Drilling in the Ocean Floor

By Jack Myers, Senior Science Editor for Highlights

If you were standing on this ship, you would see how odd-looking it is. It’s called the JOIDES Resolution. Since 1985 it has been working its way through the oceans of the world. Most of that time it has stayed quietly at rest while it drilled holes in the ocean bottom. That’s its job—to find out what’s down there beneath the ocean floor.

The 147-foot-high derrick can haul up long sections of drill pipe. Then the sections are threaded together to make a continuous pipe that can be lowered all the way to the ocean bottom. There are a lot of sharp teeth at the end of the pipe. That makes it work like a long, skinny cookie cutter. As the pipe is turned round and round and pushed downward, a pencil-shaped cookie of sediment and rock is pushed upward inside the pipe. It is called a core.
Special tools will pull a 30-foot-long piece of core up to the ship. Then there will be a cry of “Core on deck!”—and all hands will rush to the drilling deck. Carefully they will carry the core to the ship’s laboratory, where it will be studied and then labeled and stored. Altogether, the ship has collected a total of more than a hundred miles of cores. They make up a library of the seafloor’s sediment and rocks for scientists to study.

*JOIDES Resolution* has made a whole series of discoveries. Some tell about what happened in ages past, others tell about what is happening today.

**An Energy Source?**

One discovery has taught us more about a mysterious chemical called a gas hydrate. It occurs as ice-like deposits of methane and water deep beneath the ocean floor. (Methane is the stuff we call natural gas.) Gas hydrate is hard to study because it decomposes when taken from the high pressures at which it was formed. It took an invention of a pressure core sampler to bring samples up to the ship for study. The surprise was in how much of the stuff was found. Scientists of the program believe that the total amount of gas hydrate down there is greater than all other kinds of fossil fuel
(coal, oil, and gas) put together. Someday in the future we may find a way to recover it.

**Heat from Below**

I think the most exciting discoveries are in what’s happening right now beneath the seafloor. Far below, around the Earth’s center, there is a hot, hot liquid iron core. Its heat slowly rises through a thick layer called the mantle and up to the crust below the ocean floor.

We think of the mantle as being mostly rock, but it slowly flows under high temperature and pressure. So in a sluggish way the mantle behaves as a layer of thick liquid heated from below. The hottest places expand, become less dense, and rise. Since mantle composition is not the same all over, some places are better at carrying heat upward. They cause hot spots in the crust above.

A hot spot in the crust under the ocean floor gives lots of action. The crust is made of rocks with cracks and crevices between them. That creates channels where cold seawater can trickle down into hot places and other channels where the heated seawater is rising. So hot seawater is continuously trickling, or percolating, through channels in the rock. Percolation is a process often used by chemists to extract materials that can dissolve in water. (In kitchens it is used by some coffee makers to extract coffee from crushed coffee beans.)
Because it’s under great pressure, the super-hot seawater can’t boil, but it’s great at dissolving stuff out of the rock. Some of the stuff “undissolves” again when it reaches the cold water above. That leaves big deposits of minerals extracted from the crust. The idea of seafloor percolation is not a new one, but JOIDES Resolution has learned how it works. Instruments were left in several boreholes, and their information was retrieved several years later. That information confirmed the percolator idea and showed how big a percolating system can be—in one case a mile wide and more than a mile deep. These percolators churn up the seafloor. They deposit sulfur-containing minerals that provide food for seafloor bacteria. Those bacteria are food for animals that have never been seen up where we live. And studying how the percolators work tells us a lot about how our mineral deposits were formed in ages past. The JOIDES Resolution is letting us look at parts of the Earth we never saw before.

**Holding Still on the Rocking Sea**

You may have wondered how the ship can stay steady over the hole that it is drilling, maybe a mile below. That takes some special gear. The ship has twelve thrusters—jetpumps—pointed outward from the ship in different directions. They are operated automatically by controls that work to keep the ship right over the drill hole. And the derrick contains a shock absorber that protects the drill pipe from the ship’s up-and-down motion.