

Accomplishments of Scientific Ocean Drilling

For more than five decades, scientific ocean drilling has functioned as a time machine, recovering sediments and rocks from beneath the seafloor to reveal millions of years of Earth history in unprecedented detail, while providing the primary method to directly access subseafloor environments and active processes. Over this period, the U.S. has been the undisputed leader in what the journal *Nature* has called **“arguably the most successful international research collaboration ever.”** [*Nature* 501, 469–470 (2013)]. These efforts have led to nearly 15,000 peer-reviewed academic publications, almost 600 of them in *Science* or *Nature*.

Specific achievements include

- Confirmed the theory of plate tectonics by drilling a transect of cores across the South Atlantic Ocean and establishing a direct correlation between basement age and distance from the Mid-Atlantic Ridge.
- Drilled into oceanic crust and mantle-derived rocks, providing unique insights into how new seafloor is created and destroyed, and how Earth's interior exchanges heat and chemicals with the oceans.
- Improved understanding of the processes that generate tsunamis, submarine landslides, and volcanic hazards that threaten coastal populations and infrastructure. Directly sampled active fault zones associated with major earthquakes, providing unprecedented information about earthquake mechanics and fault behavior.
- Discovered and characterized a vast, previously unknown biosphere of microbes living more than two kilometers below the seafloor, one of the largest and least understood ecosystems on Earth, and a potential analog for life on other worlds.
- Installed long-term borehole observatories that allow scientists to monitor temperature, pressure, fluid flow, seismic activity, and microbial processes deep beneath the seafloor.
- Established the geomagnetic polarity timescale tied to astronomical chronologies back to 66 million years ago and created a continuous marine record back to 170 million years.
- Recovered continuous records of Earth's climate history spanning 66 million years that revealed abrupt, large-scale climate shifts occurring over decades to centuries rather than only over millennia, established the geological context for modern climate change, and provided critical tests for climate models.
- Demonstrated the close coupling among atmospheric CO₂, global temperature, ocean circulation, and ice-sheet growth and decay, helping establish the scientific foundation for understanding climate sensitivity.
- Recovered the geological record of major events in Earth history, including the Paleocene-Eocene Thermal Maximum, Ocean Anoxic Events, and the environmental aftermath of the Chicxulub impact that ended the age of dinosaurs.
- Produced irreplaceable geological archives that continue to generate new discoveries decades after samples were collected. These are housed within the NSF Gulf Coast Core Repository and partner repositories around the world.