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A. A. Snelling

Exceptional Soft-Tissue Preservation in a Fossilised Dinosaur

Only rarely are the soft tissues of animals preserved by burial and fossilisation, because such exquisite preservation requires exceptional circumstances. Yet it is becoming increasingly obvious from fossils that are being unearthed that such exceptional circumstances were probably not all that rare.

Amongst the fossil deposits best known for preservation of the soft tissues of dinosaurs are the Santana Formation of Brazil[1] and the Yixian Formation of China.[2] However, now the Lower Cretaceous Pietraroia Plattenkalk in the Benevento Province of southern Italy can be added to this list of *lagerstdtten* (known as conservative deposits). This rock unit has been known since the 18th century for its beautifully-preserved fossil fishes, but now the full preparation of a fossil theropod specimen found preserved in this marly limestone, with details of soft anatomy never seen previously in any dinosaur, has been reported.[3]

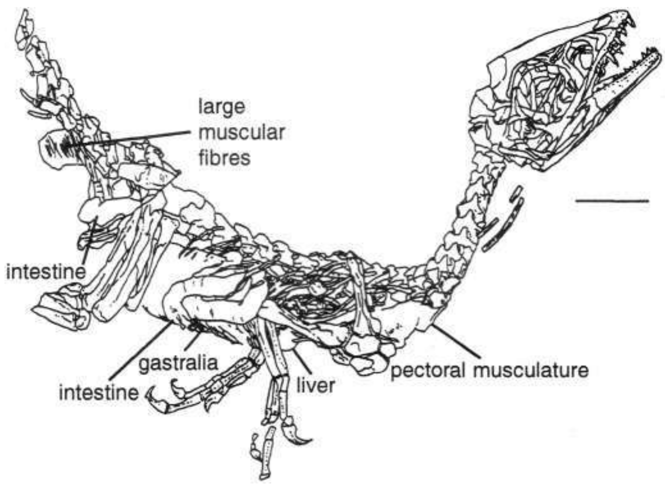

Figure 1. *Sketch of the skeleton of* Scipionyx samniticus *gen. et sp. nov., with fossilised evidence of soft parts indicated. Scale bar equals 2 cm.*

The specimen (see Figure 1) has been named as *Scipionyx samniticus* gen. et sp. nov., a new genus and species in the Maniraptoriformes family of coelurosaurs in the suborder Theropoda, and the first dinosaur ever to be found in Italy.[3] Its skeleton, 237 mm long from the tip of its jaws to the last preserved tail vertebra, lies on its left side in near perfect anatomical articulation. The head is upturned with respect to its position in life, and most of the skeleton is intact (only the distal portions of the hindlimbs, most of the tail and the second claw on the right forelimb are missing). The body proportions indicate that this animal was little more than a hatchling.[4,5]

A unique, striking feature of this specimen is the exceptional preservation of soft parts (see Figure 1).[3] Muscles are present in the chest area, with scattered acicular (needle-like) fibres clearly visible under 50x magnification. Large muscular fibres are also preserved at the tail base. Most of the intestine (5.2 mm average diameter) is positioned further forward than was generally thought, whereas the colon passes through the pelvic canal close to the vertebral column. The gut is described as being surprisingly short and deep in section. Immediately above the furcula (wishbone), there appear to be some tracheal rings. A large, reddish, well-delimited hematitic (iron-oxide-stained) halo is tentatively interpreted as liver traces, mainly because of its location.

The gastralia (abdominal ribs), still in life position, allow estimation of the abdominal depth and reveal their contribution to an effective support for the posterior intestinal tract. The presence of a furcula in this articulated specimen eliminates every doubt about the interpretation of similar structures in other theropods.[6,7] Despite this being the best preserved theropod specimen found (thus far), there is also no evidence of feathers or remnants of any other outer covering (for example, skin).[3] Thus this specimen provides no support whatsoever for the evolutionary 'just-so' story about dinosaurs being the immediate ancestors of birds.

