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Hydrothermal Vents

Student Activity Guide

Specific Activities:

1. Investigate Vents
2. Investigate Organisms
3. Investigate Chemosynthesis
4. Chemosynthetic Food Web
5. Importance of vent communities: Human Uses
6. Engineering & Ethical Challenges

1. Investigate Vents

Questions:

- a. Look up what a vent is and where it is found
- b. Describe the different types of vent. How old and how large are they?
- c. Look up how and where they were first discovered and how they are found today.

Possible Sources:

1. Current text you are using in class
2. Wikipedia - hydrothermal vents
3. <http://oceanservice.noaa.gov/facts/vents.html>
4. <http://www.pmel.noaa.gov/eoi/PlumeStudies/WhatIsACTD/CTDMethods.html>
5. www.amnh.org search "hydrothermal vents"
6. video - Bill Nye and Robert Ballard on you tube -
<http://www.youtube.com/watch?v=D69hGvCsWgA>
7. <http://www.nsf.gov/news/overviews/earth-environ/interactive.jsp> Investigate organisms living in/around these vents – microbes, mussels, shrimp , worms etc.

2. Investigate organisms

Questions:

- a. What is a chemosynthetic microbe, how does it get its food and where is it found?
- b. Do all vents have the same microbes and the same dominant organisms?
- c. What are some invertebrate and vertebrate organisms found in the vents and what is their relationship to these microbes?

Possible Sources:

1. <http://www.darkenergybiosphere.org/> - go to research theme 3 read introduction
2. <http://metcalfinstitute.org/c-debi-glossary/> link via www.darkenergybiosphere.org
3. <http://www.amnh.org/exhibitions/permanent-exhibitions/rose-center-for-earth-and-space/david-s.-And-ruth-l.-gottesman-hall-of-planet-earth/why-is-the-earth-habitable/life-that-lives-off-the-earth-s-energy/life-at-the-hydrothermal-vents/microbes-around-vents>
4. 4.noaa.gov/search?affiliate=noaa.gov&v%3Aproject=firstgov&query=tube+worms&x=0&y=0
5. <http://www.nsf.gov/news/overviews/earth-environ/interact05.jsp>
6. <http://www.nsf.gov/news/overviews/earth-environ/interactive.jsp>
7. <http://www.darkenergybiosphere.org/research/themes.html> -Research Theme II. Extent of Life: biomes and the degree of connectivity (biogeography and dispersal).

3. Investigate Chemosynthesis

Questions:

- a. How do these organisms break the chemical bonds in small molecules and use this energy to create carbohydrates, proteins and lipids - the biological molecules?

Possible Sources:

1. <http://www.pmel.noaa.gov/eoi/nemo/explorer/concepts/chemosynthesis.html> = fig 3
2. <http://www.pmel.noaa.gov/eoi/chemistry/fluid.html>
3. <http://www.darkenergybiosphere.org/resources/programs.html> - Research Theme II - Extent of life: biomes and degree of connectivity = fig 2
4. <http://oceanexplorer.noaa.gov/edu/curriculum/welcome.html>
5. <http://icomm.mbl.edu/spring2009/booklet.pdf>
6. <http://www.darkenergybiosphere.org/resources/programs.html>
7. <https://deepcarbon.net/>
8. Good overview of role of microbes: Gold's article in PNAS
<http://www.pnas.org/content/89/13/6045.full.pdf+html>

4. Chemosynthetic Food Web

Questions:

- a. Who are the primary producers & compare to a photosynthetic web.
- b. Who are the first level consumers & compare to a photosynthetic web.
- c. Who are the second level consumers & compare to a photosynthetic web.
- d. Who are the third level consumers & compare to a photosynthetic web.

Possible Sources:

1. http://oceanexplorer.noaa.gov/edu/learning/5_chemosynthesis/activities/hydrothermal.html
2. <http://www.ridge2000.org/>
via link from <http://www.darkenergybiosphere.org/resources/programs.html>
3. <http://oceanexplorer.noaa.gov/explorations/12fire/logs/sept21/sept21.html>
4. marine microbes - via link in
<http://www.darkenergybiosphere.org/resources/programs.html>

5. Importance of vent communities: Human Uses

Questions:

- a. What benefits can humans get from hydrothermal vents? Minerals? Energy Source? Food? Microbes themselves?

Possible Sources:

1. <http://www.amnh.org/exhibitions/permanent-exhibitions/rose-center-for-earth-and-space/david-s.-and-ruth-l.-gottesman-hall-of-planet-earth/why-is-the-earth-habitable/life-that-lives-off-the-earth-s-energy/life-at-the-hydrothermal-vent>
2. <http://www.darkenergybiosphere.org/resources/programs.html> - continental drilling
3. http://oceanexplorer.noaa.gov/oceanos/edu/collection/media/wdwe_energy.pdf
4. <http://www.habitat.noaa.gov/protection/renewable/index.html>
5. coastalmanagement.noaa.gov/otec/docs/environmentalfactsheet.pdf

6. Engineering & Ethical Challenges

Questions:

- a. What engineering challenges does exploration in these deep ocean vent communities present?
- b. What impact will human activities have on this ecosystem? Should we conserve or exploit?

Possible Sources:

Engineering Challenges:

1. Videos: <http://www.darkenergybiosphere.org/resources/videos.html>
2. <http://www.darkenergybiosphere.org/resources/programs.html>
3. <http://www.darkenergybiosphere.org/research/themes.html> - research theme

Ethical Challenges:

4. coastalmanagement.noaa.gov/otec/docs/environmentalfactsheet.pdf
5. <http://oceanexplorer.noaa.gov/explorations/12lophelia/background/energy/energy.html>
6. <http://www.theguardian.com/environment/2014/mar/02/underwater-gold-rush-marine-mining-fears-ocean-threat>

TOOLKIT CREDITS:

Developed by Dale Stanley (Nassau Community College, NY) with support by the rest of the C-DEBI Collaborative Toolkit Team.

WEBSITE:

http://www.coexploration.org/C-DEBI/toolkits_biology.html