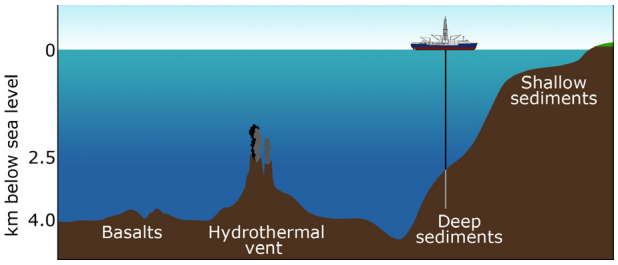
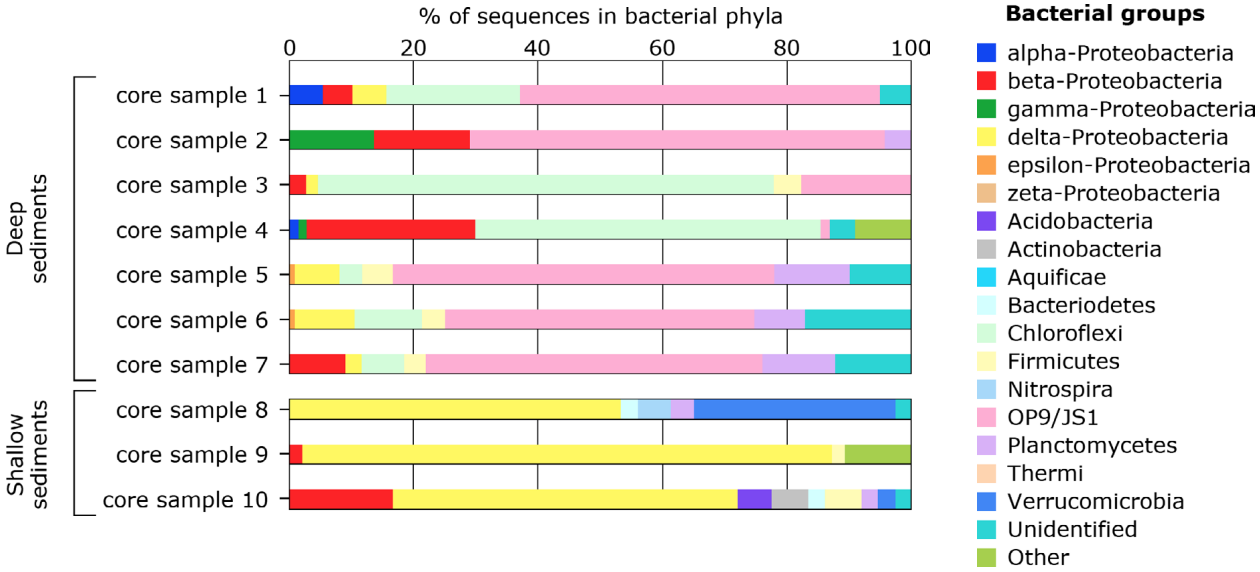
Exploring data from the sea floor (Part A)—Making observations

Grab your *How Science Works* flow chart and dive into the ocean realm to see how observations and questions can lead to the testing of scientific ideas!



The ocean has many different habitats—see image to the left. Samples have been taken from each of the habitats to see what kinds of microbes (bacteria) live there.

Below is a really cool data set gathered from both **shallow** and **deep sediments** in the ocean. Each line is a different core sample and each color represents a different kind of bacteria.



Take a close look at the data. What kinds of patterns do you see?

1) Describe at least two patterns.

2) What might explain the patterns you identified?

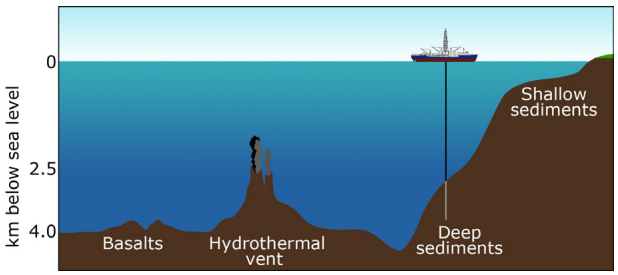
3) On your *How Science Works* flow chart, mark the steps you just took using arrows to show your pathway.

It is very likely that the patterns and explanations you wrote down are very similar to the ones generated by the science team who compiled the data (Orcutt et al. 2011). Proceed to the next chapter to test your ideas and continue this journey.

