Creative COREner...
1000 Years

written by W. Benjamin Bray

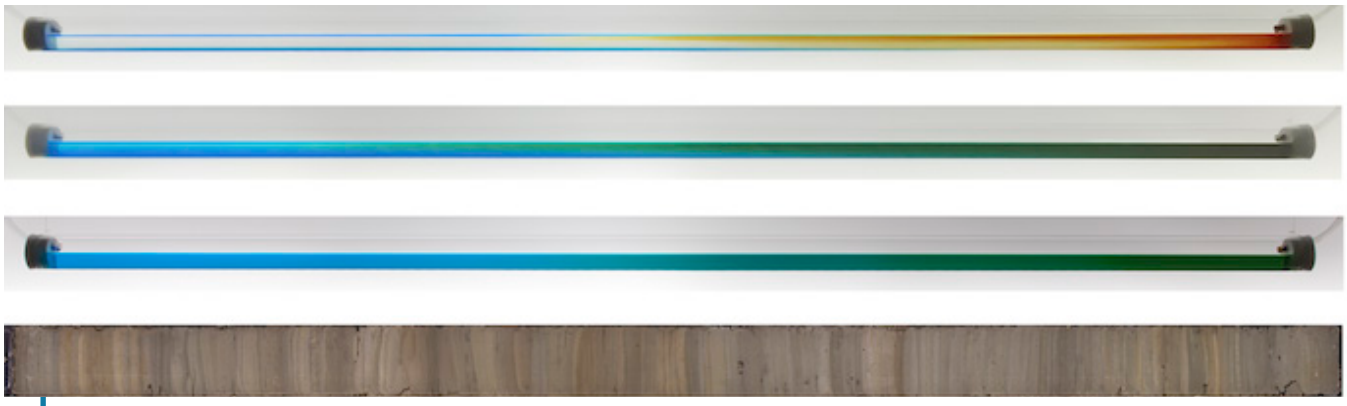
Our sense of the ocean is often in spatial units of measure, as we think of its vast surface and profound depth. Distances in the ocean seem greater than on land because it's so much more difficult to explore. Yet time is a more pertinent measure, as it often incurs cost, and its value to us increases as we get older. So, let's consider the ocean volume in terms of both, as a flowing system thousands of miles long, and a record of our influence a thousand years deep.

The "deep" domain of the ocean, according to many ocean scientists, is below 200m. This is the depth to which photosynthesis can be sustained - the deepest direct influence of natural illumination from the surface (the Sun). In the context of global climate, the deep ocean is the most dominant reservoir of heat on Earth, a density-driven, multi-layered network of flows connecting the polar regions. The deep ocean is essentially unfathomable, a vast common for doubt, where our relationship oscillates between rigorous debate and detached ambiguity. Like the Arctic and the Antarctic, it affects innumerable downstream climatic changes, but is far more difficult and expensive for scientists to explore and sense directly. And so, it remains a hiding place—a dark, massive, subconscious presence that lies outside the domain of what society generally perceives as under its control or as its responsibility.

Relative to human activity, however, the ocean isn't deep at all. If there were an "Anthropic Zone" in the ocean defined by the depth to which humans affect ocean chemistry and habitat, it would extend all of the way to the bottom. And because so much of the ocean is dark, we don't see the profound depths of humanity's influence. The ocean is deep relative to our knowledge of it, but also shallow relative to our influence.

The Meridional Overturning Circulation is the primary system of ocean currents spanning the entire globe, driven by temperature and salinity-dependent instabilities, and large-scale wind patterns. Cold, salty water is more dense than warm, fresh water, and when you have this vertical instability in the water column, you have overturning. This overturning flow is the strongest connection between the surface ocean and the deep ocean. A complete overturning of the Earth's oceans occurs in approximately 1000 years, the same time period over which human activity affects the Earth in the Anthropocene.

This massive display in the Boston Convention and Exhibition Center combines the flow and accumulation concepts presented in the the 1000 Years project, rendered as a 60-sec simulation (Credit: W. Benjamin Bray and Mark J. Stock).

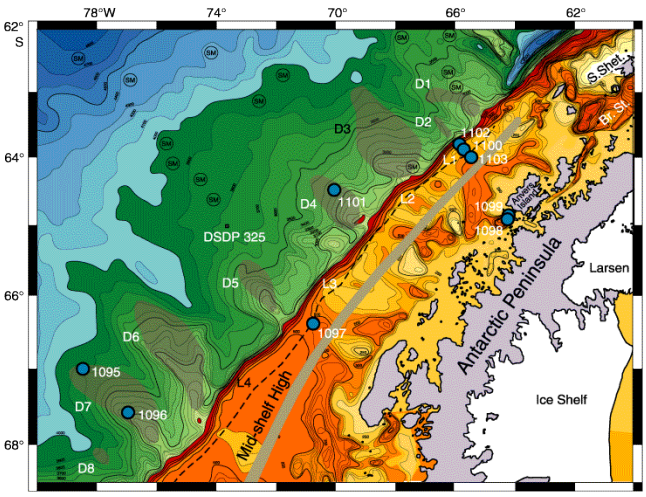


From top: The flowing Meridional Overturning Current as three tubes, in sequential stages of flow; the 1000-year sediment core (Credit: W. Benjamin Bray).

The accompanying photos present 1000 years of overturning in borosilicate tubes 1.52m long. One tube, shown in sequential stages of flow, depicts the Meridional Overturning Circulation, with cold, downwelling seawater flowing underneath warm water full of detritus that's settling to the bottom. Melting chunks of frozen seawater dyed blue trace the downwelling, while warm espresso traces the buoyant, flowing surface current. The flowing currents mix together over 48 hours into a continuous shade of dark blue-green.

The other tube presents a sediment core: a layered collection of detritus extracted from a single location in the ocean floor. Oceanic detritus that's heavy enough and isn't recycled through ocean biochemistry eventually settles to the bottom, creating layers of sediment reflecting changes in the biogeochemical dynamics of the water column over many years. Sedimentation rates vary considerably throughout the ocean, and in the Southern Ocean just west of Palmer Land, Antarctica, the sedimentation rate is approximately 1.52mm/per year, or 1.52m per millennia, the same length as the glass tube. This sediment core was photographed by the artist at the International Ocean Drilling Program repository in College Station, TX.

These depictions of the ocean in units of time and space are easier to grasp than units of influence, because the latter is more difficult to study and understand, due to its dependence on the former. But our influence on the ocean continues to reveal itself as we collect more data beyond its darkest horizons.



The 1000-year core was collected from Hole U1098A during Ocean Drilling Program Leg 178. This map shows sites drilled during that expedition on the Antarctic Peninsula Pacific margin, with bathymetry from Rebesco et al. (1998) and showing sediment Lobes L1-L4 on the outer continental shelf, Drifts D1-D8 on the upper continental rise, the mid-shelf high (MSH), and DSDP Site 325. Br. St. = Bransfield Strait, S. Shet = South Shetland Islands. (Credit: ODP)

To learn more about this piece and others, visit the artist's website.