Burgess Shale Activity

Do you think the Burgess Shale specimens illustrated in Lesson 7 of the course notes represent a reasonable approximation of the *actual* relative abundance of species found in the Burgess Shale? Do they represent actual relative abundance of specimens? Lifestyles? Foodweb niches? You will address these questions in two steps.

1. First record key characteristics for each specimen onto a copy of **Table 1** (below) using information from the Burgess Shale website at http://burgess-shale.rom.on.ca/en/.
   > AT THE SAME TIME, using that database, find the real samples shown in **Table 2** and add the species name and other information to complete Table 2.
2. Then use results to address questions presented on Connect about abundance, living habit and foodweb niche by referring to data in your tables.

Guidelines

1. Read all these instructions first!
2. We expect this to take you between 1 and 2 hours.
3. Use a paper (or Word or PDF) versions of the tables first because you will be browsing the Burgess Shale specimen database to obtain your data.
4. Find the data webpage for each specific organism, including high resolution images of fossils, starting at http://burgess-shale.rom.on.ca/en/. Here's how …
   a. Click on the "Main Gallery" link (near top centre). Loading may take several seconds.
   b. Use your browser's built-in find function (CTRL-f in Firefox) to find the specific organism.
   c. Artist impressions of specimens in your notes are impressive, but - what do the fossils look like from which these imagined illustrations were derived? Good question – so – complete **Table 2** at the same time as **Table 1** by finding the specific image of the fossil for each specimen, and matching it in Table 2's second column to the numbered artist's illustrations provided after Table 2. This should be easy for most but please note that in Table 2 some images are not oriented the same way as they are on the website.
   d. Finding the fossil images is important because detailed information needed for **Table 1** is on the specimen pages associated those fossil images. Data are well organized on each specimen's page, so you should be able to complete both tables quickly once you are familiar with how data are presented.
5. When Tables 1 and 2 are complete, you are ready to complete the question set on Connect. This is not a test but a means of checking your data and addressing the questions which are the underlying purpose of this activity.
6. There will be an OPEN discussion forum accessible to everyone for discussions with your colleagues about this activity. AND (of course) you can discuss anything you like (any time) in your small groups. But there is NO formal group component for this activity.

That's it; have fun. These are amazing creatures & the Burgess Shale fossils tell a unique and fantastic story!

Questions you will see on Connect:

1. Match illustrations to fossils; a mix/match question with ten items using images.

2. Is there enough information on the data webpage for each organism to generate an age-range diagram showing the time spans during which each of the 10 organisms lived?

3. From your completed copy of Table 1, the fossil that is the largest OTHER than Anomalocaris is [***], the smallest is [***], the rarest arthropod (based on number of specimens) is [***], and the one fossil that is a mold rather than fossilized body parts or remains is [***]. Finally the one that may have eaten Ogygopsis is [***] . Finally the one organism NOT described in course notes is [***].

4. Several observations or experiments have helped suggest that the relationship between Ogygopsis and its so-called predator is still rather uncertain. What are these lines of evidence? For each of the following, choose "True" if the observation DOES contribute to this uncertainty and "False" if the observation does NOT contribute to that uncertainty, or if the observation was not mentioned. Obtain answers by reading the following very short item (roughly 450 words): *The Geological Society of America. "Earth's first great predator wasn't: Carnivorous 'shrimp' not so fierce, 3-D model shows." ScienceDaily. www.sciencedaily.com/releases/2010/11/101101083148.htm (accessed August 31, 2015).* True false for each:
    a. Calculations that simulate Anomalocaris mouth action
    b. Fossil evidence of mouth action
    c. Calculations that simulate mouth hardness
    d. Fossil evidence of mouth hardness
    e. Calculations that simulate digestive processes
    f. Fossil evidence of gut contents or feces (or lack thereof)
    g. Fossil evidence that other things were being eaten

5. Which phylum is most abundant in OUR little sample of 10 species?

6. Is this consistent with information about relative abundance of SPECIMENS at the Walcott Quarry site provided on that page? Answer this by find the "Fossils" page under the "Science" menu of the Burgess Shale website. Keep this page open for subsequent questions!

7. Figures on the "Fossils" page comparing relative abundance of SPECIMENS at the Walcott Quarry site and relative abundance of SPECIES, indicate that there are [***] arthropod specimens compared to species and [***] perifera specimens compared to species.

