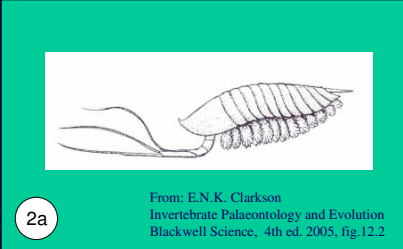
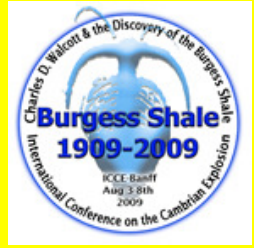


# The Eyes of *Leancoilia* ... and *Anomalocaris* sp.

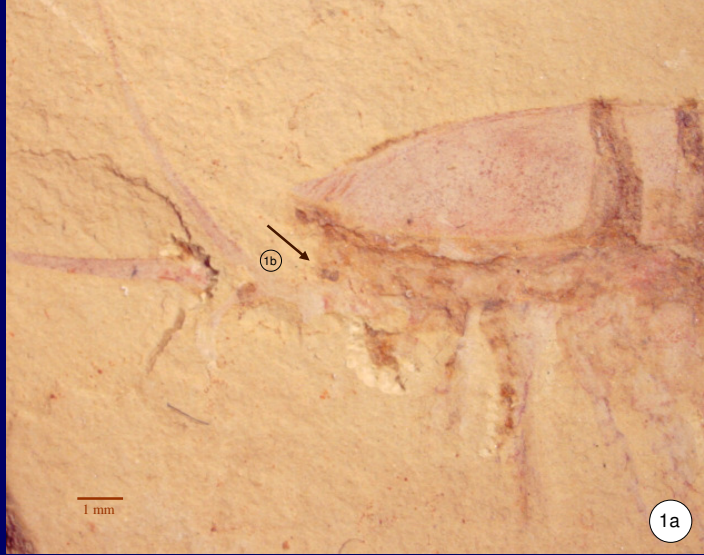
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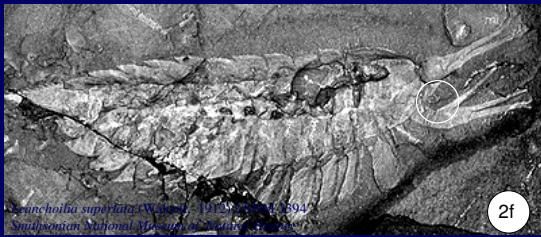
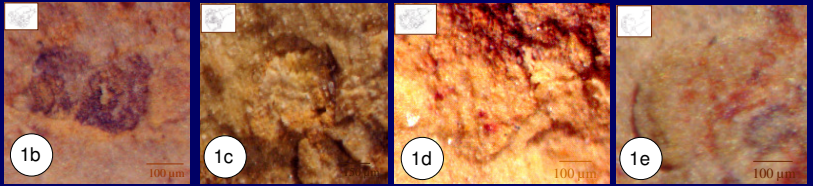
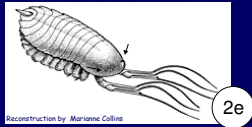
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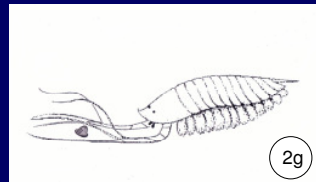
*Leancoilia* represents one of the most common non-trilobite arthropods known in the Lower and Middle Cambrian. Walcott himself described *L. superlata* to have pedunculate eyes, as had been proposed for *L. illecebrosa* from China. On the other hand, there is a long history of observations describing two pairs of pits on the head, interpreted as eyes, but without facets, attached near the front of the headshield. Most of the reconstructions, however, made between 1935 and 1983 did not show any eyes, and also during the following time the genus was considered to be blind.



Photographs from Butterfield 2002



*Leancoilia*, like many modern arthropods, has two kind of eyes: two stalked ventral eyes, and four dorsal median eyes. Methods of modern physiology allow to analyse their characteristics. The stalked eyes show a spatial frequency (Snyder 1977)  $v_s$  of  $\sim 1.2$  cycles/ radian, which is a measure to describe anatomical acuity. It is a rather low acuity like that of deep sea isopods (eagles reach 8000 c/r, man 4200 c/r). The anatomical sensitivity (Land 1981) is comparably high and can be approximated to  $266 \mu\text{m}^2 \text{ rad}$ , similar to *Limulus* (horse shoe crab), a mainly nocturnal arthropod. This is confirmed by the eye parameter (Snyder 1977)  $p = 28 \mu\text{m rad}$ , in the compromise between acuity and light gathering indicating an at least crepuscular life-style. These eyes are downwards directed, which would allow the detection of benthic worms and other small organisms to prey, but they are not really image forming as necessary for a free swimming predator. Thus the eyes of *Leancoilia* tell us, that this arthropod was a crepuscular bottom dweller. It used the great appendages to search for organisms in the ground, as it was driven forward by the backwards striking appendages. The dorsal eyes we interpret by their morphology as median eyes. In general the number four is considered to be an euarthropodean autapomorphy, already to be found here.



### *Anomalocaris* sp.

Anomalocarids were the most impressive predators of their time. In this species of Chengjiang the bulbous eyes were extended laterally, while the lenses pointed downwards to scan the space beyond for prey effectively. Additionally the eyes rather probably could be rolled forward and backward – enabling an enormous field of view. The eye had an anatomical acuity ( $v_s = 11$  c/r) comparable to that of shore crabs and a quite high number of visual units to form the mosaic-like image of an effective compound eye. The anatomical sensitivity ( $S = -27 \mu\text{m}^2 \text{ sr}$ ) as the eye parameter ( $p = \sim 9 \mu\text{m rad}$ ) indicate an at least crepuscular if not nocturnal life style. The outermost tip of the eye has smaller lenses but a lower acuity ( $v_s = 6$  c/r), and is to be interpreted as a zone of growth.

3a

3b 3c 3d

3e

3f

3g

... at least for this species of Chengjiang ...