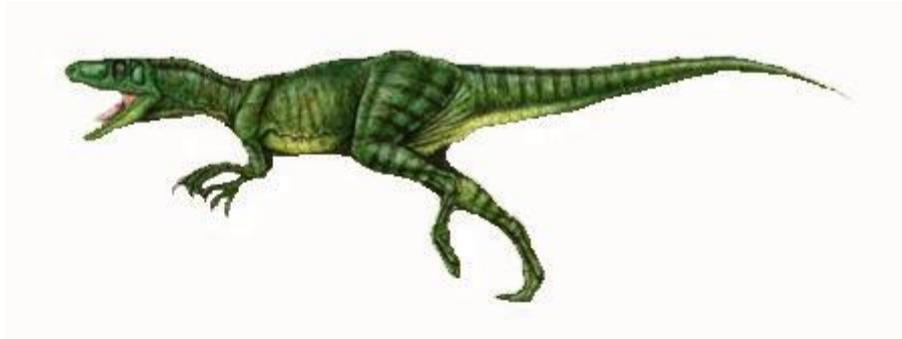




DINOSAUR BOOKLET No. 1

Neovenator salerii



Description

Neovenator salerii (pronounced 'knee-oh-vena-tour' 'sall-air-ee-eye') is a large bodied theropod dinosaur. The genus name *Neovenator* comes from 'New hunter', and the species name from that of the Salero family who owned the land from which the first important dinosaur remains were found. Since it was first found it has given its name to a new group of dinosaurs called the Neovenatoridae. This group itself forms part of the Carcharodontosauridae which are closely related to the North American dinosaur *Allosaurus*.

Neovenator walked on its long hind legs. The first specimen was found with shoulder blades (scapulae) but was missing the remainder of its arms. Reconstructions have been based on those of *Allosaurus*.

There were three clawed toes on each foot and it is likely that there would have been three digits on each hand. The long body was held in balance by a long tail. The type specimen measured about 7.5 metres long and would have stood about 2.5 metres tall.

The mouth was full of blade-like serrated teeth, and above the eyes were horned extensions of the skull.

Fossils have so far only been found in Early Cretaceous rocks of the Wessex Formation, during the Barremian Stage around 125 million years ago.

Neovenator remains have been found predominantly on the south-west coast of the Isle of Wight.

Discovery

The story of the theropod dinosaur that was later to be named as *Neovenator salerii* began on an Isle of Wight beach during the summer of 1978. The subsequent complex history of the discovery of further fossils by a number of individuals, and the interpretation of it as a new dinosaur led to a watershed in the study and conservation of Island dinosaurs.

Storms are not unusual during English summers, and one such stormy night in the summer of 1978 led to a cliff fall in Brighstone Bay on the Isle of Wight. Thus was revealed the first of a number of dinosaur bones on the foreshore amongst a pile of silt, mud and other rock. A family on holiday (the Henwoods) borrowed some tools and dug out some fossil bones from the beach debris. A geology student (David Richards) dug out further remains over the next few weeks, and the material was reported to the Museum of Isle of Wight Geology (MIWG) and the Natural History Museum, London (NHM).

Most of the bones were taken to the Natural History Museum, and it was discovered that they came from two different types of dinosaur. Dr Alan Charig of the NHM identified one of the sets of bones as coming from an ornithomimid dinosaur now called *Mantellisaurus atherfieldensis*, but the remainder came from an unknown saurischian dinosaur of a type called a theropod ('beast foot').

The theropod bones in the NHM (some vertebrae and parts of the pelvis) were given the catalogue numbers BMNH R10001.

In the early 1980's MIWG staff went back to the site to recover more of the *Iguanodon*, and once on site discovered a caudal (tail) vertebra from the theropod. This was given the number MIWG.6348. Local collectors Keith and Jenny Simmonds joined the staff and returned to the site where more of the theropod was unearthed. This included parts of the skull, many vertebrae, ribs, chevrons, gastralia, the left coracoids and scapula, and a number of bones from the legs.

Mark Lumber then found the right femur, Gabi Hulman found parts of the left foot, and more of that foot were later collected by Rob and Tess George.

