Endeavour Hydrothermal Vents: Canada's First MPA

Backgrounder on Marine Protected Areas and Endeavour Hydrothermal Vents

(note for teachers - for grades 4 and 5, headings have "short answer" which you can choose to expand upon).

1) What is an MPA?
2) Canada's Network of MPA's
3) What is a Hydrothermal Vent?
4) Endeavour - Becoming an MPA
- Canada's First MPA and how it was discovered
5) Why are Areas like Endeavour designated as MPA's?
6) Conservation of Hydrothermal Vent Areas

1)What is a Marine Protected Area and why do we have them?
Short answer: A Marine Protected Area is an ocean environment that is considered to be unique because of its habitats, species and features – and which needs protection because of their ecological significance and vulnerability to human interference.
Canada has made the commitment to protect marine environments that are unique. There are areas in the deep sea that have species of animals that are found nowhere else on earth. These species are called endemic species.
The deep sea is totally dark and cold, but in areas where the earth's tectonic plates meet, magma from the earth draws in cold water, super-heats it, and then spews it out in the form of hydrothermal (water –heat) vents. They resemble volcanoes rising from the sea floor.

2)Canada's Network of Marine Protected Areas
Short answer: Canada has a responsibility—both nationally and internationally—to protect its extraordinary marine environments for the benefit of present and future generations. Fisheries and Oceans Canada contributes to the Network through the establishment of MPAs under the *Oceans Act*.
The *Oceans Act* tasks the Minister of Fisheries and Oceans with a leadership and coordination role for the development and implementation of a national network of marine protected areas on behalf of the Government of Canada. Federal marine protected area legislated authorities are working with provincial and territorial counterparts, Aboriginal groups, industry, academia and environmental non-governmental organizations to build a national network of marine protected areas that protects key marine habitats, species and features that are ecologically significant and vulnerable.

Fisheries and Oceans Canada contributes to the Network through the establishment of MPAs under the *Oceans Act*. DFO also focuses on areas of interest that are at

various stages of progress towards designation. These areas are ecologically significant, with species and/or properties that require special consideration. Fisheries and Oceans Canada designates marine protected areas under the *Oceans Act* in order to protect and conserve:

- commercial and non-commercial fishery resources and their habitats;
- endangered marine species and their habitats;
- unique habitats;
- marine areas of high biodiversity or biological productivity; and
- any other marine resource or habitat necessary to fulfill the Minister's mandate.

3) What is a Hydrothermal Vent?

Short answer - Hydrothermal vents are the areas where ocean water is heated up by the molten magma under the earth's crust, and vent-like structures are formed. They are the result of seawater percolating down through fissures in the ocean crust in the vicinity of spreading centers or subduction zones. (places on Earth where two tectonic plates move away or towards one another). The cold seawater is heated by hot magma and re-emerges to form the vents.

There are two known types of hydrothermal vents – black smokers and white smokers, with the black smokers being the hottest of the vents. The black smokers spew a black smoke composed mainly of iron and sulphide.

Food webs at hydrothermal vents are based on chemosynthesis rather than photosynthesis. (see separate page on chemosynthesis vs. photosynthesis)

No light is available to support photosynthesis by marine algae or plants, so primary productivity occurs when bacteria-like organisms (archaea) turn chemical energy from vents into usable energy, chemosynthesis.

The Endeavour Hydrothermal Vents Area lies in water 2,250 metres deep, 250 kilometres southwest of Vancouver Island. The Endeavour Segment, part of the Juan de Fuca Ridge system, is in an area of seafloor-spreading where tectonic plates diverge (move apart) and new oceanic crust is extruded. Here, cold sea water percolates downward through the crust to be super-heated by the underlying molten lava, eventually emerging through the seafloor as buoyant plumes of particle-rich, superheated fluid.

Hydrothermal vents in the Endeavour Area consist of large hot black smokers, chimney-like structures, and surrounding lower temperature sites. Their associated plumes rise rapidly about 300 metres into the overlying water column. Formation of the large polymetallic (a substance composed of a combination of different metals) sulphide chimneys (up to 70 m height) takes place when dissolved minerals and metallic ions carried upward by the smokers precipitate upon contact with the cold sea water. Cooler waters below 115° Celsius on the seafloor and along the flanks of the chimneys support an abundance of plants and animals. Despite, and in part because of such volatility, Endeavour is host to a thriving and diverse ecosystem based upon a microbial community deriving energy from chemicals dissolved within geo-thermally (earth heated) superheated plumes of water.