8. What is one likely reason for the observed difference in specimen and species abundances? (This doesn't ask what's true, it asks what is one reason for observing the difference.)

9. Again from the "Fossils" page, the lifestyle that is most well-represented by all known Burgess Shale specimens is [***], and the lifestyle most well-represented by our own small set of 10 organisms is [***].

The lifestyle that is NOT represented in our own small set is [***]. If there are technical terms you are unsure of, look them up by googling them.

10. Which food web niche is most well-represented by our own small set of 10 organisms?

11. Based on the (admittedly simplified) figure of the Burgess Shale food web, which food web niche would we EXPECT to be most abundant in a real Burgess Shale community?

12. From your table of fossil images, how many of these specimens was "complete" – i.e. a whole organism, not just parts? Enter just a number, not a word [*].

13. Does this seem to you to be a likely "normal" proportion of complete fossils that one could expect in any other fossil collection?

14. Consider the conditions used to photograph fossils that you recorded in Table 2. Imagine you have a colleague who wants to document her collection using all four types of conditions but finds she has only enough funding to use three. Given your "experience" (i.e. data you compiled in Table 2) which of the four combinations of conditions would you recommend as being the LEAST useful for most fossils?

15. Put the following types of evidence that help paleontologists identify likely diet or feeding habits into order from most convincing to least. There could be some debate about one or two of these, so this question is worth only a small amount.

16. Given what you read about Opabina, where is the mouth on this fossilized sample? Point and click on the figure to answer this question. NOTE YOU MUST ENSURE YOUR BROWSER IS NOT ZOOMED IN OR OUT WHEN ANSWERING THIS QUESTION. IN FIREFOX, USE MENU OPTION "VIEW -> ZOOM -> RESET".

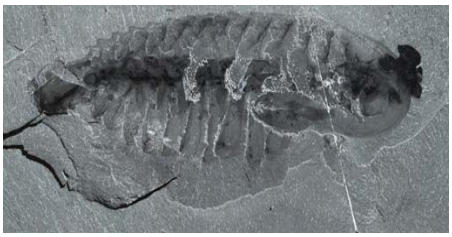


Photo © Royal Ontario Museum.

17. Because of the diversity and quality of preserved organisms the Burgess Shale Walcott Quarry site is truly a "lagerstatten" (look up that word!) Now imagine that the 10 samples we have been studying were the only samples from this field site. This would be a much more common scenario. Indicate how you suspect paleontologists would have interpreted these characteristics of the ecosystem based on these 10 alone?

18. In your searching, which specimen did you find the most interesting? [*] This does not have to be one of the 10 in our set. Also, briefly, why [*]?

19. Fill blank: Very roughly how long did you take to complete this activity from start to finish? Please answer in using *hr:min* (eg. 1:15 for 1 hour 15 minutes) [*] .

20. Fill blank: Have you any suggestions for improving this Burges Shale activity? [*]

End of questions on Connect.

Table 1, Burgess Shale sample characteristics. Use http://burgess-shale.rom.on.ca/en/. One is done as an example

	Species	Phylum	Age (My)	Max size (mm)	Abun-dance	Habit	Mob-ility	Feeding	Feeding evidence
1	Pikaia	Chordata	505	50	R	N/N	M	deposit	mud in gut
2	Opabinia								
3	Hallucigenia								
4	Anomalocaris								
5	Canadaspis								
6	Aysheaia								
7	Sanctacaris								
8	Ogygopsis klotzi								
9	Hazelia								
10	Wiwaxia								

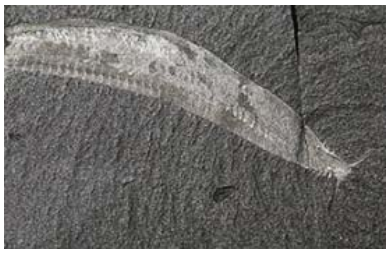
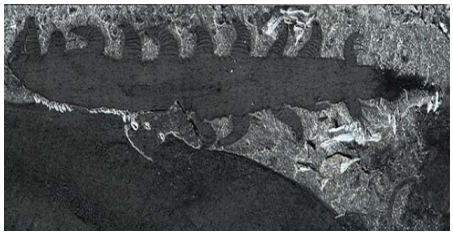
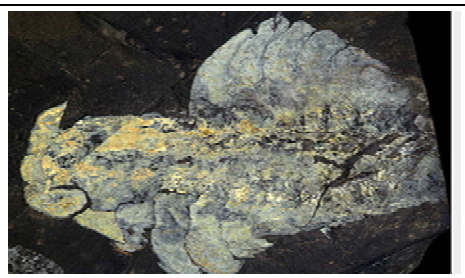
Column values: Complete blanks using terms or codes as follows:

