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Fossilized beetles are redder than they were in life

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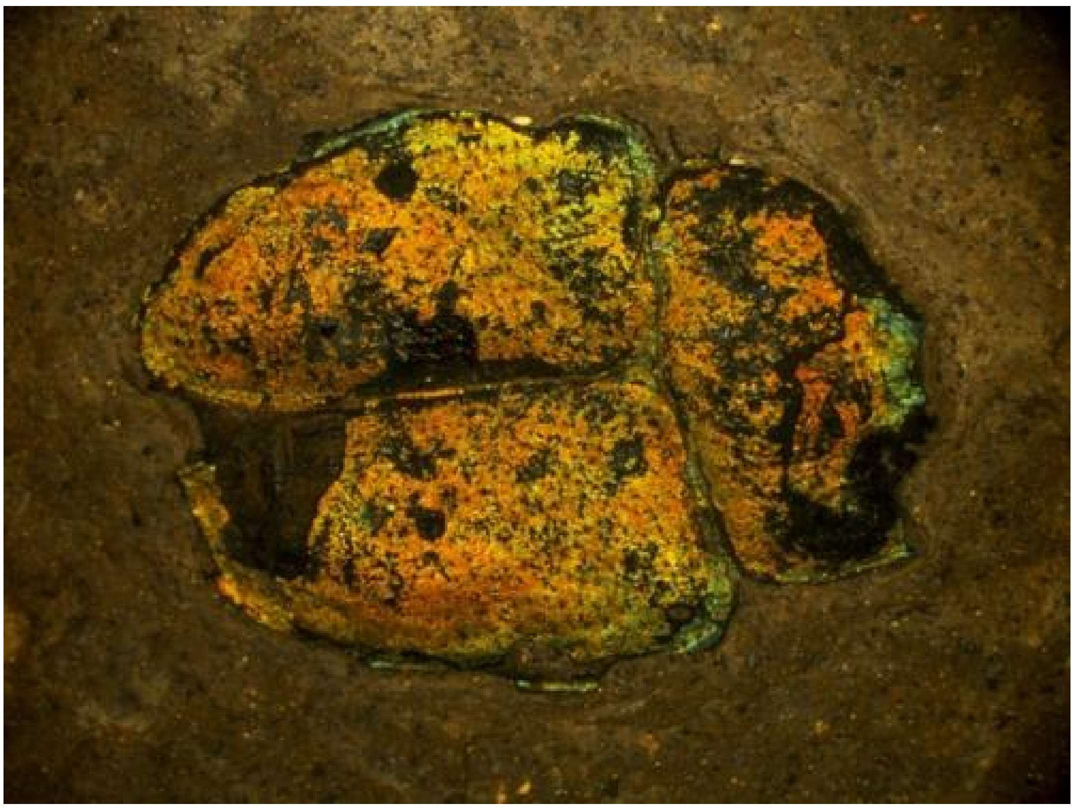

Image credit: Maria McNamara

(PhysOrg.com) -- A new study published in the journal *Proceedings of the Royal Society B* shows that the colors of fossilized beetles do not represent the colors they sported in life. From what researchers can determine, the fossilization process shifted the colors toward the red end of the spectrum.

Maria McNamara, a postdoctoral research fellow from the Department of Geology and Geophysics at Yale led the research. She and her team examined the fossilized remains of a variety of beetle specimens dating from 15 to 47 million years ago. The beetles had lived in what are now Idaho and Germany, as well as a few other locations.

Using a transmission electron microscope and a scanning electron microscope, the researchers examined the beetle's exoskeleton. The fine layers that make up the exoskeleton and the way these layers bend and reflect light is what is responsible for the magnificent colors seen in these beetles. Using the microscopes, the team determined that the process of fossilization had changed the chemistry in the exoskeleton structure and altered its refractive index. This change caused the colors to redshift, so brightly violet beetle from millions of years ago would appear blue in a fossilized form just as a bright yellow beetle would now appear more orange.

The researchers point out that this new information will allow them to determine the true color of these insects and give them evidence of the evolution of structural color. McNamara explains that colors have a variety of functions and may play a role in communication or thermoregulation, so identifying the true color of the insects can help them better understand what the colors were used for.

While the researchers saw this redshift in the beetles they examined, they do caution that the level of redshift differed slightly between specimens. The beetles they examined also came from similar lake sediment and they suggest that other sediment may also alter the changes seen.

While this study was done on beetles, the hope is it can now be used to help determine the original colors in other insects such as butterflies and dragonflies.

More information: The original colours of fossil beetles, *Proceedings of the Royal Society B*, Published online before print September 28, 2011, doi: 10.1098/rspb.2011.1677

Abstract
Structural colours, the most intense, reflective and pure colours in nature, are generated when light is scattered by complex nanostructures. Metallic structural colours are widespread among modern insects and can be preserved in their fossil counterparts, but it is unclear whether the colours have been altered during fossilization, and whether the absence of colours is always real. To resolve these issues, we investigated fossil beetles from five Cenozoic biotas. Metallic colours in these specimens are generated by an epicuticular multi-layer reflector; the fidelity of its preservation correlates with that of other key cuticular ultrastructures. Where these other ultrastructures are well preserved in non-metallic fossil specimens, we can infer that the original cuticle lacked a multi-layer reflector; its absence in the fossil is not a preservational artefact. Reconstructions of the original colours of the fossils based on the structure of the multi-layer reflector show that the preserved colours are offset systematically to longer wavelengths; this probably reflects alteration of the refractive index of the epicuticle during fossilization. These findings will allow the former presence, and original hue, of metallic structural colours to be identified in diverse fossil insects, thus providing critical evidence of the evolution of structural colour in this group.

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