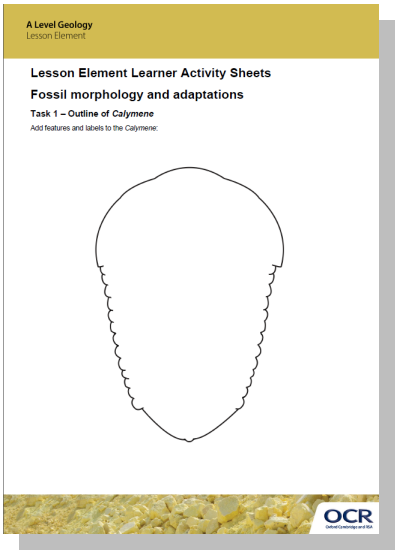
Lesson Element

Fossil morphology and adaptations

Instructions and answers for teachers

These instructions should accompany the OCR resource 'Fossil morphology and adaptations' activity which supports OCR A Level Geology.



Introduction to knowledge of modes of life for fossils

A series of activities that could be applied to any of the fossil groups studied in A2 Unit 795: *Evolution of Life, Earth and Climate* – printable resources have been included for the trilobite section with extension resources for ammonites, brachiopods, bivalves and echinoids.

Associated materials

- A Level Geology (2008) Heinemann, Unit 5, Module 2 p228-248 'Morphology of Fossils and Adaptation of Organisms'
- Lesson Element learner activity sheets
- PowerPoint of the completed diagrams as this will save photocopies
- Selection of fossils, mould of fossils or photographs of fossils available to teacher

Learning outcomes

These tasks have been developed by an experienced teacher from strategies used in a similar context with GCSE science students. They are designed to:

- engage students in the learning of new terminology
- encourage group learning through the use of collective memory strategies
- apply new terminology in familiar and unfamiliar settings
- promote higher level thinking skills.

By using these tasks students will be able to:

- describe and label the trilobite exoskeleton
- explain the function of each morphological feature
- identify and justify features required for a trilobite with a nektonic way of life
- identify and justify features required for a trilobite with a planktonic, benthonic or infaunal way of life
- to apply their knowledge through justification of the importance of features for organisms
- apply knowledge to models and hand specimens of fossils

Introduction to the task

When studying A2 Unit 795: *Evolution of Life, Earth and Climate* students may struggle to recall the large amount of new terminology required for each of the fossil groups; these activities provide alternative ways to help students to engage with and understand the terms. By making small changes to the students' expectation of the teaching and learning style in the lesson they become active questioning participants in the process rather than passive copiers of information.

Students often have an overall knowledge about the characteristics of fossils and their way of life but find it difficult to apply this knowledge and use morphological terms accurately. These tasks help students to recall morphological terms and their functions through the repetitive use of the same terms while applying them to increasingly challenging and unfamiliar situations. Students are challenged to consider the importance of each feature from the perspective of the organism living in a particular environment.

Students start by learning the basic morphology of trilobites using clear and typical diagrams in a collective memory group task. In the follow on tasks students engage with the individual parts of the fossil and rank which would be most important for the fossil, including a justification for their decisions. Further stretch and challenge for students is provided through diagrams of other species of trilobite, adapted to different life styles, which they need to label. Finally students should be prepared to produce

their own annotated sketches using the plaster casts and/or hand specimens of fossils that are available in the school/college.

Introduction to trilobite morphology

Task 1 – Outline of *Calymene*

Group students in teams of 3-4.

