Lizard fossil provides missing link in debate over snake origins

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(PhysOrg.com) -- Until a recent discovery, theories about the origins and evolutionary relationships of snakes barely had a leg to stand on.

Genetic studies suggest that snakes are related to monitor lizards and iguanas, while their anatomy points to amphisbaenians ("worm lizards"), a group of burrowing lizards with snake-like bodies. The debate has been unresolved--until now. The recent discovery by researchers from the University of Toronto Mississauga and the Museum für Naturkunde Berlin, Germany of a tiny, 47 million-year-old fossil of a lizard called *Cryptolacerta hassiaca* provides the first anatomical evidence that the body shapes of snakes and limbless lizards evolved independently.

The findings appear in the journal *Nature*.

"This fossil refutes the theory that snakes and other burrowing reptiles share a common ancestry and reveals that their body shapes evolved independently," says lead author Professor Johannes Müller of Humboldt-Universitat, Berlin.

The fossil reveals that amphisbaenians are not closely related to snakes, but instead are related to lacertids, a group of limbed lizards from Europe, Africa and Asia. "This is the sort of study that shows the unique contributions of fossils in understanding evolutionary relationships," says Professor Robert Reisz from the University of Toronto Mississauga, the senior author of the study. "It is particularly exciting to see that tiny fossil skeletons can answer some really important questions in vertebrate evolution".

The German research team, led by Müller and American graduate student Christy Hipsley, used X-ray computed tomography to reveal the detailed anatomy of the lizard's skull and combined the anatomy of *Cryptolacerta* and other lizards with DNA from living lizards and snakes to analyze relationships. Their results showed that *Cryptolacerta* shared a thickened, reinforced skull with worm lizards and that both were most closely related to lacertids, while snakes were related to monitor lizards like the living Komodo dragons.

Even though snakes and amphisbaeans separately evolved their elongate, limbless bodies, the discovery of *Cryptolacerta* reveals the early stages in the evolution of burrowing in lizards. By comparing *Cryptolactera* to living lizards with known lifestyles, co-author and U of T Mississauga paleontologist Jason Head determined that the animal likely inhabited leaf-litter environments and was an opportunistic burrower.

"*Cryptolacerta* shows us the early ecology of one of the most unique and specialized lizard groups, and also reveals the sequence of anatomical adaptations leading to amphisbaenians and their burrowing lifestyle,"

says Head. "Based on this discovery, it appears worm-lizards evolved head first."

Provided by University of Toronto