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 )

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.

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 )
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](image.png)

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 an 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 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. The upper part of the

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2 See web site by S. M. Gon III [http://www.trilobites.info/eyes.htm](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.

In his book of 1993, Levi Seti states\textsuperscript{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.

\textit{A C McIntosh Jan 2013 – This article first appeared in ‘Origins – Examining the evidence’
Barnard, McIntosh and Taylor, Truth in Science, Nov. 2011}