Dino-era sex riddle solved by new fossil find

January 20 2011

"Mrs. T" is a female Darwinopterus (wingspan 0.78 m) preserved together with her egg. Credit: Lu Junchang

(PhysOrg.com) -- The discovery of an ancient fossil, nicknamed 'Mrs T', has allowed scientists for the first time to sex pterodactyls – flying reptiles that lived alongside dinosaurs between 220-65 million years ago.

Pterodactyls featured prominently in Spielberg's Jurassic Park III and are a classic feature of many dinosaur movies where they are often depicted as giant flying reptiles with a crest.

The discovery of a flying reptile fossilised together with an egg in Jurassic rocks (about 160 million years old) in China provides the first direct evidence for gender in these extinct fliers. This fossil shows that females were crestless, solving the long-standing problem of what some pterosaurs did with their spectacular head crests: showy displays by males.

The find was made by an international team of researchers from the Universities of Leicester, Lincoln and the Geological Institute, Beijing. Details of the unique new find are published today (January 21) in the journal *Science*.

David Unwin, a palaeobiologist in the Department of Museum Studies at the University of Leicester, was part of the research team that studied the fossil. He said:

"Pterosaurs, flying reptiles, also known as pterodactyls, dominated the skies in the Mesozoic Era, the age of dinosaurs, 220-65 million years ago. Many pterosaurs have head crests. In the most spectacular cases these can reach five times the height of the skull. Scientists have long suspected that these crests were used for some kind of display or signalling and may have been confined to males, while females were crestless. But, in the absence of any direct evidence for gender this idea remained speculative and crested and crestless forms were often separated into completely different species."

"The fossil we have discovered, an individual of Darwinopterus (a pterosaur first described by the same team of scientists in 2009) is preserved together with an egg showing that it must be female. This type of discovery, in which gender can be determined with certainty, is extremely rare in the fossil record, and the first to be reported for pterosaurs."

This graphic shows the sex-related features of Darwinopterus. The male (right) has a large head crest, but this is absent in the female (left). Credit: Mark Witton

The new discovery, christened "Mrs T" (a contraction of "Mrs Pterodactyl") by the research team, was made in Jurassic rocks of Liaoning Province in northeast China and seems to represent a tragic accident. The well developed shell shows that Mrs T was just about ready to lay her egg when she was killed in an accident that broke her left forearm, possibly the result of a storm, or perhaps even a volcanic eruption, which were common in this part of China around 160 million years old.

Dr Unwin said: "Mrs T shows two features that distinguish her from male individuals of Darwinopterus. She has relatively large hips, to accommodate the passage of eggs, but no head crest. Males, on the other hand, have relatively small hips and a well developed head crest. Presumably they used this crest to intimidate rivals, or to attract mates such as Mrs T.

"Mrs T is a once in ten lifetime's discovery. As long as the skull or hips are preserved we can now confidently identify males and females of

Darwinopterus and, even more importantly, we can use this technique to sex other pterosaurs because they often show differences in head crests and hips just as in Darwinopterus".

This is a close up of the egg (20 by 28 mm) preserved together with Mrs. T, a female Darwinopterus. Credit: Lu Junchang

Dr Unwin added: "Gender is one of the most fundamental of biological attributes, but extremely difficult to pinpoint with any certainty in the fossil record. Being able to sex pterosaurs is a major step forward. Finally, we have a good explanation for pterosaur head crests, a problem that has puzzled scientists for more than 100 years. Now, we can exploit our knowledge of pterosaur gender to research entirely new areas such as population structure and behaviour. We can also play matchmaker for pterosaurs bringing back together long separated males and females in the single species to which they both belong".

Apart from gender the new find also has much to tell us about pterosaur reproduction. Said Dr Unwin: "Mrs T's egg is relatively small and had a soft shell. This is typical of reptiles, but completely different from birds which lay relatively large hard-shelled eggs. This discovery is not

surprising though, because a small egg would require less investment in terms of materials and energy – a distinct evolutionary advantage for active energetic fliers such as pterosaurs and perhaps an important factor in the evolution of gigantic species such as the 10 meter wingspan Quetzalcoatlus."

Provided by University of Leicester