

COSEE-West lecture & workshop, Nov. 29 and Dec. 2, 2006
“Hydrothermal Vent Communities”

GLOSSARY

- A** **abyssal:** deep sea region below 13,000 feet (4,000 –6000 m) This area covers over 50% of the sea floor.
- Alvin:** deep sea submersible that can carry a pilot and 2 passengers to a maximum depth of 4,500 meters (14,764 feet). *Alvin* has made almost 4,000 dives since its first dive in 1964.
- anion:** a negatively charged ion (see definition of *ion*)
- autotroph:** an organism that manufactures its own food by photosynthesis or chemosynthesis
- bacteria:** single-celled or noncellular spherical or spiral or rod-shaped organisms lacking chlorophyll that reproduce by fission; important as pathogens and for biochemical properties
- B** **bicarbonate:** a salt of carbonic acid (containing the anion HCO₃) in which one hydrogen atom has been replaced; an acid carbonate
- bathyal:** the deep sea region between 600 and 10,000 feet (~200 to 30000 m)
- benthic:** bottom-dwelling; occurring on the bottom of the ocean, lakes, rivers, etc.
- black smokers:** roaring jets of super-hot water, usually above 662°F (350°C), that look black due to the presence of iron sulfides. Discharge velocity has been measured at a powerful 6 feet (2 meters) per second
- C** **carbon dioxide (CO₂):** a colorless gas composed of carbon and oxygen atoms that is required for the process of photosynthesis
- carbon fixation:** the conversion of inorganic carbon into energy-rich organic carbon, usually by photosynthesis, but also by chemosynthesis
- chemoautotroph:** an organism that depends on inorganic chemicals for its energy and principally on carbon dioxide for its carbon
- chemosynthesis:** the production of organic material by energy from chemical reactions rather than light. Typically involves sulfide or methane oxidation in deep-sea ecosystems. The oxidation processes provide vent bacteria with the energy needed to produce organic matter.
- chimney:** a geological formation that may take various shapes and sizes that forms over a hydrothermal vent by minerals precipitated out of hydrothermal vent water by the colder surrounding sea water
- D** **deep sea:** the deep, lower regions of the ocean where sunlight doesn't penetrate
- demersal:** living close to the bottom of the sea
- deposit feeder:** an animal that feeds by consuming sediments or detritus on or in the seafloor
- detritus:** particles from decaying plants and animals
- diversity:** number of species, but also the relative distribution of individuals among species. Low diversity occurs when one species is very abundant and others are rare
- dominance:** extent to which one or a few species accounts for most individuals.

Dorvilleidae: a group of polychaetes (Annelida) adapted to coping with high sulfide concentrations

E **East Pacific Rise (abbr. EPR):** a mountain chain, characterized by volcanic activity and vents, that runs primarily north-south in the Pacific and rises 1 to 1.5 miles (1.6-2.4 km) above the ocean floor, with a width of 1 to 2 miles (1.6-3.2 km), at an average depth of 1.7 miles (2.7 km). It abuts the North American Plate at the Gulf of California.

ecotone: zone where two ecosystems overlap, each of which supports species from both ecosystems as well as species unique to the ecotone

endosymbiont: organism (usually bacteria) living inside a host organism (see *symbiosis*)

exosymbiont: organism living on the exterior surface of a host organism (see *symbiosis*)

extremophile: an organism (usually single-celled, most are bacteria or of Archaea) that lives comfortably in environments formerly considered lethal, such as those that are very hot or lack oxygen

F **fathom:** a unit of measure for ocean depth. One fathom = 6 feet (1.83 meters).

G **gill:** the respiratory organ of aquatic animals that breathe oxygen dissolved in water.

H **hadal zone:** deep sea region below 20,000 feet (6,100 m); the deep trenches. These constitute about 2% of the ocean floor.

hemoglobin: blood pigment that carries oxygen

hydrogen ion: the positively charged ion of hydrogen, H⁺, found in all aqueous solutions of acids

hydrogen proton: the positively charged nucleus of the hydrogen atom

hydrogen sulfide (H₂S): a compound toxic to many life forms but utilized by some bacteria as an energy source to fix carbon through oxidation and can support specialized chemosynthesis-based communities. The most prevalent chemical dissolved in the sea water of vents, it smells like rotten eggs and is produced when seawater reacts with sulfate in the volcanic rock below the ocean floor.

hydrothermal vent: an opening in the sea floor through which super-heated water and other materials are discharged into the surrounding seawater. The fluids rich in reduced chemicals support dense animal communities based on chemosynthesis.