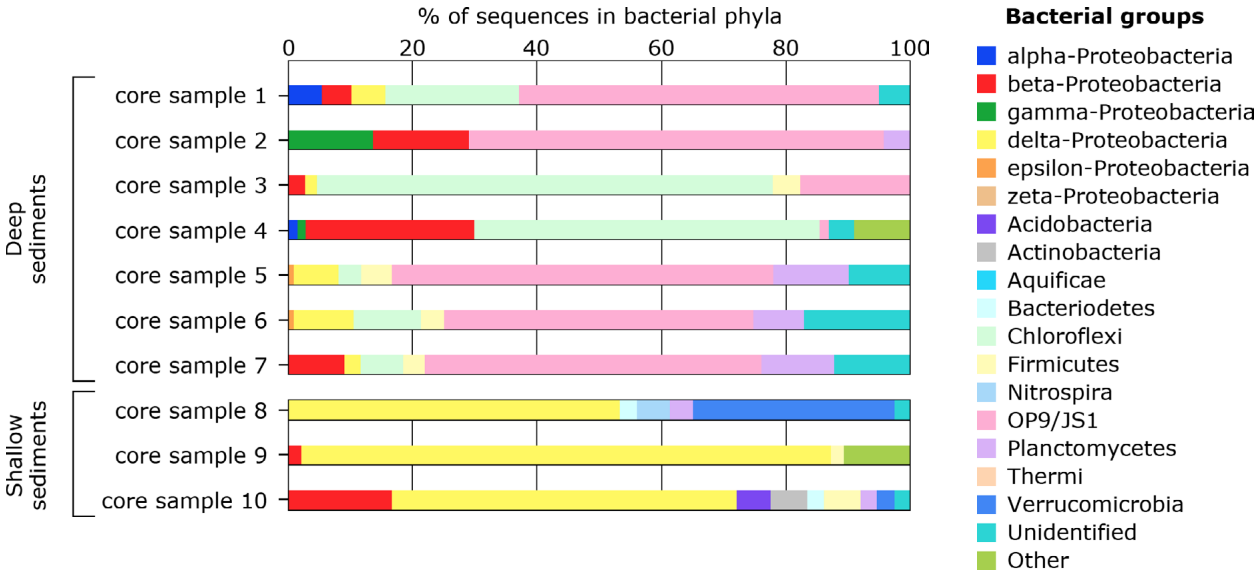
Data and images modified from Orcutt et al. 2011 (see citation below) and courtesy of the Deep Earth Academy and Integrated Ocean Drilling Program.

Orcutt, B.N., J.B. Sylvan, N.J. Knab, and K.J. Edwards. 2011. Microbial ecology of the dark ocean above, at, and below the seafloor. *Microbiology and Molecular Biology Reviews* 75(2):361-422. doi: 10.1128/MMBR.00039-10

Exploring data from the sea floor (Part B)—Generating ideas from observations



If you just completed the previous chapter, you will recognize the data set below (Orcutt et al. 2011). If you have not, take a moment to become familiar with the image on the left and the data below that show types of microbes (bacteria) found in deep sediments of the ocean. Each line is a different core sample from a different site and each color represents a different kind of bacteria. Before moving on, identify one pattern that you see.



You might have noticed that the OP9/JS1 bacteria represented by the pink lines is dominant in most of the deep sediment samples represented. One of the many explanations your scientific mind might generate is: *OP9/JS1 bacteria are found only in deep sediments of the ocean.*

1) Describe how you would test this idea. What type of new data would you need to gather? What would you expect to find?

2) Before you gather more data to investigate this question, it is important to consider some alternative ideas or hypotheses that might be possible.

Write down at least two additional hypotheses and what patterns you would expect to see in the data if each was supported.

3) On your *How Science Works* flow chart, continue your journey by using arrows to mark the steps you just took.