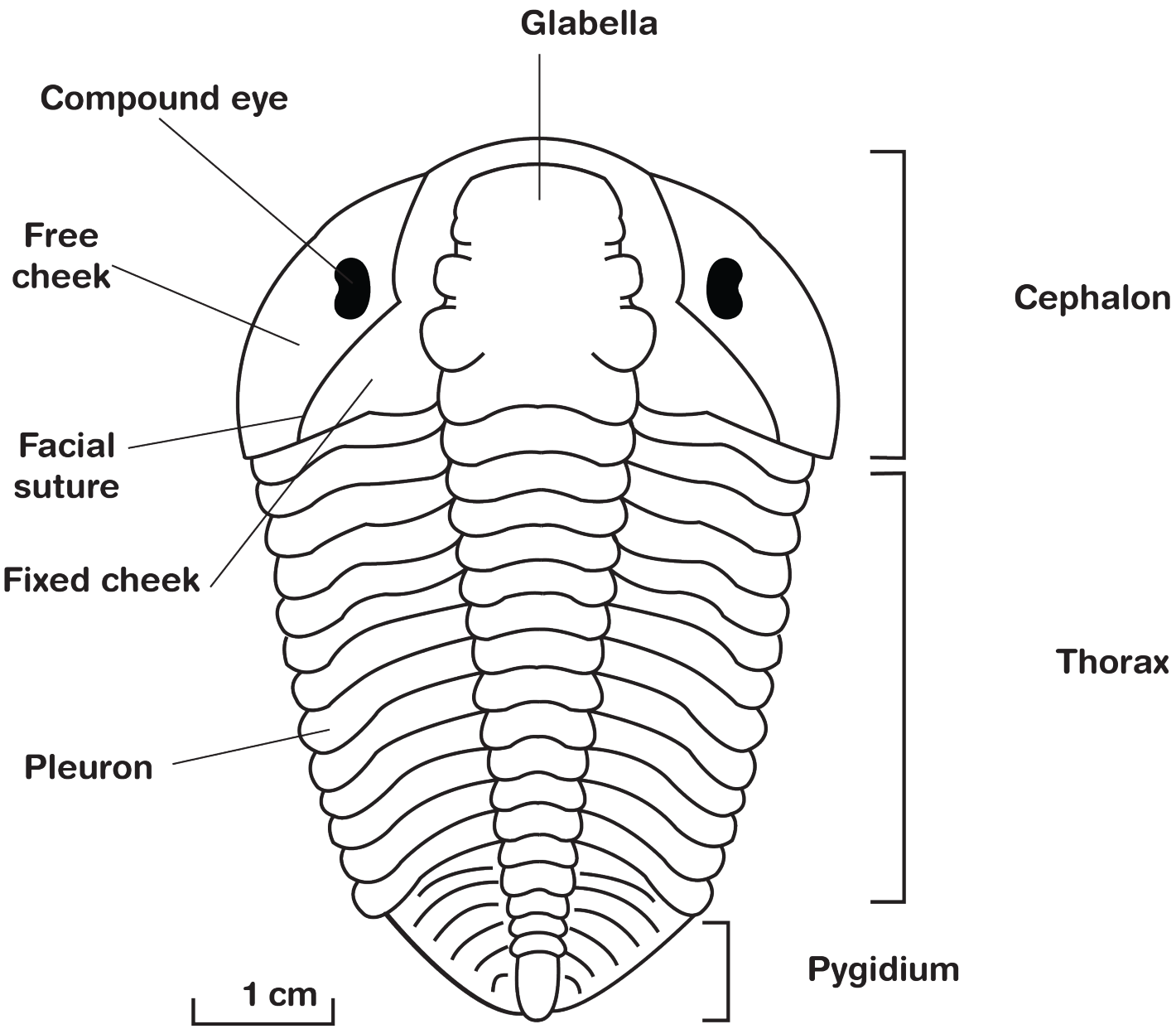
Provide each group with an outline of *Calymene.*

At the front of the class lay out several copies of the completed and labelled *Calymene* diagram to allow at least one copy for every two groups.

One student at a time (per group) goes to front of the class; they have 10 seconds to study the completed diagram. The student returns to the group and adds features and labels to their outline. Groups can discuss what information the next student needs to find out. Repeat until all students have fed back to their group twice.

Display the completed diagram to the class, allowing groups to self-assess against the features they have drawn on and the labels added.

Calymene with morphological features labelled



Task 2 – Labelling features in unfamiliar situations

Groups can use their diagrams from Task 1 to support the following activity.

Depending on resources available provide students with a sheet of unlabelled images of trilobites (from the internet or palaeontology textbooks) and ask them to sketch and label as many of the features as they can using their original diagram to help. Alternatively provide students with a range of hand specimens of trilobites which students could sketch and label.

Examples could include *Trinucleus, Deiphon, Olenellus, Paradoxides, Cyclopyge, Trimerus, Illaenus, Dalmanities, Phillipsia, Agnostus, Ogygiocaris.*

To conclude this task, students should sort the trilobites into two groups, one which is easier and one which is harder to label and they should explain why they have grouped them in this way.

Task 3 – Functions of features

Provide each group with the *Calymene* diagram which includes labels and function of each feature and lifestyle (available in learner activity sheets).

Each group must rank each feature to indicate which is most important to the organism.

Discuss as a class the different decisions groups have made. Students must justify why they think each feature is important or why a feature is not important.

All groups should answer the following question and then share responses with neighbouring groups.

