

# A Deep Dive into the Abyss: Exploring the Opportunities of Hydrothermal Vents

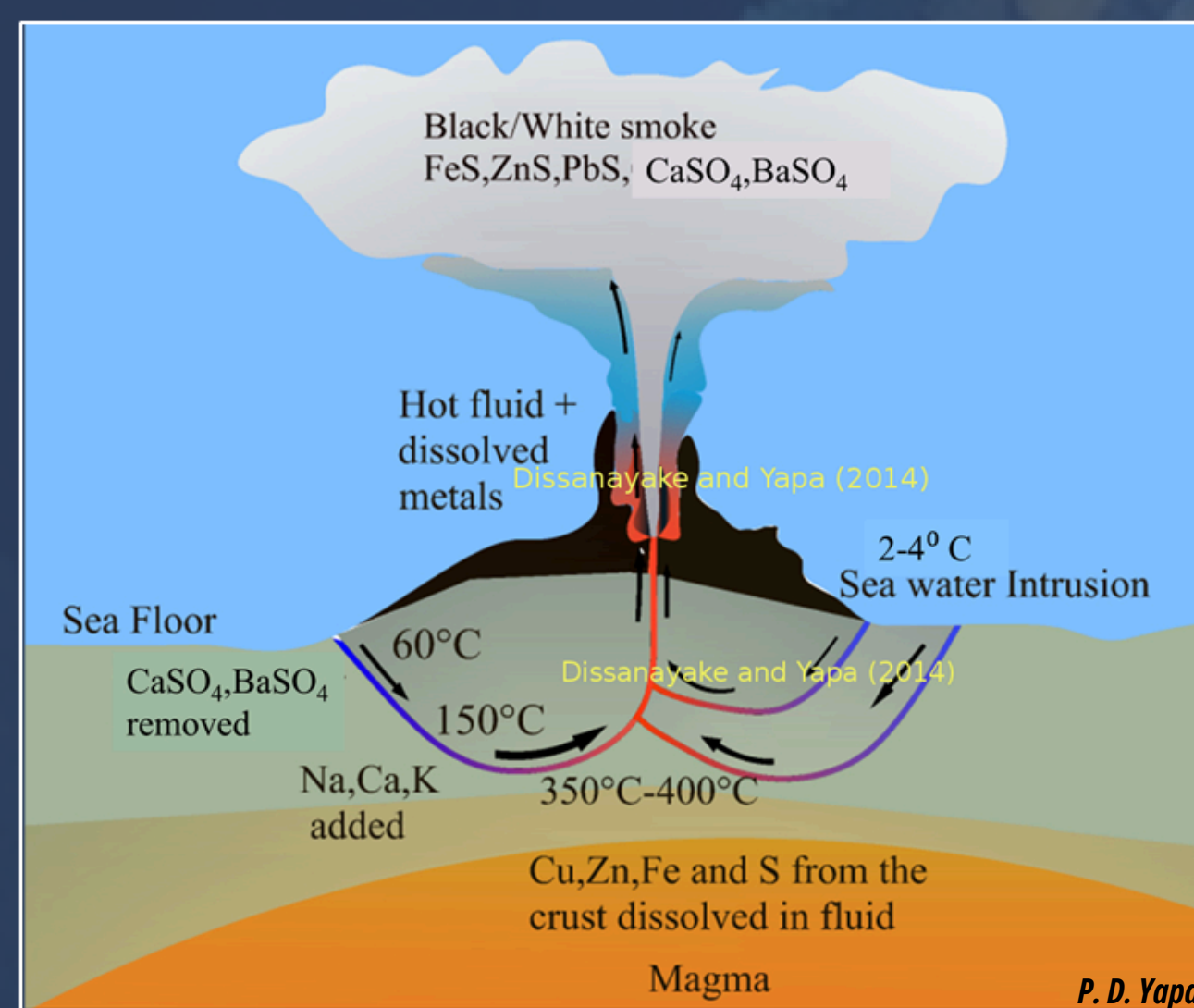
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## What are Hydrothermal Vents?



