Trilobite Eyes

According to evolution, trilobites are some of the oldest creatures that one can find from the fossilised past. They were evidently sea going creatures walking on the sea floor and are called trilobites because they have 3 lobes. These are not the body sections cephalon, thorax and pygidium, but rather the three longitudinal lobes (see figure 1) – these are the central axial lobe, and two symmetrical pleural lobes that flank the axis.

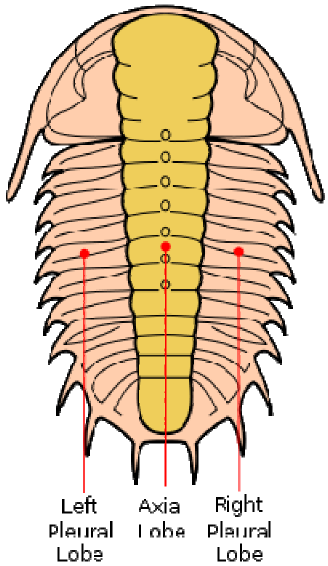

Figure 1   The three longitudinal lobes of the trilobite. (Diagram courtesy of Dr. Sam Gon III http://www.trilobites.info)

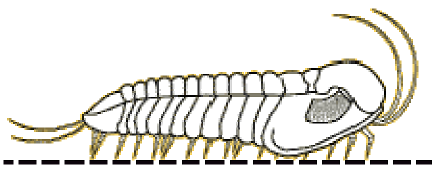

Figure 2   An impression of how a living trilobite would have looked on the sea floor. (Diagram courtesy of Dr. Sam Gon III http://www.trilobites.info)

There are a very large variety of trilobites and they are found in Cambrian through Devonian and Carboniferous up to Permian strata. Thus traditional dating for the trilobite fossils, which among animal fossils are very numerous, would be 550 million years ago through to 250 million years ago. A remarkable fact is that the precursors to these creatures have never been found. Arthropods (many legged creatures) appear abruptly in the Cambrian strata, and do not show evidence of development – rather there is a large variety of trilobite fossils in these layers which strongly suggests that all these varieties existed alongside each other.

Trilobite eyes

What is particularly fascinating is that the compound eyes of trilobites are not made of protein but in fact are made of calcite which is a crystal. But the problem with natural crystals of calcite ($CaCO_3$) is that they give double vision images as illustrated in figure 3. The reason for this phenomenon is due to the fact that some transparent materials are birefringent. By this is meant that such materials have two refractive indices, and not the usual one. When an arbitrarily polarized beam enters a birefringent crystal, it splits into two component beams, one polarized perpendicularly to the optical axis (the axis of rotational symmetry), called the 'ordinary' ray, and one with its polarization in a plane which includes the optical axis, called the 'extraordinary' ray. They travel independently in separate directions at different velocities and consequently objects viewed through the crystal have a double image effect. This will happen for all lines of sight except when viewing directly along the optical axis.

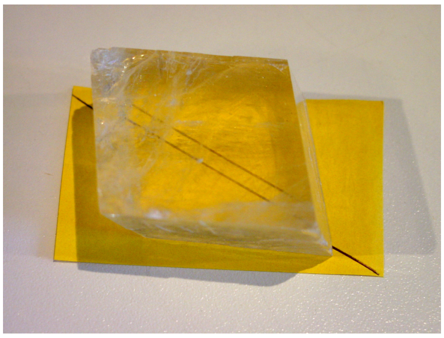

Figure 3 The double image occurring in a natural crystal of calcite (Calcium Carbonate $CaCO_3$)

The remarkable fact is that the individual lenses of the trilobite eye are oriented so that the line of sight is indeed directly aligned to the optical axis so that double images are not observed by the humble creature.

Another remarkable fact is that the depth of field is very large. Objects remain in focus at a distance of a few millimetres up to infinity.

Lastly sophisticated control of spherical aberration (distortion) is in evidence. By shaping the lens in such a way that there is appoint of inflexion on a radial outward from the centre, it was discovered by Descartes and Huygens that there were certain optimum shapes to remove such aberration and to keep the image in sharp focus. The astonishing fact is that the shape of these lenses is exactly in accordance with these shapes[1] discovered in the 17th Century, by Descartes (1596-1650) and Huygens (1629-1695). The lenses of calcite in the trilobite eyes have both these shapes and an intralensar material is further added and attached to the main lens to sharpen the image[2]. The upper part of the

[1] Clarkson, E. N. K. & R. Levi-Setti. 1975. 'Trilobite eyes and the optics of Descartes and Huygens'. Nature 254 (1975): 663-667.

[2] See web site by S. M. Gon III http://www.trilobites.info/eyes.htm In this web site there is a wealth of information as to the different types of trilobites and in particular a very useful description of the calcite compound eye structure. Gon has a disclaimer against

doublet lens is particularly important for seeing in water, The additional material has a different refractive index and enables the sharp focus to be maintained over a depth of field.

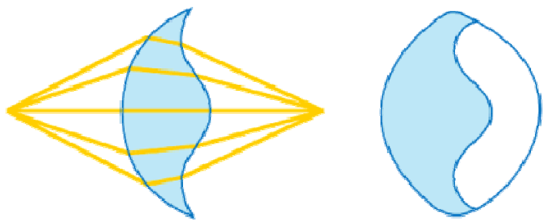

Figure 4. The Descartes lens designed for minimal aberration (left) is found in the lens of the trilobite Crozonaspis (right).

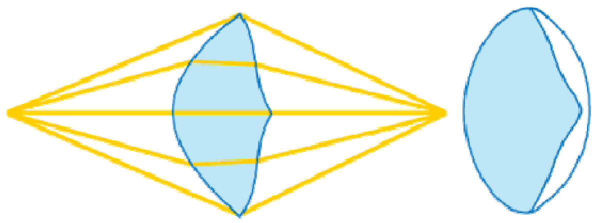

Figure 5. Huygens' lens design for minimal aberration (left) is found in the lens of the trilobite Dalmanitina (right)

In his book of 1993, Levi Seti states[3] "Trilobites had solved a very elegant physical problem and apparently knew about Fermat's principle, Abbe's sine law, Snell's laws of refraction and the optics of birefringent crystals…". Such statements hardly support the notion that mindless natural selection could evolve such physics.

The sophistication of the optics using lenses made from birefringent material, such that the optical axis of each of the calcite components are aligned to the line of sight is astonishing. That furthermore each of the hundreds (and in holochoral cases, thousands) of lens shapes is identical to the Huygens or Descartes optical shapes is a strong indicator of intelligence design. These facts coupled with the lack of any precursors to trilobites in the Precambrian strata, confirm that that these creatures did not come from simpler ancestors, but are part of a family of animals created for a sea floor environment.

A C McIntosh Jan 2013 – This article first appeared in 'Origins – Examining the evidence'
Barnard, McIntosh and Taylor, Truth in Science, Nov. 2011

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intelligent design, and argues that the eyes are an example of evolution. The fact that there are no precursors in the Precambrian strata strongly suggests that the trilobite family represents an example of a creature designed for its environment. The sophisticated optics of the trilobite eye is entirely consistent with this position. The reader is encouraged to examine the evidence and draw his own conclusions.

3 Levi-Setti, R. 1993. "Trilobites: A photographic atlas", Second edition, 1993,. The University of Chicago Press, Chicago, p. 33.