In 1985 Steve Hutt, Martin Munt and Robin Reid found two more vertebrae half a kilometre along the coast from the original site. These became part of the MIWG collection and were catalogued MIWG.5470 (they were also later found to be from another *Neovenator*).

During 1987 the NHM material (BMNH R10001) was temporarily loaned to the Island for study.

Also during 1987 Jenny Simmonds found more theropod remains (vertebrae and parts of the pelvis). However although it was later revealed to be *Neovenator*, it was from a different individual. These new fossils came into the collections of the Museum of Isle of Wight Geology and were numbered MIWG.6352. Further work led by MIWG staff found a pubis from this dinosaur with an enlarged pubic boot.

In 1990 Steve Hutt, curator at the MIWG published an early brief description in the Proceedings of the Isle of Wight Natural History and Archaeological Society along with Keith Simmonds and Gabi Hulman. At this stage it was still an unidentified theropod.

By 1996 it was obvious that the Island had a new dinosaur and its name *Neovenator salerii* was announced in a research paper by Steve Hutt, Dave Martill and Mike Barker. The research into the dinosaur was also submitted by Steve Hutt for an unpublished MPhil dissertation in 1999. Steve gave it the name *Neovenator salerii* ('Neovenator' = new hunter, 'salerii' comes from the name of the Salero family who owned the land the first *Neovenator* remains came from).

Further fossils still continued to be found. David Cooper had found a caudal vertebra and in 1998 Steve Hutt and Penny Newbery found the left femur and right tibia.

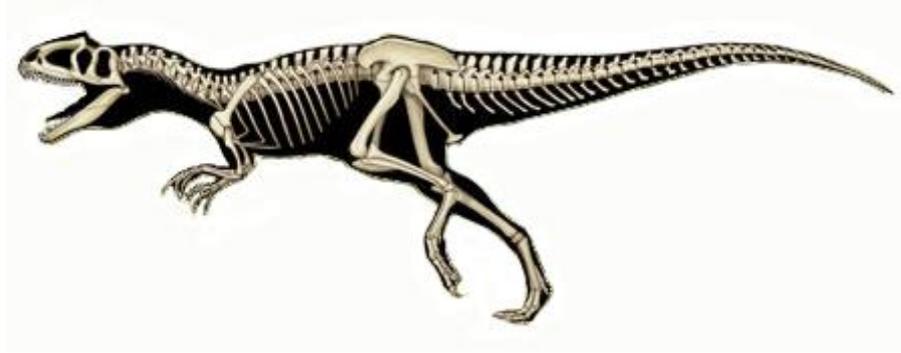
Nick Oliver found further remains of another individual close to the original site. The fragmentary bones include possible sections from a jaw, parts of cervical vertebrae, pieces of ischium and limb sections. These were catalogued as IWCMS 2002.186.

Enough remains of the 1978 dinosaur, along with the fossils from the same animal held by the NHM in London, were preserved to warrant the identification of this dinosaur as a new genus and species. It is estimated that around 70% of the bones have been found so far. It can sometimes be the case that an organism (previously unknown to science) is given the name of its finder, however in this case with so many people involved it was decided to name it after the owner of the land the first specimens fell from.



The specimen known as MIWG.6348 became the type specimen (or holotype). Much of it is on display at Dinosaur Isle in a large case. Some of the material is mounted as a reconstructed skeleton, while fossils that are too fragile to mount lie on sand in the base of the case.

Fossils



The fossils from the type specimen (holotype), and some of the later remains, were found within an area that has since been interpreted as from a large flood event that washed in trees and other plant material. The bones from *Neovenator* were mixed up with another dinosaur *Mantellisaurus atherfieldensis* that was probably washed in during the flood. Bones from both of the dinosaurs were preserved in a siltstone matrix, and have a considerable amount of iron sulphide in them. Remarkably both the holotype of *Neovenator* and the fossil bones of the *Mantellisaurus* show a number of pathological problems in the vertebrae and other bones.