Seawater seeps through the cracks in the ocean floor and gets heated by hot magma beneath the earth's crust. The water becomes 'superheated' and loaded with dissolved minerals. Eventually the water will get pushed out of the ocean floor and as the mineral-rich fluids meet the cold ocean water, they cool rapidly and make chimney-like structures, called hydrothermal vents.

- Can reach up to 400 degrees Celsius
- The chemicals are the energy source for unique ecosystems known as chemosynthetic communities

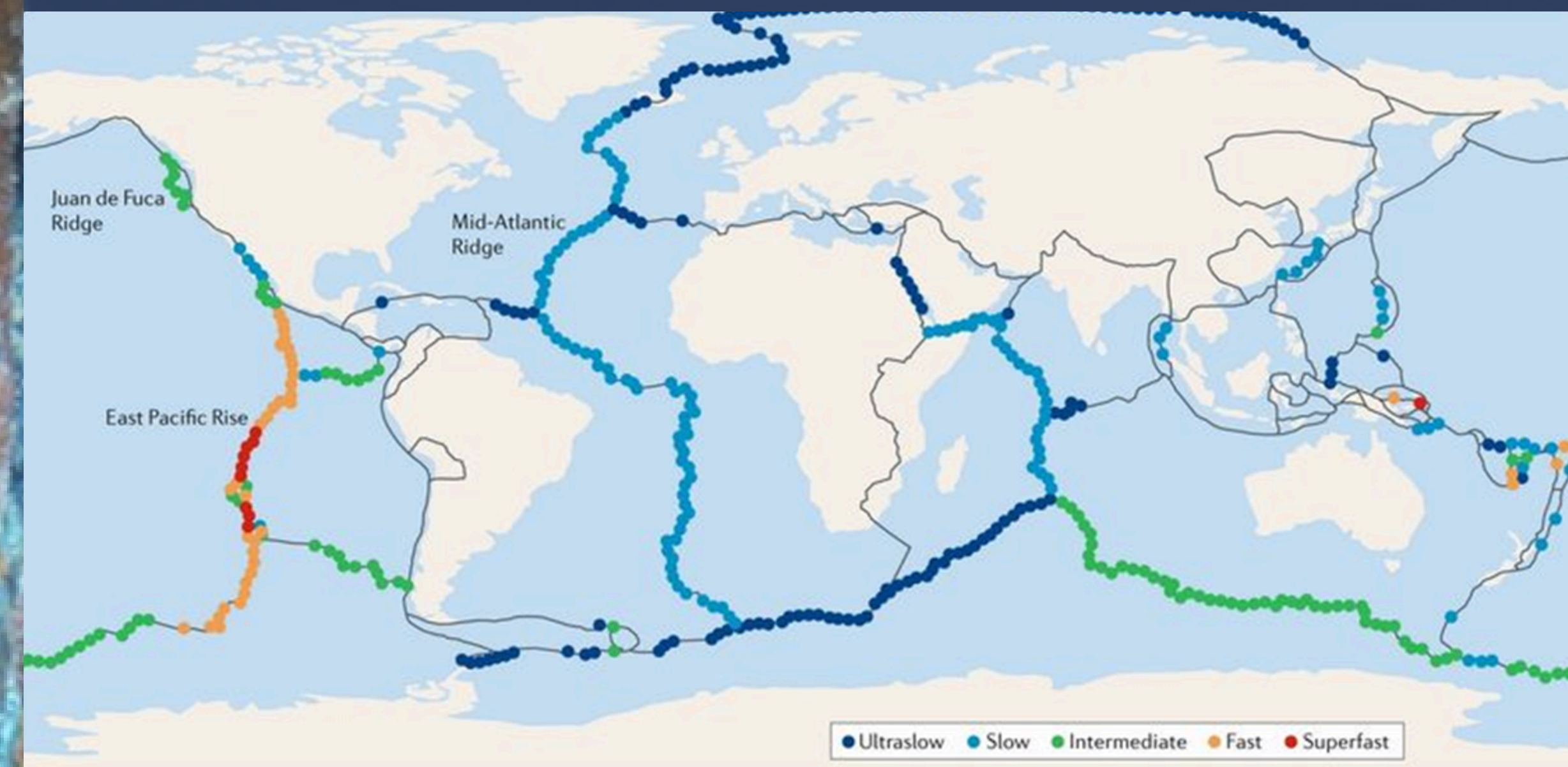


## Energy and CO2 storage



- Sustainable energy and fuel production
- Thermal power of up to 60 MWt.
- Produce hydrogen from organic matter
- Extremophiles are ideal candidates to replace the mesophilic organisms used in traditional biofuel production
- Storing 4 000 tons of carbon each day

