, if we know that a geological formation in Tanzania is of Middle Triassic age and contains a certain characteristic fossil, then strata in Brazil and Switzerland which contain very similar

fossils are likely to be Middle Triassic too. Of course, on only one sort of fossil we could be wrong, for it might have a very long time-range. But suppose we find several different fossils in Tanzania, each of which has close relatives in Brazil and/or Switzerland; then it is almost certain that the three strata are contemporaneous.

The best fossils for these purposes are those which are abundant, small, widely distributed and with short time-ranges; for example, the shells of tiny sea-creatures which are carried all over the globe by currents, which evolve rapidly into something different, and which may be found in their millions when a

bore-hole is sunk. Typical examples are illustrated. Geological surveys, oil companies and mining companies employ palaeontologists to help them map the Earth's crust in their search for water, mineral fuels (oil and coal), ores and fertilisers.



16. *MEGALOSAURUS* (Greek, 'big lizard') This animal was a typical pseudosuchian, belonging to the group from which dinosaurs, pterosaurs, crocodiles and birds all evolved. Contrary to what is stated in many books, however, none of the pseudosuchians showed any tendency towards walking or running on their hind legs alone. *Megalosaurus* lived in Tanzania in Middle Triassic time, 200 million years ago. It was of crocodile-like build, with large teeth in the upper jaw, a double row of smaller, pointed down the middle of the back and hind legs rather longer than the front ones. Its habits are very probably like those of modern crocodiles, though it may have been less fond of the water.



Spinosuchus, a small and primitive pseudosuchian, from the Upper Trias of the Black Mountains of Scotland. About 9 feet long.



Spinosuchus, a small and primitive pseudosuchian, from the Lower Trias of China. About 10 feet long. The closely related and even larger *Spinosuchus* is found in contemporary rocks in South Africa.



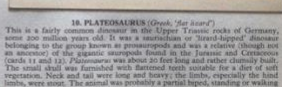
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## Who invented 'Dinosauria'?

The word 'Dinosauria', from the Greek for 'terrible lizard', was proposed by Richard Owen in 1842 at the Plymouth meeting of the British Association for the Advancement of Science. It was published the following year. Owen based his new concept on three English



disks already described (*Megalosaurus*, *Iguanodon* and *Hylaeosaurus*), but a fourth (*Corythosaurus*), which had also been described, was considered by Owen to be a gigantic crocodile.



22. *IGUANODON* (from Owen and Grev's 'book') The Lower Cretaceous of southern England has yielded bones and footprints of this large ornithomimid (140-100 million years old) but never a complete skeleton. In 1870, however, about 20 skeletons in various horizons of completeness were discovered in a Belgian combine at Bernissart. *Iguanodon* was the dinosaur first named by John Adam Mantell in 1825, the second dinosaur to be named and described (in 1825) and one of the three upon which Owen based his concept of 'Dinosauria' in 1842. Early reconstructions (those in the Crystal Palace in London) were entirely wrong: *Iguanodon* was a heavily built herbivorous biped, 16 feet tall and 51 feet long, with remarkable spiky skin.

The Crystal Palace restoration of *Iguanodon* (made by Waterhouse Hawkins under the supervision of Richard Owen in 1853-54).

## Mantell and the first Iguanodon

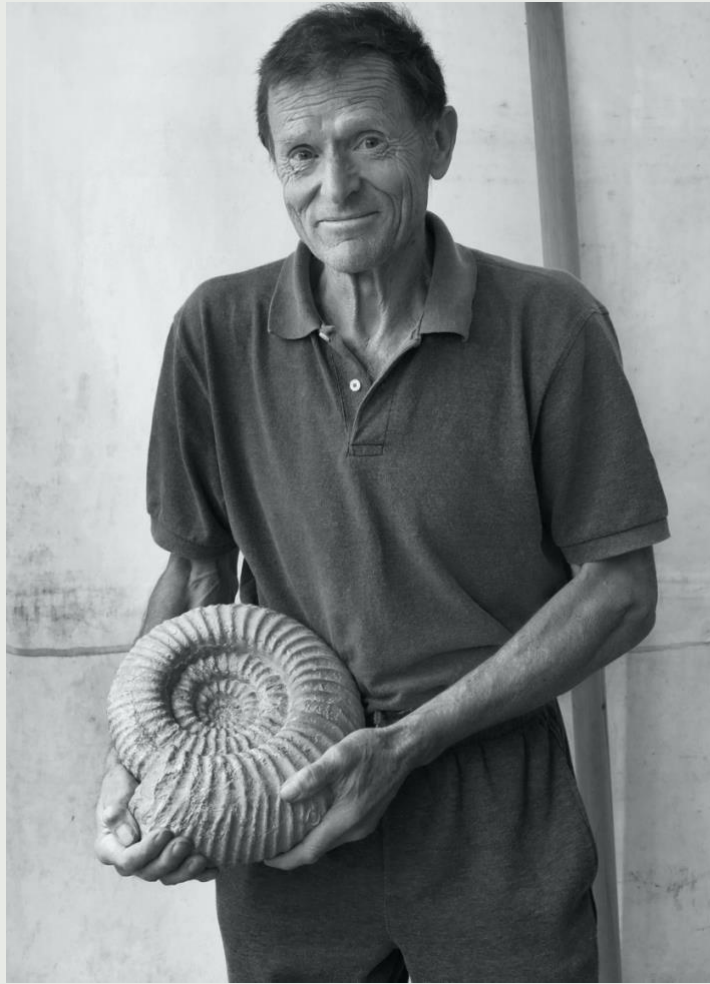
Gideon Mantell (1790-1853) was a doctor who was born and lived in Lewes, Sussex; in 1831 he moved to Brighton. He took a great interest in fossils, made a large private collection and wrote several books. In 1822 his wife found the first *Iguanodon* tooth. Mantell rightly believed them to be reptiles, although eminent zoologists of the day thought they belonged to a rhinoceros. Many



