

Fabulous fossil preserves eyes of 429-million-year-old trilobite

Enlarge / Don't think you can pull one over on this trilobite—he's still got one good eye, ya know.

Brigitte Schoenemann

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Among fossils, trilobites are rock stars. They are adorable (as stony arthropods go), with a segmented shape distinctive enough to be a common logo. But they're also fascinating because there are so many examples in the fossil record over such a long period of time, given that they thrived for over 250 million years. Studying their evolution is enlightening in part because odds are good for finding excellent specimens.

The University of Cologne's Brigitte Schoenemann and the University of Edinburgh's Euan Clarkson took a look into the eyes of one exquisitely preserved trilobite specimen, and they learned plenty about how the creature's eyes developed and what that says about evolution. And, as a bonus, they conclude that this particular trilobite species was probably translucent.

A real lens

The fossil in question comes from 429-million-year-old

sedimentary rocks in the Czech Republic. It's a centimeter-long trilobite called *Aulacopleura koninckii* that split in half as the rock layer was peeled apart. The shape of the structures in one of its two eyes is nicely visible, with bits split between the two halves.

Like other early arthropods, trilobites had compound eyes—think about the many-faceted cluster of a fly's eye. Each unit in that cluster is called an “ommatidium.” At the top of each ommatidium is a lens, with cone cells beneath it that also help focus incoming light. That light is carried down through a stalk-like “rhabdom” to reach the receptor cells that send signals to the brain. The researchers could make out each of these components in the fossil.

Enlarge / Here you can see the whole compound-eye cluster.

Brigitte Schoenemann

Some of the details of these structures have been debated for trilobites, as it isn't every day you run across a fossil that

preserves them. Most notably, the makeup of the lens and cone pair is a little unclear, with questions about whether trilobites formed useful lenses using the mineral calcite, as some organisms do today. These researchers found an older (over 500-million-years-old) trilobite eye a few years ago and noted a meager, non-calcite lens that left the refractive work to beefy cone cells.

This trilobite eye looks different. The cone appears to be minuscule, while the lens is considerably thicker. Even a thicker lens made of chitin isn't refractive enough to focus light underwater, but it would be up to the task with calcite inside. The researchers suspect that's the case here.

Splendid isolation

Another interesting observation relates to what is *surrounding* this whole structure. In this kind of compound eye, each ommatidium has to be encased in something that blocks light in order to isolate it from the neighboring ommatidia, keeping each unit distinct. Structural walls can be seen fulfilling that job in the fossil specimen, but the researchers also seen signs of dark pigment in those walls. (Incredibly, these pigments are stable enough to be preserved in fossils.) That seems duplicative, but modern translucent critters like shrimp also have pigments in those walls since the walls themselves aren't sufficient to block light. So, the researchers suggest, these trilobites might also have been translucent.

Enlarge / The round structures are individual lenses atop an ommatidium—one unit of a compound eye.

Brigitte Schoenemann

Overall, *everything* about this compound eye looks modern—“comparable to that of living bees, dragonflies and many diurnal [daylight-dwelling] Crustaceans,” the researchers write. That would show just how long ago this system evolved.

Given things like the length-width proportions of the lenses and ommatidia in the fossil, the researchers can also use analogies to modern organisms to guess at the trilobite’s habitat, as well. It likely lived in well-lit, shallow waters and was active during the day, they say. So if you could travel back 429 million years, that’s where you’d start looking for *A. koninckii*, scurrying around like a glassy, flattened shrimp.

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