The discovery of this specimen can only be described as remarkable, considering the scarcity of juvenile theropod dinosaurs in the fossil record. Furthermore, it's the exceptional preservation of soft tissue that makes this juvenile theropod specimen unique. It has been suggested that to accomplish such exceptional preservation, the fine-grained marly limestone containing this fossilised dinosaur must have been deposited in a shallow lagoonal environment affected by cyclic periods of low oxygen levels.[3]

However, this suggestion ignores the evidence in comparable modern environments with low oxygen levels and water-saturated lime muds that anaerobic bacteria will rapidly destroy soft tissues. The solution — extremely rapid burial of the animal in the lime muds followed by rapid diagenesis (hardening) to marly limestone. Indeed, rapid diagenesis of lime muds can be observed today on the north Norfolk (England) coast,[89] and has been given as the explanation for the Santana Formation *lagerstdtten* (Brazil).[10]

Thus one can only marvel at the inability of so many scientists to see and comprehend what such exceptional soft-tissue preservation implies — not slow and gradual sedimentation and burial, but extremely rapid geological processes.

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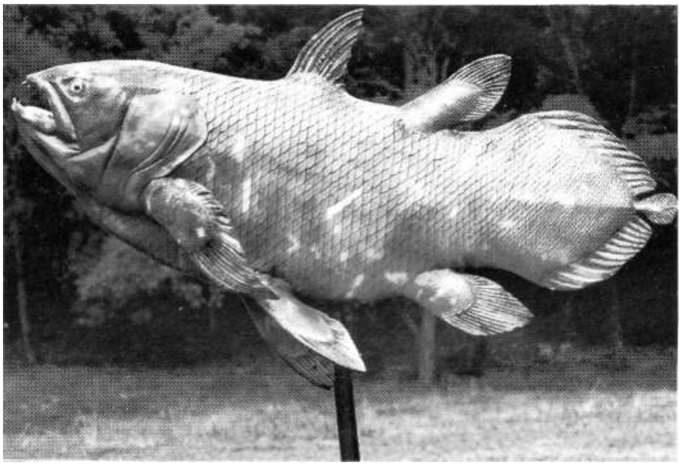
A. A. Snelling

Famous Living Fossil 'Link' Idea Fizzles Further

Palaeontologists of last century and the first half of this one enthusiastically taught that coelacanth fishes were the ancestors of land creatures. Of course, they knew coelacanths only as fossils, believing that they had gone extinct countless millions of years ago. They pointed to their muscular lobed fins and the bony structure therein as the ideal precursor structures for the limbs of tetrapods. Clearly, coelacanths would have already used their muscular fins to walk on the sea bottom.

However, living coelacanths were found, stunning long-agers, in 1938 (Figure 1). Later, films of their activities showed that they used their fins for anything but walking. Yet, says Alex Meyer of the University of Konstanz, Germany, the belief that they were the actual ancestral group to land animals is *'still the predominant textbook dogma'.*[1]



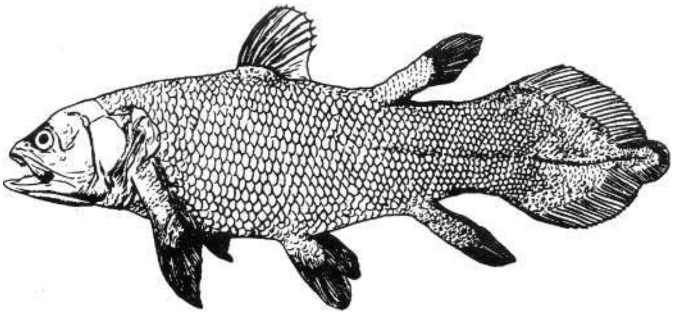


Figure 1. The coelacanth fish, once believed to be the ancestor of land creatures.

Granting the evolutionary scenario for the sake of argument, if coelacanths were really the descendants of the ancestral group which gave rise to tetrapods, one might expect that comparing their DNA to that of other groups of modern fishes, theirs would be the closest to that of land creatures. Mitochondrial DNA studies by Axel and others[1] have now suggested that this is not the case. Attention is now once more being focused on the lungfishes as possible candidates.

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