I **invertebrate:** animal that lacks a backbone

ion: an electrically charged atom or group of atoms formed by the loss or gain of one or more electrons

M **macrofauna:** sediment-dwelling animals retained on a 0.3 mm mesh screen - typically includes polychaetes, molluscs and crustaceans. Usually requires a microscope to visualize them.

megafauna: seafloor animals visible by eye or camera (without a microscope). May include sea cucumbers, starfish, brittle stars, sponges, decapods.

methane: a clear odorless substance (CH₄), used as an energy source (natural gas), acts as a greenhouse gas

methanotroph: an organism capable of oxidizing methane to manufacture its food

microelectrode: microscopic instrument (needle-like) used to measure the oxygen, sulfide or hydrogen content of sediment porewaters

mid-ocean ridge: a series of mountain ranges on the ocean floor, more than 84,000 kilometers (52,000 miles) in length, extending through the North and South Atlantic, the Indian Ocean, and the South Pacific.

minisub: submersible vessel that can carry one or two persons

Mollusca: a phylum of invertebrate animals, mostly marine, typically having a soft unsegmented body, a mantle, and a protective calcareous shell; includes the edible shellfish and the snails

mussel: a type of bivalve mollusc

N **nitrate (NO_3^{-1}):** an important nutrient in the ocean

P **paradigm:** viewpoint that dominates thinking

pH: a measure of the acidity or alkalinity (also called basicity) of a solution. The pH scale goes from 0 to 14. A solution that has a pH of 7, such as pure water, is a neutral solution. A substance that, when added to water, increases the concentration of hydrogen ions and lowers the pH is called an acid. A substance that reduces the concentration of hydrogen ions and raises the pH is called a base.

photophore: a body organ that makes light

photosynthesis: chemical process in green plants and certain other organisms by which carbohydrates are synthesized from carbon dioxide and water using light as an energy source, releasing oxygen as a byproduct.

plate tectonics: the process involved in the movement of large plates on the Earth's crust, driven by convection currents in the Earth's mantle

R **remotely operated vehicle (ROV):** an unmanned submersible vehicle used to observe, film and collect samples

S **sessile:** stationary; attached to the seafloor or an object such as a pier piling

species richness: number of species present

spreading center: the zone between diverging plates at which new ocean floor is being created

stable isotopes: atoms of the same atomic number, but different atomic weight that are used as biogeochemical markers (e.g., $^{13}\text{C}/^{12}\text{C}$, $^{15}\text{N}/^{14}\text{N}$, $^{34}\text{S}/^{32}\text{S}$) that reflects aspects of an organism's environment or diet

subduction zone: the juncture where 2 of the Earth's crustal plates collide, resulting in one of the plates being drawn down or overridden by the other (an ocean trench)

sulfate reduction: chemical reaction that converts sulfate (SO_4^{-2}) to hydrogen sulfide. Carried out by microorganisms.

sulfide oxidation: chemical reaction that converts hydrogen sulfide to thiosulfate or elemental sulfur; carried out by microorganisms.

sulfide toxicity: poisonous effects of sulfide; it binds to hemoglobin molecule in place of oxygen, causing suffocation and inhibits cell metabolism

sulfur (S): a pale yellow nonmetallic element occurring widely in nature; combines with hydrogen to create hydrogen sulfide

sulfur bacteria: bacteria that oxidize sulfide to fix carbon through chemosynthesis. These can be large and filamentous (like spaghetti) or live as symbionts.

suspension feeder (filter feeder): an animal that eats by filtering or straining small particles of food by passing the water through a filtering device, such as barnacle legs, clam gills, etc.

symbiosis: a close, prolonged association between two or more different organisms of different species that may, but does not necessarily, benefit each member.

V **vestmentiferan tubeworm:** A type of tube-dwelling worm that lives in hydrothermal vent communities, getting nourishment from chemosynthetic bacteria living inside the worm
[Latin origin of “vestmentiferan”: “vestmentum” = “garment” and “ferre” = “to bear”; the body of the worm has a collar of tissue just below the gills that folds over, resembling the collar of a cloak]

Z **zonation:** pattern of animal distribution in which different species occupy different regions (i.e. different water depths)