Which features could the *Calymene* trilobite survive without? Identify the features and justify your decision.

Task 4 Extension activity – How trilobites are adapted to lifestyle

Provide each group with labelled diagrams of *Agnostus, Deiphon* and *Trinucleus*.

Repeat the activity of ranking each feature for each individual trilobite. This time students should focus on the different environments in which each trilobite would be found and how this may make different morphological features important.

All groups should answer the following questions and then share responses with neighbouring groups.

Which features could the *Agnostus, Deiphon* and *Trinucleus* trilobites survive without? Identify the features and justify your decision.

How would you improve the morphology of each trilobite to increase its chance of survival/success in a particular environment?

Task 5 Homework activities – Bivalves, Brachiopods, Echinoderms and Ammonites

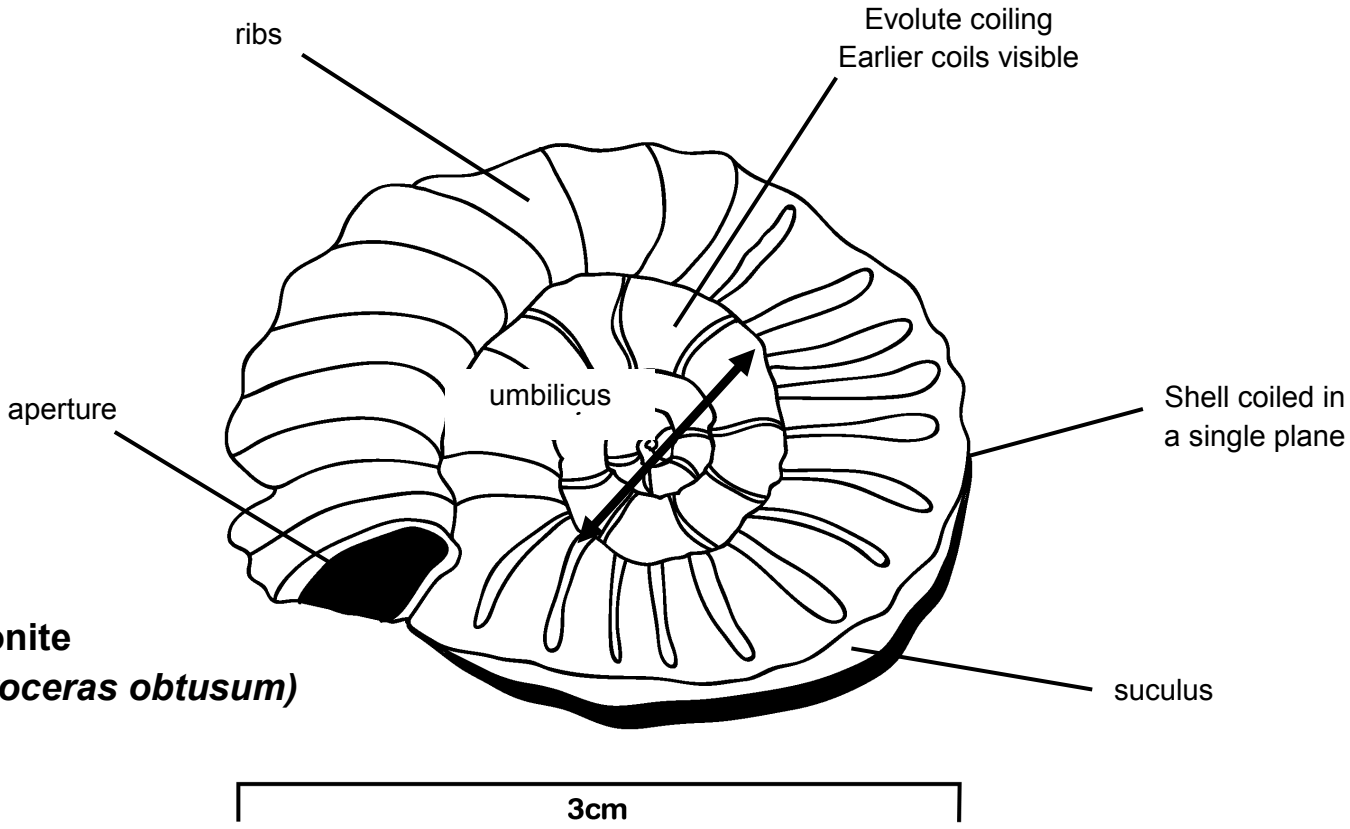
Outline drawings are provided for example for the following fossil Groups.