Most of the bones from the type specimen (catalogue number MIWG.6348) are both heavy and dark in colour due to the mineralization that followed burial in the ground. Some bones are relatively complete like this caudal vertebra (from the tail); others are missing parts that may have been eroded early on, or where the parts disappeared during cliff falls.



6348



This (almost complete) dorsal vertebra from the type specimen displays the golden brown sheen that is common amongst most of the bones from this animal.

Whilst the preservation of some bones display this particular colour others are black, and a few are grey. This is due to the way the animal was buried - the body lay on a varied ground surface at some stage, and then different minerals were washed through depending on the porosity of the rock surrounding the bones.

Fossil wood tends to turn black in Wealden muds, and bones that are associated with the wood are often found with this black colouration as well. Bones found in grey silt tend to be grey and those in the red floodplain muds tend to be pink in colour and very fragile.

The study of the changes to bones as they become fossils is called taphonomy.



MIWG 6348

Mixed in with the bones of the type specimen of *Neovenator* were the remains of an Iguanodontid. Both sets of dinosaur remains had bones with pathological problems.

Here on the *Neovenator* is the 21st caudal (tail) vertebra. On the far side can be seen a bulging growth of extra bone that has surrounded one of the lateral processes. The tail had a number of damaged bones, including two that were partially fused



MIWG 6348

This is one of the vertebrae from the tail of the type specimen. Its elongated form shows that it is from nearer the tip, although there are still a few more to go before the end of the tail is reached.



In this picture are some of the bones from the foot of *Neovenator*. There are long metacarpals, pedal phalanges, two ungual phalanges and a large vertebra.

The Science

Systematic palaeontology

Dinosauria Owen, 1842

Saurischia Seeley, 1887

Theropoda Marsh, 1881

Tetanurae Gauthier, 1986

Avetheropoda Paul, 1988

Allosauroidea Marsh, 1879

Carcharodontosauridae Brusatte & Sereno 2008

Neovenatoridae Benson, Carrano & Brusatte 2010

Neovenator gen. nov.

Neovenator salerii Hutt et al, 1996

Research

Although there are a number of bones and teeth in the collection that have been attributed to *Neovenator* those that have been studied the most can be found in just three groups, belonging to individual dinosaurs. These are identified by the catalogue numbers MIWG.6348 (the original material from the 1978 cliff fall), MIWG.5470 (two vertebrae found about half a kilometre away in 1985) and MIWG.6352 (some vertebrae with pelvic material found in 1987).

After the extensive research work on specimen MIWG.6348 by Steve Hutt that resulted in his MPhil thesis, and the naming of *Neovenator salerii* as a distinct new genus and species of dinosaur, there was a period when little research was published.

Mention of *Neovenator* was made in 2001 in the Field Guide - Dinosaurs of the Isle of Wight by Martill and Naish, and then there was a long gap during which an almost-forensic analysis of the bones was carried out.

As a consequence a substantial monograph was finally published in 2008 which provided a detailed description of the osteology (by Stephen Brusatte, Roger Benson and Steve Hutt). Other researchers have been studying the features that may give clues as to its relationship with other dinosaurs (the phylogeny) and this resulted in the publication of two further papers – first in 2008 by Stephen Brusatte and Paul Sereno who placed *Neovenator* within the Carcharodontosauridae, and then in 2010 by Roger Benson, Matthew Carrano and Stephen Brusatte who established a new group for dinosaurs like *Neovenator* called the Neovenatoridae.

Neovenator is the first allosauroid to be discovered in Europe.

References

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Some facts and figures

Size

Measurements of the type specimen indicate that it would have been about 7.5 metres long, and 2.5 metres high.

Mass

Estimated 1,000kg to 2,000kg for a large adult.

Eats

Meat, possibly other small dinosaurs like Hypsilophodon and young Iguanodon.

How fast could it run?

Would vary depending on size, age and health; but perhaps up to 20 miles per hour.

The geology and age

Lower Cretaceous

Wealden Group

Wessex Formation

The remains of *Neovenator* have so far only been found in rocks from the Wessex Formation; and the area the fossils are found in is currently dated somewhere between 123 and 125 million years in age.

Where was it found?