of the *Iguanodon* bones he collected were found in Tilgate Forest, just outside what is now Crawley. In 1825 he published a description of his new animal and named it. He also managed to acquire the famous Maidstone *Iguanodon*, found in 1834, which was the first specimen found with bones and teeth and which is now in the Natural History Museum in London.



23. *CORYTHOSAURUS* (Greek, 'helmet lizard') *Corythosaurus* from the Upper Cretaceous of Canada (75-70 million years old) was one of the many different hadrosaurs or duck-billed dinosaurs - really very specialised ornithomimids. About 30 feet long, it was probably only a partial biped and may often have walked on all fours; the deep, strong tail and the webbed fingers of the hand suggest that it was a good swimmer. The front parts of the jaws are toothless, formed a duck-like bill; the back parts have hundreds of grinding teeth, arranged in batteries, which suggest a diet of hard vegetation. The peculiarity of *Corythosaurus* was a hollow, helmet-like crest covering the entire top of the skull.



David Sole, 2016

With an ammonite from the Portland beds at  
Chapmans Pool found in the 1980's.



Pavlovia Sp. In limestone matrix,  
Upper Kimmeridge clays, Chapmans Pool



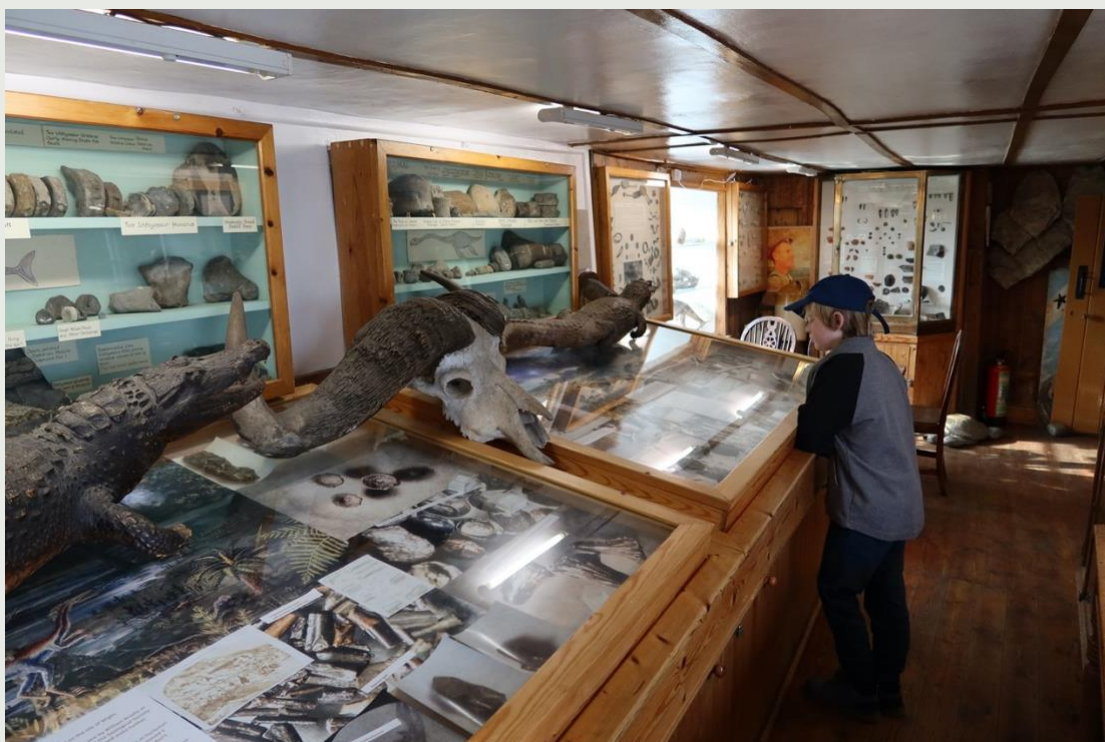
Charles Newman, 2016  
Host of the annual Square and Compass Fossil  
Festival handling recent finds.



## The Fossil Record

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# Square & Compass Museum



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Fossil Fish - Lepidotes, Peveril,  
Middle Purbeck Beds.  
Discovered and prepped by Andrew Webster, 2014



Tree remains silicified to stone.