1. Ammonite - *Asteroceras obtusum* a rather plain Jurrassic ammonite from the Black Ven Marls at Lymme Regis, internally it shows spectacularly complex suture lines. Ammonites are used as zone fossils in Mesozoic.
2. Brachiopod – *Spirifer* a common fossil in the British Carboniferous. Brachiopods are used as zone fossils in Lower Carboniferous reef limestones.
3. Bivalve - *Lutraria lutraria* the common otter shell, these shells (up 15cm long) with an obvious palial sinus, can be collected from British beaches. Bivalves are used as zone fossil in Tertiary and non-marine Carboniferous (Coal Measures).
4. Echinoid – *Micraster* – heart urchin, this is an internal mould found on the beach at Littlehampton, Sussex. Echinoids are used as zone fossils in the Upper Cretaceous chalk.

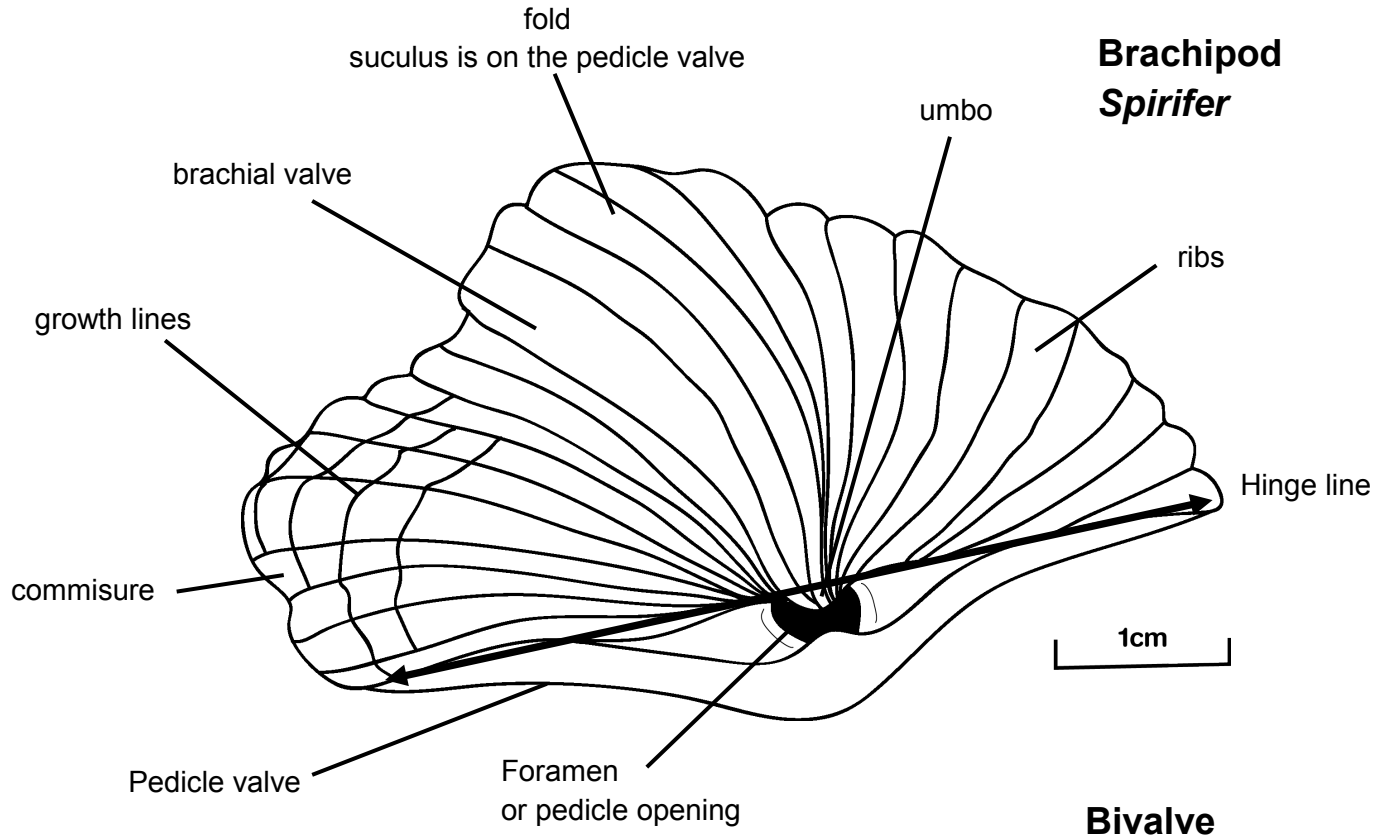
These resources can be used by students in a number of ways:

- Simple labelling exercise transferring detail from idealised textbook drawings to more typical field sketches of real fossils.

