Blasts from the Past 8: The Determination of the Mode of Life of Trilobites

Background

PDFs of Teaching Earth Sciences 26.3 onwards may be downloaded from the ESTA website and there is an archive section on the website that includes copies of the earlier publications of ESTA and the Association of Teachers of Geology (the precursor to ESTA). There are some useful teaching ideas in these earlier publications. Some of these ideas are being updated and re-published in the magazine under the heading: "Blasts from the Past".

The determination of the mode of life of trilobites

This activity was produced by Mike Merchant (Merchant, 1978). It is a simple but effective exercise that encourages students to look at the morphology of fossil trilobites, record their observations and then use the morphological features observed to objectively determine how trilobites lived. The original activity has been updated so that it now includes a recording sheet and a set of photographs that can be used if specimens or plaster cast models of trilobite fossils are unavailable. Web links have also been added to extend the activity and provide background information about trilobites. This exercise is suitable for A-level students, who should have knowledge of trilobite morphology and an idea of how trilobites may be classified. It can also be adapted for use with GCSE students.

Introduction

Mode of life of extinct species can be determined by comparison with closely-related living fauna and extrapolating that information back to extinct forms. This method of determining mode of life relies on biological uniformitarianism and so it cannot be used if a group of fossils is now extinct. A second method is to study a group of fossils, attempt to explain their shape, form and structure (morphological features) in terms of their function during life and so work out how different adaptations relate to different modes of life. (This concept of relating morphological features to their function during life is called functional morphology)

Trilobite modes of life

Studies of the mode of preservation of trilobites and the rock types they are associated with indicate that trilobites were marine animals. Trilobites show a wide variation in morphology and these differences in morphology can be related to the way in which they lived in their marine environment. Most of these animals were adapted to one of three modes of life: some lived as benthonic crawlers, others had a burrowing mode of life or were adapted to living in the water column where they had an active swimming (nektonic) mode of life. Table 1 outlines trilobite morphological adaptations related to each of these modes of life.

Mode of Life	Habitat	Morphological Adaptation
Benthonic crawlers: Weighting: 0-7	The animal browsed or 'grazed' on or near the sea floor, probably in the neritic zone.	• large thorax with many jointed limbs • large projecting compound eyes placed high on the cephalon • ventrally-situated mouth • pygidium reduced, usually tapering • spine may be present at the posterior margin of the pygidium • isopygous (cephalon equal in size to pygidium)
Burrowers: Weighting: 7-18	The animal lived a near sessile existence buried just below the substrate in soft mud or silt.	• large cephalon with thickening along the anterior margin • reduced thorax and pygidium • eyes absent, reduced or placed on 'stalks' • convex cheeks with a marginal facial suture • micropygous (cephalon larger than pygidium)
Active swimmers (nektonic): Weighting: 18-38	The animal, using its pygidium and appendages, swam freely, for varying distances, probably close to the sea floor.	• streamlined body, large pygidium • thorax of many segments • large anterior compound eyes • macropygous (cephalon smaller than pygidium)

Table1 Morphological features of trilobites

Exercise

1. Study the five trilobites shown in Figures 1 to 6.
2. On Table 2, indicate with a tick the morphological features that apply to each trilobite.
3. Use Table 2, add up the total weightings for each morphological adaptation and record the totals on this table.
4. Using Table 1, assess the most likely mode of life for each trilobite and then complete Table 2.

Figure 1 *Calymene clavicula*
(Photograph by Dwergenpaartje at English Wikipedia)

Figure 2 *Dalmanites limulurus*
(Photograph by DanielCD at English Wikipedia

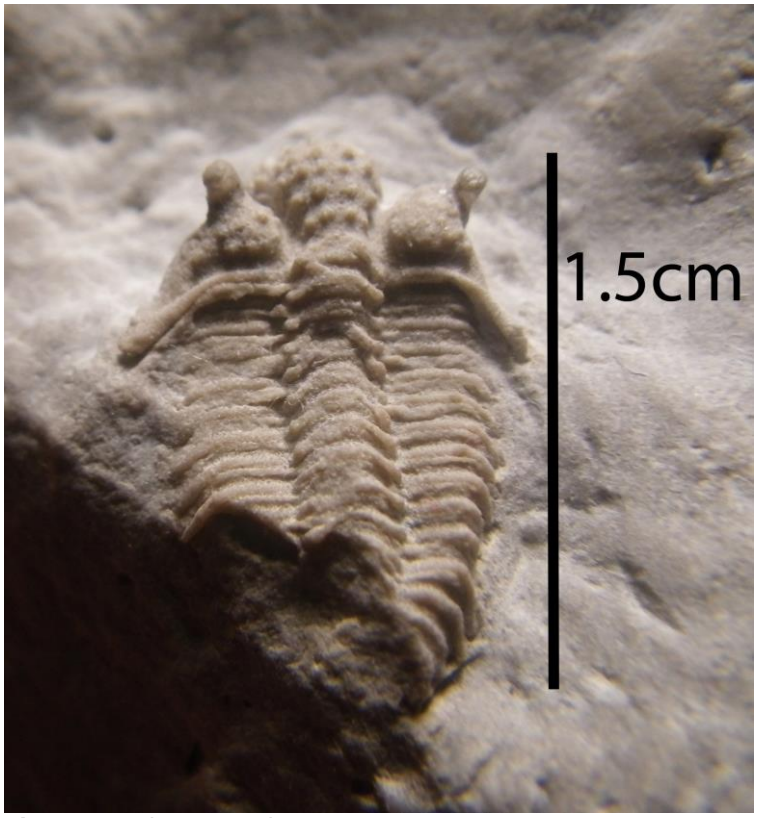

Figure 3 *Encrinurus egani*
(Photograph by squalicorax1234 at English Wikipedia)

