

SATURDAY E.M., Nov. 4
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Discovery in the central Pacific of a tremendous underwater mountain range---1,000 miles long, 100 miles wide and up to 14,000 feet in height---was announced yesterday as a joint University of California - U.S. Navy expedition returned to San Diego.

The submerged mountain range, which has been named the "Mid-Pacific Mountains", stretches all the way from Wake Island to Necker Island near the Hawaiian group.

Hydrographic charts had previously indicated isolated shoal points in this area, but the findings of the expedition proved conclusively that these were not isolated peaks but the summits of a long narrow, virtually continuous mountain range as mighty as the Sierra Nevada.

Most of these sea mounts were flat on top---as if eroded by wave action in shallow water and then sunk below the surface. Clam, snail and sea urchin shells were dredged from a submerged mountain top that has now sunk to the 6,000 foot level.

Entitled "Operation Midpac", the expedition was sponsored by the University of California's Institute of Geophysics and the Office of Naval Research and Bureau of Ships of the U.S. Navy, and carried out by the University of California's Scripps Institution of Oceanography and the U.S. Navy Electronics Laboratory at San Diego.

Led by Dr. Roger Revelle, acting director of the Scripps Institution, the expedition consisted of two vessels, 85 crew members and 30 scientists from the Scripps Institution, U.C.L.A., U.S.C. Stanford, the U.S. Geological Survey and the U.S. Navy. The two ships were the HORIZON, a 143-foot converted Navy tug which now

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belongs to the Scripps Institution, and the EPCE(R)-857, a 220-foot research vessel assigned to the U.S. Navy Electronics Laboratory.

The two vessels set out from San Diego for the central Pacific on July 27 and completed their 96-day, 27,000-mile trip on November 1.

Chief mission of the expedition was to explore the vast, watery frontier which comprises the floor of the Pacific Ocean, and about which comparatively little is known.

Scientists had previously believed that the floor of the Pacific had remained relatively stable for hundreds of millions of years. But the mass of evidence brought back by "Operation Midpac" shows that in recent geologic times it was the scene of violent movement and that there have been great changes in depth.

Dr. Revelle points out that underwater sea mounts---the gigantic "Mid-Pacific Mountains"---were thrust up and afterwards sunk. They have sunk in such recent geologic times that the submergence is thought to be due primarily to the sinking of the sea floor itself. Great quantities of ash were also dredged up, indicating widespread and violent volcanic activity.

In exploring the bottom of the deep Pacific, the scientists of "Operation Midpac" used a number of new tools which have been developed only in the past few years.

With modern developments in instruments and techniques it is possible to learn a great deal more about the deep sea than has ever been known before, Dr. Revelle pointed out.

Some of these new scientific tools are:

1. The recording echo sounder, which makes it possible to trace the bottom configuration of the ocean without stopping a ship. Somewhat similar to Sonar, a sound pulse is sent to the

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bottom and when it bounces back is recorded on a continuous tape.

2. The seismic refraction method (such as that used in exploration for oil), for determining thickness of mud and structure of rocks. Sometimes the two ships were as much as 80 miles apart when seismic refraction was used, and a total of 35,000 pounds of TNT was exploded on the trip.

3. A new method of pulling long cores of mud from the bottom of the sea, developed by the Swedish scientist Kullenberg. With equipment available on the two exploration vessels, cores up to 24 feet were taken.

4. A complex electronic recording system for measuring the temperature of deep bottom mud. This consisted of a sturdy, waterproof box, able to withstand 7,000 pounds per square inch of pressure, attached to a spear fitted with thermometers. When lowered and plunged into the mud, this device recorded the submarine temperatures.

5. A new type of dredge for scooping up rocks off the ocean's floor.

6. A special, underwater camera, developed at the U.S. Navy Electronics Laboratory, for obtaining flashlight pictures at depths up to one mile..

7. A chemical analytical technique for counting bacteria in bottom muds and measuring dissolved chemical substances.

"Operation Midpac" explored Bikini atoll and Kwajalein atoll in the Marshall Islands, finding them to be an enormous pile of calcareous remains on top of old volcanic peaks. Considerable evidence gathered on this expedition supports the theory---advanced by Charles Darwin nearly 100 years ago---that coral atolls are formed by reefs growing around old volcanos.

Thus, coral atolls represent the largest structures ever made by living creatures, Dr. Revelle pointed out. In comparison, the pyramids of Egypt and the Empire State Building are microscopic.

On some of the submerged volcanic summits, expedition scientists found round, nodules---rough surfaced balls of almost pure manganese, several inches in diameter. When cracked open, a nucleus of a pebble, a piece of volcanic rock, the ear bone of a whale, or a shark's tooth would be found inside.

One of the most dramatic results of the expedition came from the study of bacteria in the buff and chocolate brown ocean muds. In Southern California muds, bacteria are concentrated in the first few inches where plenty of food exists. Cores obtained from the deep sea, however, showed that approximately the same number of bacteria existed 20 feet deep as at the surface of the mud.

Dr. Revelle suggests that these bacteria in nature's "deep freeze" are in a state of suspended animation since little or no food exists that far down. Some of these bacteria may be literally millions of years old---perhaps the oldest living things on earth. When brought to the surface and put in a culture medium, the bacteria begin to grow with strength and vigor.

In addition to studies made of the Pacific's floor, many other related scientific projects were carried on during the three months cruise. Meteorologists sent radiosondes aloft to get information up to 100,000 feet, and found weather not to be as stable as had been thought. Sound experts found as many as six sound-reflecting layers in the water. Many types of queer tropical fish---including hatchet-fish with rows of luminescence along their sides---were caught. Scientists found the North Equatorial Current making giant swirls between the Equator and the 10th Parallel.

Personnel of "Operation Midpac", the joint University of California-U.S. Navy expedition, included the following:

Scientific leader---Dr. Roger Revelle, Acting Director of the Scripps Institution of Oceanography, La Jolla

Naval Commander, captain of the EPCE(R)-857---LCdr. D.J. McMillian
USN

Master of the HORIZON---James Faughn (Scripps)

Senior Scientist, EPCE(R)-857---William Batzler (U.S. Navy Electronics Laboratory)

Seismic measurements---Russell W. Raitt, Thomas W. Runyan, Daniel Gibson (Scripps)

Temperature gradients---James M. Snodgrass, Arthur Maxwell, William Thompson, Frank Hetzel (Scripps)

Bottom cores---Jeffrey D. Frautschy, Louis Garrison, George Brayton (Scripps)

Dredging and underwater photography---Dr. Robert S. Deitz, Dr. H.W. Menard, Carl Shipek (U.S. Navy Electronics Laboratory) and Edward Hamilton (Stanford)

Geological work,--Marshall Islands---Dr. Kenneth O. Emery, Robert F. Dill (U.S.C.)

Chemical work on bottom sediments---Dr. Sidney Rittenberg (U.S.C.)

Bacteriological work on cores---Richard Morita (Scripps)

Biological collections and hydrographic measurements---Robert P. Huffner, Deane F. Carlson (Scripps)

Water temperature---Jeremiah Black, Joseph Rogue (U.S. Navy Electronics Laboratory)

Meteorological work---Davis S. Johnson, Leon Sherman, Joseph Edinger (U.C.L.A.)

Maintenance of scientific equipment---Scott Cosby (correct spelling) (U.S. Navy Electronics Laboratory)