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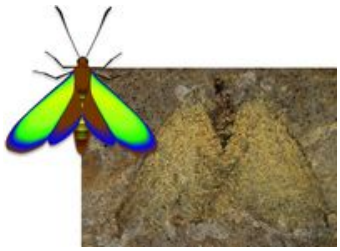
An Ancient Moth, Now in Full Color

by Brian Switek on 15 November 2011, 5:00 PM | 0 Comments

What was blue, yellow, and fuzzy all over? The answer, according to a new study on prehistoric color, is a 47-million-year-old moth. The brilliant hues, researchers say, may indicate that this group of insects has been waging an evolutionary arms race that dates back tens of millions of years.

ENLARGE IMAGE



Don't eat me. The restored colors (*inset*) of a 47-million-year-old moth (fossil, *above*) may have served to camouflage the insect and warn would-be predators of the creature's toxic taste.

Credit: Adapted from M. E. McNamara et al., PLoS Biology, 9 (2011)

It's not easy to figure out what animals looked like millions of years ago. The petrified remains of long-dead organisms do not typically preserve their original colors. But in the past few years, paleontologists have found a way around this obstacle through the phenomenon of structural color. By analyzing microscopic structures in a fossil, researchers can sometimes figure out which pigments they correspond to or which wavelengths of light they reflect. The approach has revealed the original hues of a variety of organisms, from beetles to feathered dinosaurs.

The latest creature to be cast in Technicolor is a 47-million-year-old moth found in the oil shale of Messel, Germany. This deposit is famous for its intricate fossil preservation, and the moth specimen was so exquisite that Yale University paleontologist Maria McNamara and colleagues were able to zoom in on the insect's wings to detect the fine details of tiny scales. The scales contained what McNamara calls "fossilized multilayered reflectors" in which "light is reflected at the same angle from the different layers in the structure, producing a single visible color." Using mathematical models designed to investigate the relationship between scales and colors in modern butterflies, she and colleagues were able to determine the hues of the fossil moth.

Although the fossilized moth looked brown and gold, the restoration revealed that this insect was much more vibrant in life. The outside of the wings were lightly outlined in brown before shading into blue, green, and yellow. No indication of iridescence was found, meaning that the colors would have looked the same from any viewing angle.

The reconstructed palette, which the team describes online today in *PLoS Biology*, may provide paleontologists with clues about the habits of the prehistoric moth. The green color and lack of iridescence on the moth's wings, McNamara and colleagues suggest, are features often associated with camouflage among modern insects. Perhaps the coloration helped the moth hide from would-be predators, such as bats, in the ancient Messel forest. Alternatively, it could have acted as a deterrent. "The color would have been very conspicuous when [the moths] were feeding on flowers," McNamara says, "when it probably would have served as a warning signal" in the same way that modern moths use bright colors to let predators know they are toxic and taste awful. Today's moths, she

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says, may be carrying on an arms race between predator and prey that goes back at least 47 million years.

The new analysis probably pinned down the actual color of the fossil moth, says entomologist Daniel Janzen of the University of Pennsylvania. But what those colors meant for the insect's lifestyle is more difficult to discern, he cautions. The bright hues could have been useful for courtship, camouflage, or communication, as seen among living moths, he says. Still, Janzen notes that the connection between colors and behavior can be applied to the fossil record just as it can to modern moths: "We have no reason to suspect that basic field ecology was different 40-plus million years ago than it is today."

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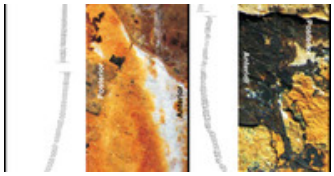

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