Figure 4 Trinucleoidea trilobite *(Lloydolithus llyodi)*
(Photograph by Tomleetalwan at English Wikipedia)

Figure 5 *Ogygiocarella debuchii*
(Photograph by Dwergenpaartje at English Wikipedia)

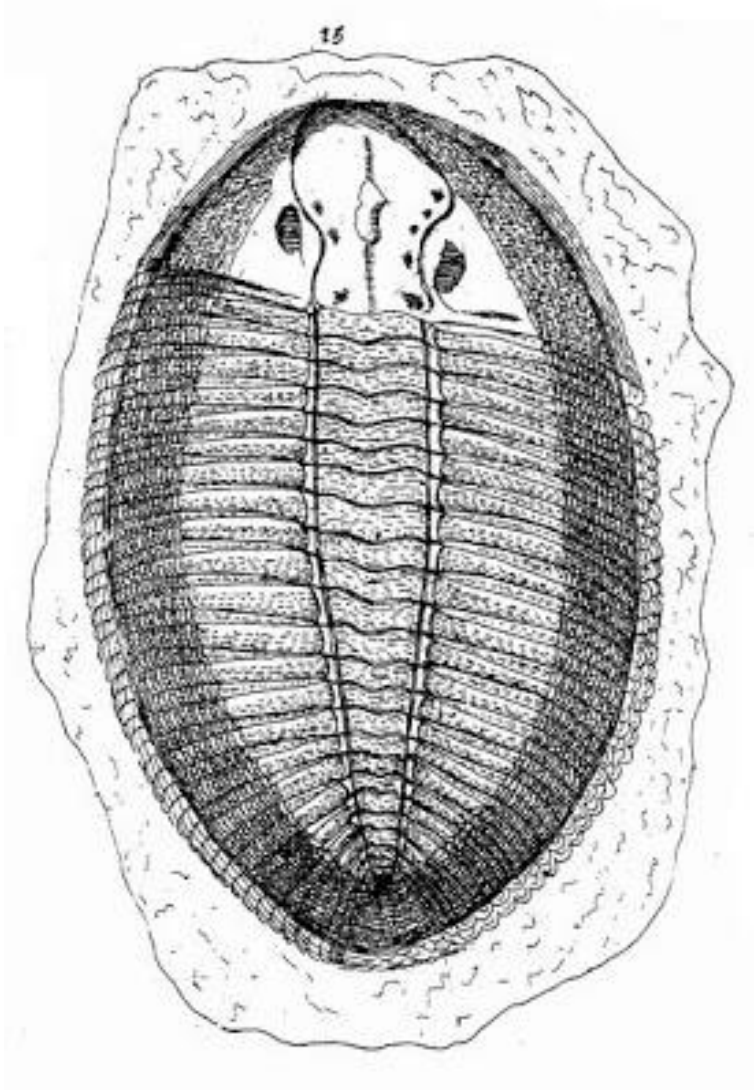

Figure 6 Etching of the trilobite *Ogygiocarella debuchii*
(Etching by Rev. Edward Lhwyd at English Wikipedia)

Weighting	Morphological Adaptation	*Calymene* Figure 1	*Dalamanites* Figure 2	*Encrinurus* Figure 3	*Trinucleoidea* Figure 4	Ogygiocarella Figures 5 & 6
5	Less than 7 thoracic segments					
10	1-11 thoracic segments					
1	11-13 thoracic segments					
2	Large centrally-placed compound eyes					
11	Compound eyes with marginal or anterior position					
6	Eyes absent or stalked					
7	Convex cheek with marginal facial suture					
9	Streamlined dorsal outline					
3	Isopygous					
4	Micropygous					
8	Macropygous					
	Totals					
	Probable mode of life: benthonic crawler or swimmer or burrower					

Table 2 Record of the morphological features of different types of trilobites

References

Merchant M. (1978) The determination of the mode of life of trilobites. *Geology Teaching*, **3** (3) pp. 21-22.

1. Photographs of Ordovician Trilobites of the United Kingdom.
http://www.amnh.org/our-research/paleontology/paleontology-faq/trilobite-website/gallery-of-trilobites/ordovician-period-trilobites/ordovician-trilobites-of-the-united-kingdom-alphabetized/
[Accessed May2016]

2. Further information about trilobites – and more photographs.
http://www.palaeontologyonline.com/articles/2013/fossil-focus-trilobites/
[Accessed May2016]

3. This site is an illustrated web guide to the orders of trilobites.
http://www.trilobites.info/trilobite.htm
[Accessed May2016]

4. This site shows line drawings of trilobites. The drawings are in a consistent style.
http://www.trilobites.info/drawing.htm
[Accessed May2016]

5. Information about trilobite feeding habits.
http://www.trilobites.info/feeding.htm
[Accessed May2016]

6. Summary of modification to Trilobite morphology and mode of life.
http://web.missouri.edu/~macleodk/paleo5-17h%20trilobites.pdf
[Accessed May2016]

7. Life in the Palaeozoic and basic information about trilobites.

http://www.open.edu/openlearn/nature-environment/natural-history/life-the-palaeozoic/content-section-4.1
[Accessed May2016]

8. A well-illustrated article by Richard Fortey. It describes the life styles of trilobites (reprint from American Scientist).
http://www.cornellcollege.edu/geology/courses/greenstein/paleo/trilobites.pdf
[Accessed May2016]

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