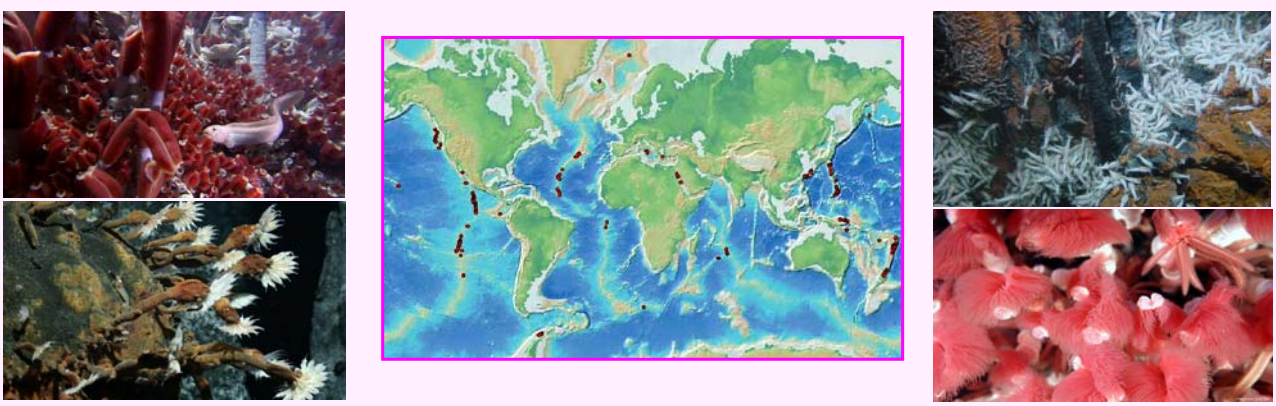
WHAT ARE HYDROTHERMAL VENTS?

GEOLOGY STUFF: Hydrothermal (hot water) vents are found along volcanic submarine mountain chains called the mid-ocean ridges. Here, seawater seeps into the crust through cracks. The cold seawater is heated by hot rock in the mantle where the temperature is over 1200°C, causing metals and sulfur from the rocks to dissolve. The solution with sulphide and hydrogen, manganese and metals, rises back to the seafloor. When the 400°C superheated fluid hits the surrounding cold and oxygen-rich seawater, its dissolved metals and sulphide come out of solution (precipitate) and so the fluid appears as dense black smoke (hence the term "black smokers" often used when describing vents). These particles are deposited to the seafloor, forming the chimneys of hydrothermal vents, which can reach up to 45 m in height – as tall as a 7 story building!

WHEN WERE THEY DISCOVERED?: Hydrothermal vents were first discovered in 1977 on the Galapagos Rift in the Pacific and scientists first saw black smokers from the submersible *Alvin* in 1979. The scientists found spectacular mineral chimneys and lush oases of exotic animal life in the dark depths of the ocean. This remarkable discovery was totally unexpected - imagine their surprise! Weird and wonderful creatures were thriving in dense communities and it was a complete mystery as to what these animals were using for an energy source in the absence of sunlight, and in the presence of the toxic, high temperature conditions at the vents. Scientists had so much to learn.....

WHERE ARE THE VENTS?: Since the first discovery of hydrothermal vents, over 100 vent sites have been found along mid-ocean ridges in the Pacific, Atlantic and Indian Oceans, and many more are yet to be discovered as we extend our exploration to remote locations. The locations of those vents that have been studied already are marked on the map. Two new vent sites were discovered in 2005 - one on the south Mid-Atlantic Ridge and one on the Arctic Ridge system (the northern most vent fields found in the world so far).



WHAT ANIMALS LIVE THERE?: Over 300 new species of animals have been discovered at vents from a number of different animal groups. Many are exclusive to these ecosystems and would be unable to exist outside them. There are differences in the composition of the animal communities found at the different vent sites. For example, the vents in the East Pacific are dominated by giant tubeworms up to 1.5 meters long (*Riftia*), large white clams (*Calyptogena magnifica*) and mussels (*Bathymodiolus*). In the Atlantic, however, the vents are dominated by dense aggregations of shrimp and mussels. The recently explored Indian Ocean vents also had some surprises to offer...while most of the fauna is related to the animals in the Pacific, the dominant species is the common shrimp *Rimicaris* from the Atlantic!

BIOLOGICAL STUFF: Vent animals live independently from sunlight and photosynthesis. Here, tiny organisms play the same role as green plants and algae and form the base of the food chain. Instead of using energy from the sun to produce food, they use energy from chemicals from the Earth's interior. This process is called chemosynthesis. Because the animals are able to survive without sunlight, it has been suggested that hydrothermal vents could host life elsewhere in our solar system.

Some vent animals, like the giant tubeworm, survive only as a result of a symbiotic relationship with bacteria that feed directly on the chemicals. The plume of the worm is bright red because it is filled with blood. The plume can uptake oxygen and carbon dioxide from seawater and hydrogen sulphide from the hydrothermal vent. The worm then transports these ingredients in its blood to a region further down the body called the trophosome. The trophosome is home to the billions of bacteria that sustain the life of the worm. They use the ingredients to produce organic carbon that then nourishes both the bacteria and the giant tubeworm. Clever eh?!