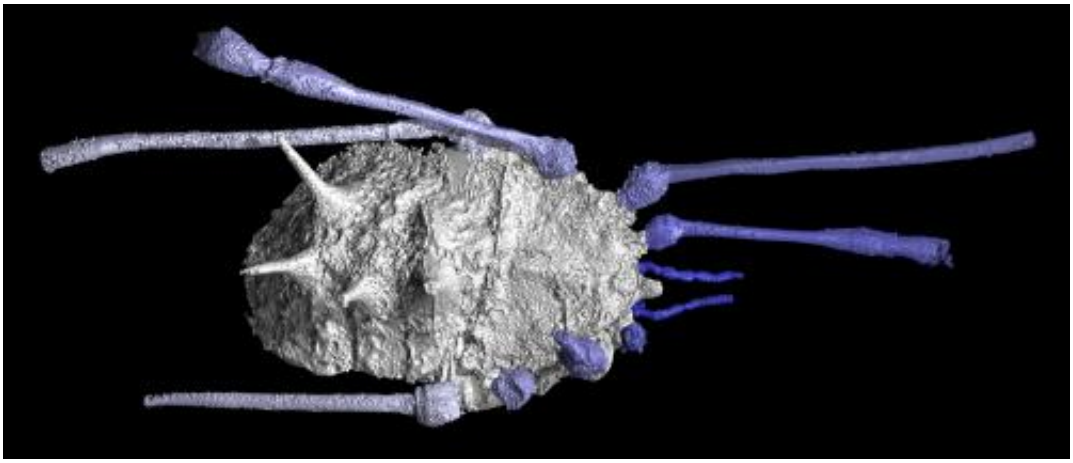
Ancient harvestmen revealed in 3-D models

August 23 2011



Dyspnoi

Two ancient types of harvestmen, or 'daddy long legs,' which skittered around forests more than 300 million years ago, are revealed in new three-dimensional virtual fossil models published today in the journal *Nature Communications*.

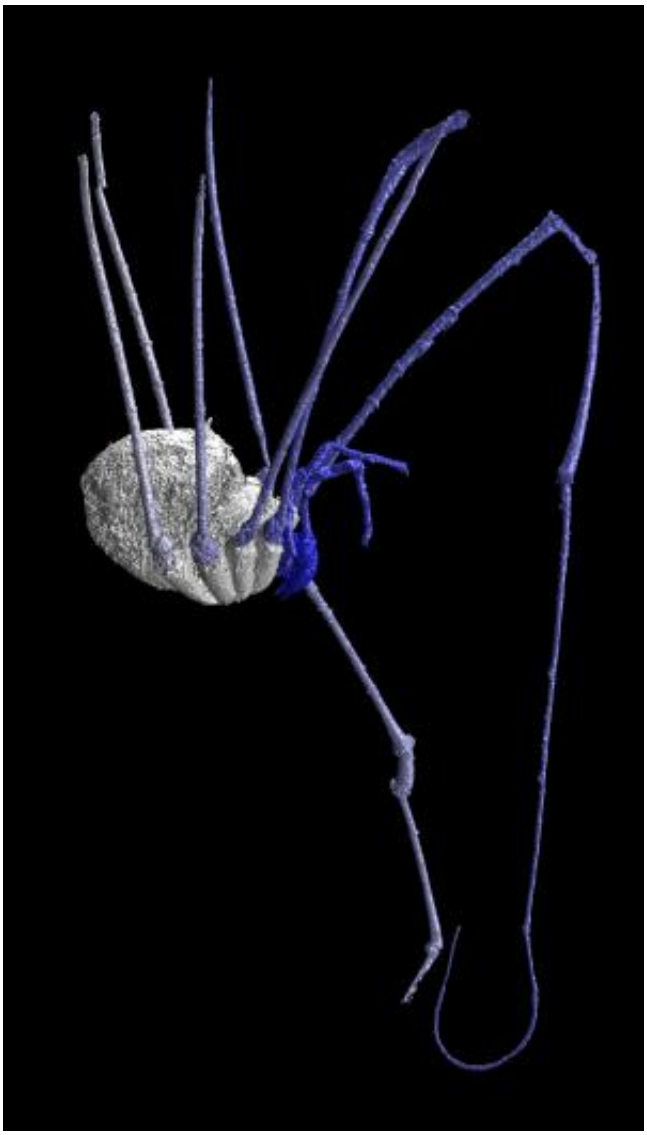
An international team, led by researchers from Imperial College London, have created 3D models of two fossilised species of harvestmen, from the Dyspnoi and Eupnoi suborders. The ancient creatures lived on Earth before the dinosaurs, in the Carboniferous period. The 3D models are providing fresh insights into how these ancient eight-legged creatures, whose 1cm bodies were the size of small buttons, survived in the Earth's ancient forests and how harvestmen as a group have evolved.