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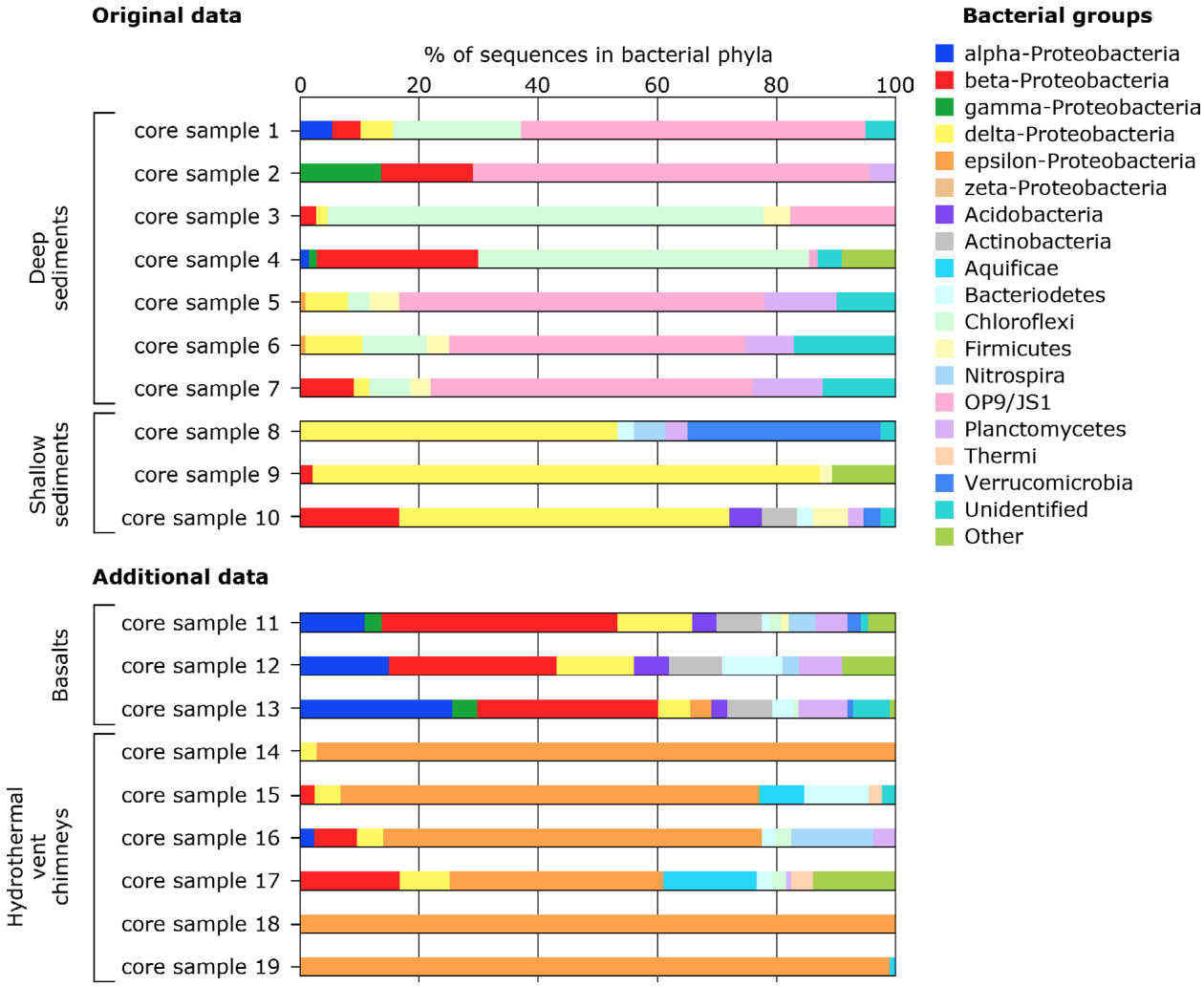
Exploring data from the sea floor (Part C)—Testing your ideas

One way to test your idea would be to examine the distribution of microbes in other ocean habitats. The data set below (Orcutt et al. 2011) includes the original data from the deep and shallow sediments plus data from two additional habitats: basalts and hydrothermal vent chimneys. The additional data may or may not match your original expectations, but that is OK! It is what it is. Take a close look and analyze the data in the context of the hypotheses you generated.



1) Explain how the new data (actual observations) impacted each of your hypotheses.

4) Did the data support any of your hypotheses? If not, how could you modify your ideas based on this new data?

5) Draw arrows on your flow chart to show your pathway.

6) What would you do next …
- Ask new questions?
- Start the process to publish your findings?
- Chat with your colleagues?
- Explore the literature?
- Collect more data?
- Other?

Mark it with an arrow on the flow chart! Want more practice? Pick a new question generated from patterns you now see in the data. Come up with multiple hypotheses and what you would expect to see if each is supported with new data.

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