Seismometer for exploration of the sea floor

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A sensitive "ear" dropped 15,000 feet to the ocean's bottom is aiding a study of puzzling sea floor noise by scientists at the University of California's San Diego campus.

In the waters of the Pacific off the coast of Hawaii, UCSD researchers have employed a three-component seismometer to explore a shaking of the sea floor-- believed to be caused by storms at sea and the pounding of the surf.

Scientists call the ground-shaking "microseismic noise." Among the questions about it which they would like answered are: What is the origin of the noise? Is it more obvious in some waters than in others? Can the noise be studied by placing seismometers on the bottom of the sea?

In collaboration with the Air Force Office of Scientific Research as part of the Advanced Research Projects Agency's Vela-Uniform Program, University researchers conducted seismic measurements in October in preliminary studies designed to yield information of the noise level on the ocean bottom. Dr. Hugh Bradner, a physicist in the Institute of Geophysics and Planetary Physics, directed the deep-ocean measurements from the charted vessel, Kanalo.

Why study ocean seismic noise? Ordinarily, seismic measurements are records of vibrations from the earth's interior, caused by the fracture or failure of rock under great strain. UCSD scientists, however, are concerned with a seismic noise which seems to originate in the ocean, or at the seashore. Most of this noise is due to a continuous shaking, and is not a fracture of rock inside the earth.

The recording of ocean seismic noise by placing a seismometer an the sea floor is a relatively new process; in fact, nearly all ocean noise has, in the past, been detected by seismometers located on land. Scientists have speculated, however, that normal "background" noise may be less on the ocean floor than it is on land. Hence, they feel that seismographs placed on the ocean floor may be more sensitive to regular and irregular vibrations than their counterparts on shore.

Included in this Vela-Uniform Program is the monitoring of seismic stations on land, and the gathering of seismic data from all parts of the world. A significant aspect of the program is to determine the feasibility of placing seismometers on the bottom of the ocean.

The recent UCSD seismographic plants were made in waters approximately 30 miles west of Kailua Kona, Hawaii, and approximately 150 miles south south-east of South Point, Hawaii. According to Dr. Bradner, the free-falling, self-rising measurements reached record Pacific Ocean depths, and may also be the first in deep-water made with accurately simultaneous land measurements.

While the three-component instruments were ocean-tested, simultaneous recordings were taken with seismometers at the Volcano Observatory on the island of Hawaii. Additional recordings were also obtained in Hawaii and La Jolla under the direction of Dr. Richard Haubrich, Assistant Professor of Geophysics.

Three-component, or "three-dimensional," measurements necessitate the planting of a package containing three seismographs into the ocean-- each one pointing in a different direction. A single seismograph reflects the motion of the ocean floor in only one direction. "But the motion isn't just up and down, or East and West," explains Dr. Bradner, "You must measure in all directions to learn the type of motion."

The instruments used in the UCSD measurements are modifications of the California Institute of Technology Lunar Seismometer-- an instrument originally constructed for seismographic measurement on the moon.

The free-falling, self-rising procedure has been used infrequently in obtaining seismic measurements, according to James Dodds, Design Engineer on the project. Using this method, scientists are able to drop the instrument package into the ocean's depths and eventually recover it, although the package is not attached to the vessel.

A sphere containing the measuring instruments is affixed to a 150 pound steel spike, or anchor, and the package sinks to the ocean floor, planting itself on the bottom. After the instrument has completed the recording of data, an electrical signal actuates a device which releases the sphere from its anchor.

The sphere, in turn, floats to the surface. At the surface, a radio attached to the sphere transmits signals which are picked up by a direction finding radio aboard the vessel. Thus, location of the instruments is fixed, and eventual recovery facilitated.

Other deep ocean seismic measurements are planned for February, between La Jolla and Hawaii. Analysis of data obtained on the October voyage is currently in progress.