- Using the labelled field sketch apply their knowledge of morphological adaption to interpret the mode of life of fossil, justifying their interpretation.
- Starting from the example field sketch develop a resource using two further examples to teach other students how the basic form of each Group adapts to different modes of life.
    - Bivalve – epifaunal (eg muscle or oyster), shallow burrowing (eg cockle), deep burrowing (eg common otter)
    - Brachiopod – inarticulate (eg *lingula*), articulate with pedicle (eg *spirifer*), articulate without pedicle (eg *productids*)
    - Echinoids – regular (epifaunal), sand dollars (shallow burrowing), heart urchins (deep burrowing)
    - Ammonites – evidence for environmental adaption in ammonites is equivocal and still the subject of debate. Keel or suculus may indicate strong swimming predatore, elaborate ornamented shells may indicate slow moving benthic scavangers while some heteromorphs are interpreted as pelagic vertical migrants.
- Compare the morphological features of bivalves and brachiopods and suggest why bivalves have replaced brachiopods as the dominant shelled organisms in the shallow marine seas in the Tertiary.

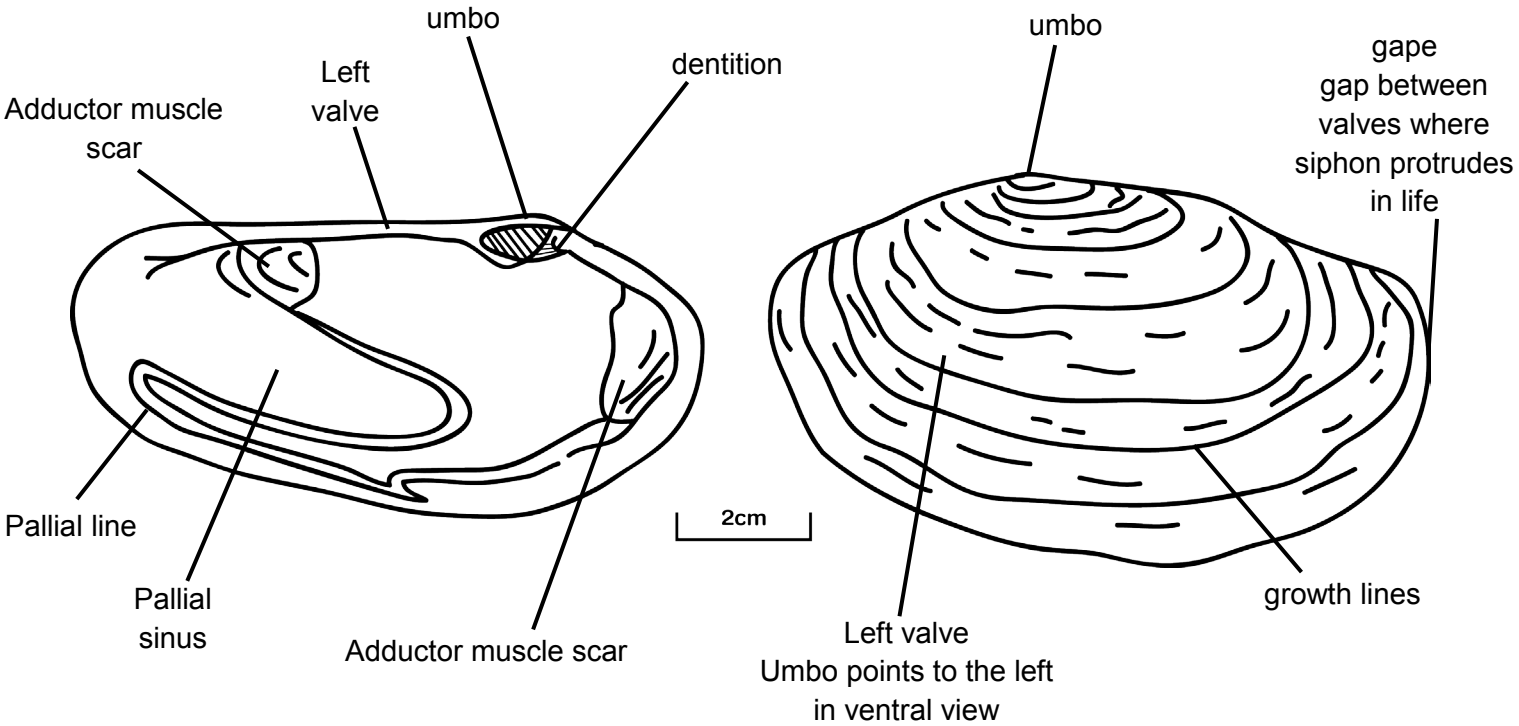


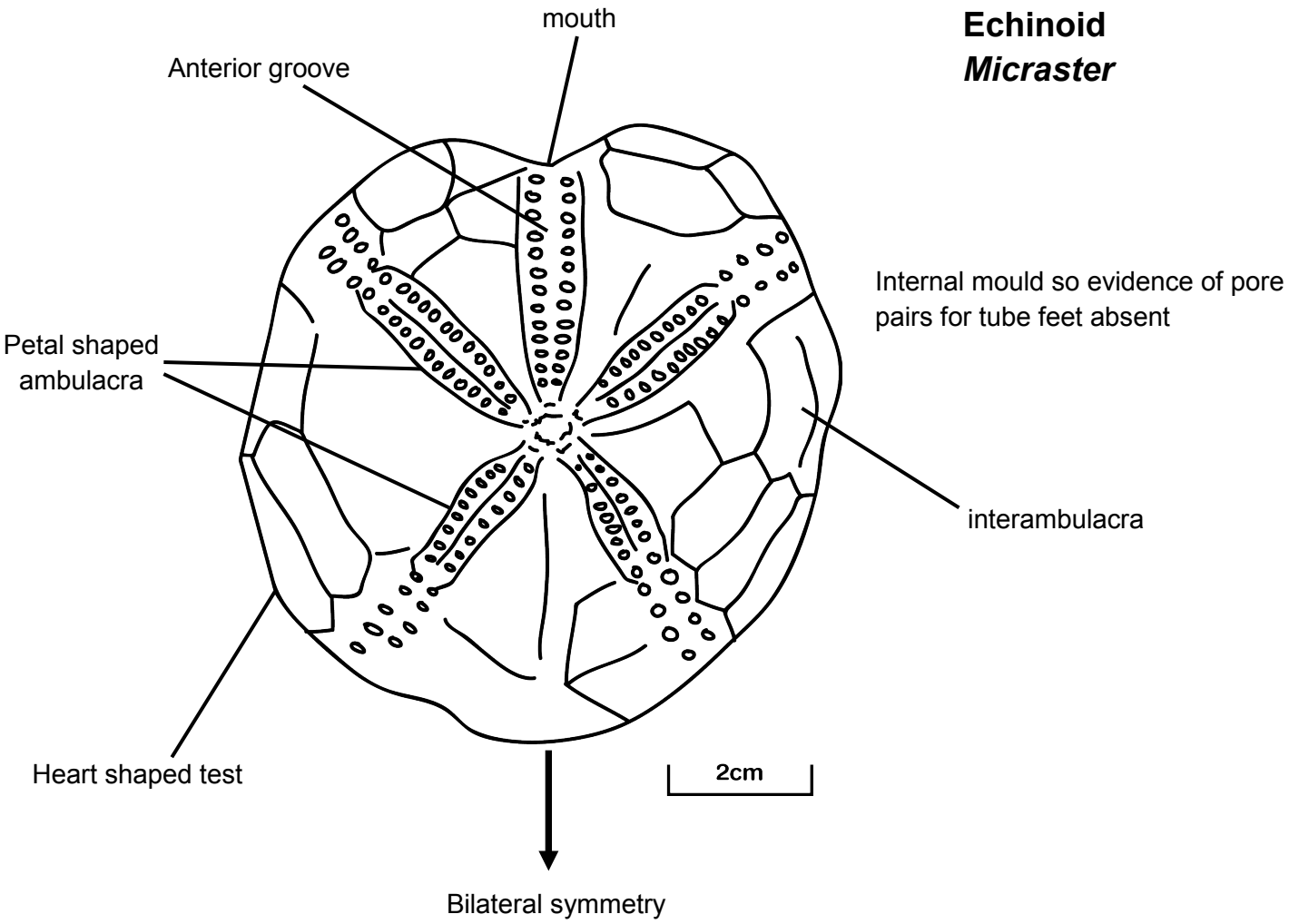
Ammonite
(Asteroceras obtusum)



Brachipod
Spirifer

Bivalve
(Lutaria lutaria)





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