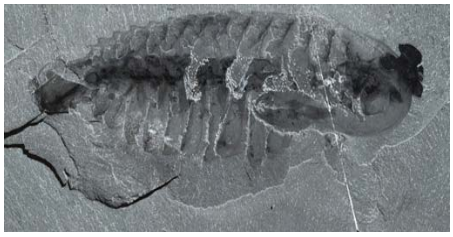
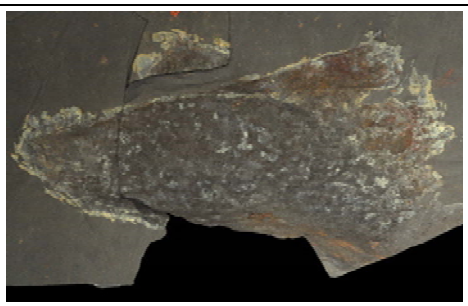
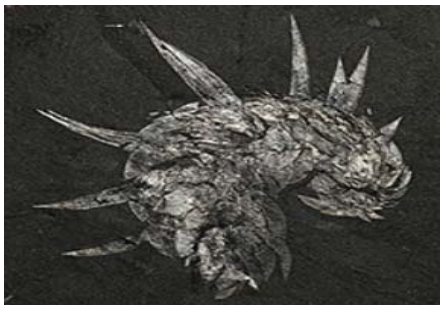
- **Phylum:** Arthropoda, Chordata, Onychophora, Mollusca, or Porifera
- **Abundance of whole or partial specimens:** R=rare, C=common, or A=abundant
- **Habit:** Ep=Epibenthic, En=Endobenthic, Nb=Nektobenthic, Nt=Nektonic, N/N=Nektonic or nektobenthic
- **Mobility:** M=mobile, S=sessile
- **Feeding:** carnivorous, deposit, suspension feeder, herviborous, scavenger
- **Feeding evidence:** very short comment on evidence used to infer feeding style.

Table 2: specimen photographs. Row one is completed for you as an example.

While completing Table 1, find specimens shown in this table, and fill in blank table cells. Information will be in the caption to the high resolution "zoomable" figure of each specimen.

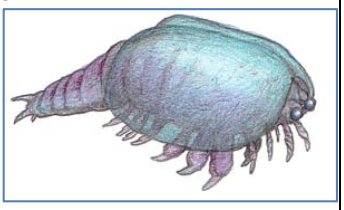
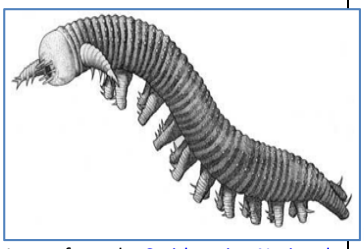
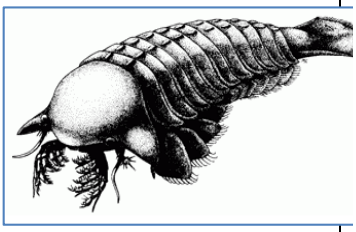
Note: - *Lighting options*: dry direct, dry polarized, wet direct, wet polarized.
- *"Completeness" options*: complete, partial, incomplete by implication, not stated.

Specimen photograph	Illustration # (listed below)	Species name & specimen "completeness"	Conditions and lighting for specimen photos
	#5	Ogygopsis klotzi Incomplete by implication	Dry, direct light
			
			
			
			

All photos are © Royal Ontario Museum and can be found at http://burgess-shale.rom.on.ca/en/.

Illustrations from EOSC326 notes, Lesson 7. Numbering is arbitrary.

1  Illustration by Karen Carr copyright by the Field Museum.	2  Part of a drawing downloaded from Paleoimagery.	3  Image from Insectos de Chile.	4  Part of an Illustration by Karen Carr copyright by the Field Museum.
5  Part of an Illustration by Karen Carr copyright by the Field Museum.	6  Image from the Smithsonian National Museum of Natural History	7  Image from Palaeos	
8  Part of an Illustration by Karen Carr copyright by the Field Museum.	9  Part of an Illustration by Karen Carr copyright by the Field Museum.	10  copyright by Karen Carr	