Other scientists have previously suggested that harvestmen were among the first groups on land whose bodies evolved into their modern-day form at a time while other land animals such as spiders and scorpions were still at an early stage in their evolution. The researchers say comparing the 3D fossils of the Dyspnoi and Eupnoi species to modern members of these harvestmen groups provides further proof that ancient and modern species were very similar in appearance, suggesting little change over millions of years.

Dr Russell Garwood, who is currently based in the computed tomography lab at the Natural History Museum in London and who carried out his research while at the Department of Earth Science and Engineering at Imperial College London, says:

"It is absolutely remarkable how little harvestmen have changed in appearance since before the dinosaurs. If you went out into the garden and found one of these creatures today it would be like holding a little bit of prehistory in your hands. We can't yet be sure why harvestmen appear so modern when most land animals, including their cousins such as scorpions, were in such a primitive form at the time. It may be because they evolved early to be good at what they do, and their bodies did not need to change any further."

The 3D virtual fossil models have also provided the researchers with further proof that the Dyspnoi and Eupnoi lineages had evolved from a common harvestmen ancestor around 305 million years ago. The researchers say their work supports earlier DNA-based studies and is important because it provides a clearer picture of the early evolution of these creatures.



Eupnoi

The researchers also found clues as to how both creatures may have lived hundreds of millions of years ago. The team believe that the Eupnoi probably lived in foliage just above the forest floor, which may have helped it to hide from predators lurking on the ground. The 3D model of the Eupnoi revealed that it had long legs with a curvature at the end that are similar to the legs of its modern relatives who use the curved leg parts to grip onto vegetation while moving from leaf to leaf.

The researchers also determined that the Eupnoi's body had a very thin and soft outer shell or exoskeleton by analysing a section of the 3D fossil showing a part of its abdomen that had been crushed during the fossilisation process. This indicated to the team the fragility of the Eupnoi's exoskeleton.

The Dyspnoi fossil had spikes on its back and the scientists believe this may have provided it with some protection from predators who would have found the creature a prickly meal to swallow, and that the Dyspnoi may have lived in moist, woody debris on the forest floor. Dyspnoi's modern American descendent Acuclavella cosmetoides also has spikes for protection and lives in similar environmental conditions.

It is rare to find fossilised remains of Harvestmen because their soft, tiny, fragile bodies are difficult to preserve during the fossilisation process. Only around 33 fossilised species have been discovered so far.

Currently, most palaeontologists analyse fossils by splitting open a rock and looking at the creatures encased inside. This means that they can often only see part of a three-dimensional fossil and cannot explore all of the fossil's features.

The method used in today's study is called 'computed tomography' and it enables researchers to produce highly detailed virtual models using a CT scanning device, based at the Natural History Museum in London. In this study, scientists took 3142 x-rays of the fossils and compiled the images into accurate 3D models, using specially designed computer software.

This research follows on from previous modelling studies carried out by Imperial researchers on other prehistoric creatures including ancient spiders called Anthracomartus hindi and Eophrynus prestivicii, and an early ancestor of the cockroach called Archimylacris eggintoni.

More information: "Carboniferous harvestmen demonstrate early cladogenesis and stasis in Opiliones' ", 23 August 2011, *Nature Communications* journal.

Provided by Imperial College London