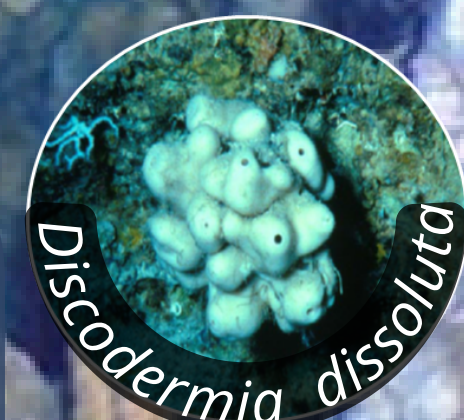
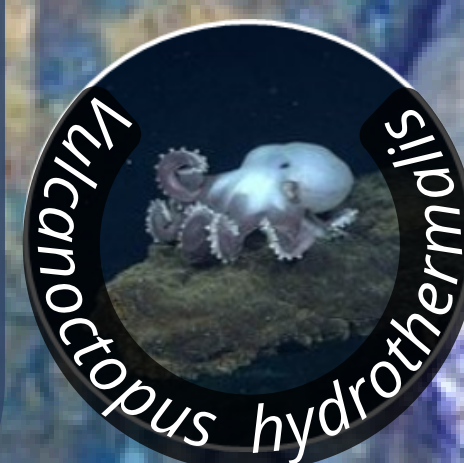
## Distribution of Hydrothermal Vents



The map shows locations of confirmed and inferred active deep-sea hydrothermal-vent fields (water depths >200 m). Ridge axes/mid-ocean ridges are coloured according to spreading rate: ultraslow (dark blue; <20 mm per year), slow (light blue; 20–50 mm per year), intermediate (green; 50–80 mm per year), fast (orange; 80–140 mm per year) and superfast (red; >140 mm per year).

## Biodiversity

- Thermal gradient provides habitats for diverse species
- Special conditions create species found nowhere else
- Different vent types create different niches for special and new organisms
- High levels of hydrogen sulfide, hydrogen gas and other chemical compounds are good energy sources for bacteria and archaea
- The microorganisms are primary producers of hydrothermal vent ecosystems, known as chemoautotrophs
- Chemoautotrophs convert chemical energy from the Earth's subsurface into biomass and organic molecules



## A new realm of Medicinal Possibilities

### Anti-tumor drugs

- Exopolysaccharides (EPS) in the matrix of bacteria imitate the activity of glycosaminoglycans (GAG), important in cancer growth and metastasis

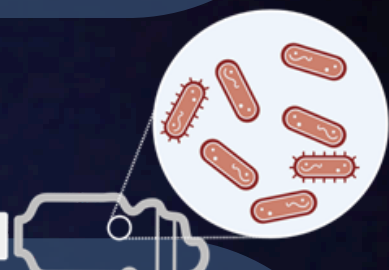


### Pandemics - help with diagnosis

- An enzyme isolated from a microbe was used to diagnose among other things COVID, AIDS and SARS.

### Antibiotics

- Compounds with antibacterial properties isolated from fungi living in the digestive gland of the *X. testudinatus* crab



## Plastic Degrading Microbiomes

- Extremophilic microbes in hydrothermal vents
- Adapted to extreme conditions
- Produce enzymes that break down synthetic and natural plastics
- Sustainable waste management
- Sustainable resource utilization
- Innovative technology with potential for real-world impact



(Aarnes, H, 2023), (Khan and Majeed, 2019), (Brazelton, 2017), (Aryadi et al. 2016), (Dick, 2019), (Zykowska, 2019), (Ruiz C., 2013), (Chengqian Pan, 2017), (Woods Hole Oceanographic Institution, 2018), (Hiroshi Miyake, 2019), (P. D. Yapa, no date), (Dennis R. A. Mans, 2016), (Deep-Sea Octopus, 2023), (Spencer Alley, 2019)

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