In Brighstone Bay on the south-west coast of the Island. The exact location is being kept secret to protect any further remains that might become exposed.

When was it first found?

In 1978.

Something different or unusual?

Neovenator is very similar to the North American carnivorous dinosaur *Allosaurus fragilis*.

Environment and adaptation

Neovenator remains are found in the soft mudstones of the Wessex Formation, dating from the early Cretaceous around 125 million years ago. These mudstones were deposited during flooding events alongside the banks of meandering rivers, and are stacked within a deep basin comprising muds, silts and sandstones that reach over 500 metres in depth (from rock cores from the Arreton borehole). Within the former rivers are found the fossilized remains of fish, turtle, crocodiles and numerous shells, along with plant material washed in from further upstream. The lack of preserved wood as coal seams indicates that the southern half of the Isle of Wight was not heavily wooded for any appreciable length of time, and this is also supported by the small size of the fossilized root traces that can be seen in the mudstones exposed along the beach and in the cliffs.

The environment would probably have consisted of an open plain, with numerous meandering small rivers - covered in ancient bracken and cycads with small areas of trees. The main wooded areas probably lay further to the north on higher ground that allowed trees to reach old age

rather than be destroyed in the floods or by meandering rivers. The vista would probably have been fairly open making it a difficult ambush environment for a predator, but also one in which prey would have little cover either.

The current thoughts are that juvenile carnivorous dinosaurs like *Neovenator* may have hunted in a different way to adults, and eaten different prey so that they didn't compete. Young animals today often work together, but unlike some mammals who co-ordinate attacks reptiles mainly tend to gather in a frenzy to bring down a large prey.

The build of an adult *Neovenator* is not viewed as that of an endurance pursuit animal, but probably that of an ambush creature or one that fed on carrion when necessary. Juveniles may have robbed nests of eggs or young animals, and may even have fed on insects.

Until we find an area of extensive trackways that record the movements of different *Neovenator* during hunting, migration and feeding – or find a group of fossils preserved together - their social organization will probably remain a mystery and a topic for speculation.

The human story

Finding, collecting, conserving, researching and reporting any important fossil material is a time-consuming exercise, and in most cases takes many years to complete (if it ever really finishes). During this time it is rare for all of the work to be undertaken just by one person.

In the case of *Neovenator* the history has involved a large number of people, not just as a result of the extended period over which the bones were found but as a result of the subsequent detailed scientific follow-up that still continues as new ideas about its lifestyle and evolutionary links are explored.

Every one of these people will have personal memories, but like many great finds they are rarely recorded unless they can be published. Tales of cold weather, of digging in pouring rain or the excitement of a new bone appearing in the mud are all part of the experience of being involved in finding a new dinosaur like *Neovenator*.

The story of *Neovenator* also marked a turning point in the way that Isle of Wight dinosaur remains were treated. Prior to the 1970's many finds were lost to the Island as researchers took them to mainland Universities and museums. The first *Neovenator* remains are mainly held on the Island, but some were taken to a London museum. Greater public awareness of the importance of the Isle of Wight's fossils (including its dinosaurs) has meant that since that time many of the new finds are now retained on the Island.

The future

It is thought by some researchers that fossil material from the UK mainland might also be *Neovenator*. The theropod pages of the 'Dinosaurs of the Isle of Wight' produced by The Palaeontological Association include the suggestion that some material identified as *Megalosaurus oweni* and *M. dunkeri* may be *Neovenator*, and that some other unidentified fossils could also be from *Neovenator*. Given that a number of bones have been found on the Island from different animals (and the size of the dinosaur suggests they would each have required a large hunting area) it does raise the possibility that we might find *Neovenator* on the UK mainland in the future.

Produced by

Trevor Price, Dinosaur Isle Museum (with a lot of help from Steve Hutt, who initially co-ordinated the *Neovenator* excavations, spent long wind-swept and rainy days collecting the remains along with a lot of collectors and then put it all together to describe this graceful, but dangerous dinosaur). From articles quoted, research papers and images from the collection at Dinosaur Isle Museum, Culver Parade, Sandown, Isle of Wight, England PO36 8QA

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