(Joy Hillier, personal com. Dec. 2015)

4) How did Endeavour become an MPA, and how was it discovered?
Short answer – after discovering hydrothermal vents along tectonic plates in other areas of the world, scientists following the plate lines along the Juan De Fuca plate looking for similar areas discovered the Endeavour site.

Suspicions that Hydrothermal vents existed occurred in the 1880's. The first discovery of a hydrothermal vent happened in the Red Sea sixty years later. Unusually hot, deep waters led scientists to explore further and take samples from the sea floor. With a crude sampling device, they pulled up hot black material resembling tar that was an astonishing 56 degrees C.
The Endeavour hydrothermal vents off the west coast of Vancouver Island were first discovered in 1982, as scientists followed divergent tectonic plates (moving away from each other) looking for "hot spots" and found the Endeavour site. This area was designated Canada's first Marine Protected Area in 2003.

5) Why are Areas like Endeavour designated as MPA's?

Short answer – these are areas of the world with unique (endemic) features and species (sometimes found nowhere else on earth) that are vulnerable to human activities and interference,

Areas that are ecologically significant, with species and/or properties that require special consideration are considered for candidacy or designation as a Marine Protected Area. The fact that there are species that exist in the hydrothermal vents that are nowhere else on earth, and sometimes only in the one particular area of hydrothermal vents makes it critical to protect these special places.
Endeavour hydrothermal vents area has over 11 species that are found nowhere else on earth, including other vent locations in the world. This is called endemism, these species are endemic – or limited to – only the Endeavour vents area.

One of the unique and unexpected discoveries found at vent sites is gigantism. Tubeworms at these sites grow to 3m in length. In shallow ocean waters, tubeworms are common but only grow to about 10-15 cm. If we wish to protect biological diversity, these strange islands of biodiversity that differ greatly from our own ecosystems must be protected.
(Joy Hillier, pers. communication, January 2016.)

On March 7, 2003, the Minister of Fisheries and Oceans Canada announced the designation of Endeavour Hydrothermal Vents as Canada's first marine protected area. This marked the first step in an effort to develop a network of protected areas across Canada — from coast to coast to coast.
http://www.dfo-mpo.gc.ca/oceans/publications/mpaspotlight/index-eng.html
http://www.dfo-mpo.gc.ca/oceans/publications/bc-mpa/page06-eng.html

6) Marine Conservation and why we need it.

Short answer - Marine conservation, is the protection and preservation of ecosystems in oceans and seas. Marine conservation focuses on limiting human-caused damage to marine ecosystems, and on restoring damaged marine ecosystems. Marine conservation also focuses on preserving vulnerable marine species. (Wikipedia)
Marine Protected Areas are designed to protect unique areas, such as the Endeavour hydrothermal vents area, from human interference.

Why do we need to conserve things?
There are many pressures to use plants and animals that we find can assist us in our health or daily lives. Discoveries of sea life that produce substances that assist in human health creates pressure on that species, and can be deadly or harmful to them. The rich amounts of heavy and precious metals at vent sites make them under pressure from mining operations. This creates the need to protect or conserve them.

"At minimum, 96 active deep-sea hydrothermal vent fields are currently under consideration for deep-sea mineral extraction. That is nearly one-fifth of all known hydrothermal vent fields. In contrast, only 8% of hydrothermal vent fields fall within a marine protected area."
http://www.southernfriedscience.com/?p=15951

http://news.ubc.ca/2015/10/26/only-four-per-cent-of-the-ocean-is-protected-ubc-research/

Key words for internet or library resources search:

1) Marine Protected Areas of Canada

2) Network of Marine Protection

3) Policies and Governance for Marine Protected Areas

4) Guiding Principles for Marine Protected Areas

5) Process for Determining Marine Protected Areas

6) Management and Monitoring of Canada's Marine Protected Areas

7) Oceans Act – Endeavour Hydrothermal Vents Marine Protected Area Regulations Designation, Prohibitions, and Coming into Force
http://laws-lois.justice.gc.ca/eng/regulations/SOR-2003-87/page-1.html#docCont

8) Marine Conservation and human pressures
http://www.southernfriedscience.com/?p=15951

http://issues.org/30-4/final-frontier-vs-fruitful-frontier-the-case-for-increasing-ocean-exploration/.