

# Wyoming geophysicist's discovery may provide a new tool for oceanographers

by Paul McWilliams

Invisible walls often separate scientists of different disciplines. Sometimes one discipline's unneeded junk is treasure to another. Occasionally, an alert scientist is able to breach one of those walls and the treasure is discovered.

Thanks to Steve Holbrook, a professor and geophysicist at University of Wyoming in Laramie, Oceanographers might soon be able to use an old tool, called seismic reflection profiling, in a whole new way to map and study currents, eddies, and internal waves within the ocean. More importantly, oceanographers may be able to apply this technique to numerous data sets that have already been collected by geophysicists around the world. Ocean dynamics are important for understanding the role that oceans play in global climate.

In the past oceanographers could only roughly map the spatial structure of the ocean's temperature and salinity by repeatedly dipping sensors into the different layers, often kilometers apart.

During August of 2000, Holbrook was onboard the research vessel M/V Maurice Ewing using the 50-year old technique explore the structure of rocks deep within seafloor off Newfoundland. He noticed weak reflections from within the water column. Rather than ignoring the curious data, he decided to find an oceanographer to ask. "I actually did a Google

search," says Holbrook. Ironically, he discovered Ray Schmitt at Woods Hole Oceanographic Institution, where they had both worked in the very same building for eight years without ever meeting. Schmitt compared Holbrook's data to known ocean temperature and salinity layers, called thermohaline fine structure, and found a remarkable match. Their findings were published in the August 8, 2003 edition of journal *Science*.



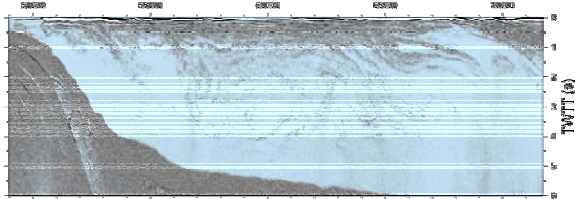
**Steve Holbrook (left) and Ray Schmitt examine a seismic reflection profile.**

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Traditionally, seismic reflection profiling has been used create pictures of the earth's structure deep within the seafloor and to search for oil and gas deposits. Sound waves are sent from a ship through the water and deep into the earth and bounce off different layers within the rock that makes up the ocean floor. A computer records the echoes and uses sound-speed calculations to create a picture

of layers in the earth beneath the seafloor. Seismologists using this technique have always recorded weak reflections from within the water, but they were not trained to recognize the significance of this part of their data.



Images like this might soon allow oceanographers to more quickly spot ocean-mixing phenomena. The image is a cross section of the ocean. The vertical axis represents two-way time travel in seconds. The base of the section, at 6 seconds, represents a depth of approximately 4500m. (Steve Holbrook, University of Wyoming)

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So far the seismic profiling data seem to match those from more traditional techniques, but Holbrook and Schmitt need to do more work to confirm that the echoes provide an accurate picture of dynamic ocean layers. "The goal is for this to become a standard tool for oceanographic research, but it won't really replace traditional methods," says Holbrook. Instead it will provide oceanographers with a way to see a more detailed map of the lateral spatial connections between their widely spaced samples.

Holbrook is confident that data from any deep-sea marine seismology expedition can be reprocessed to yield valuable oceanographic information.

Holbrook's primary focus remains undersea geology, but during his expeditions he now looks at seismic reflections from the water too. A small

National Science Foundation grant has purchased temperature-measuring equipment so that he can compare his profiles to temperatures deep in the ocean.

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