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X-Rays Provide Researchers with Views of Coral Growth Patterns

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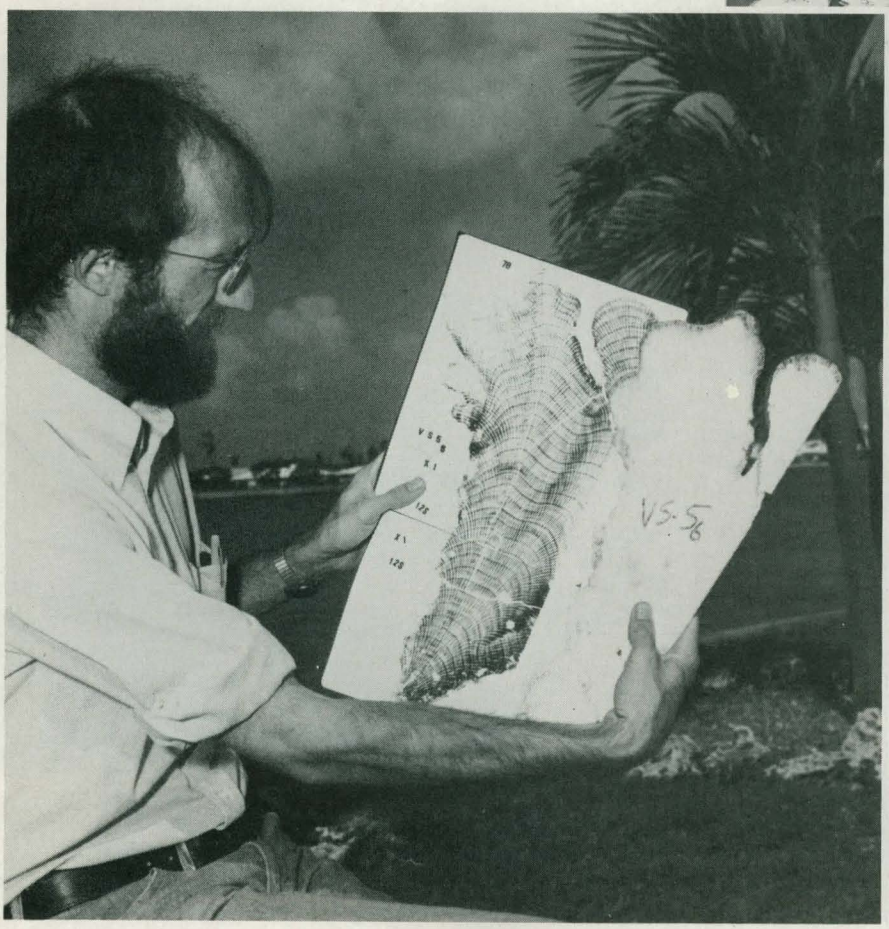

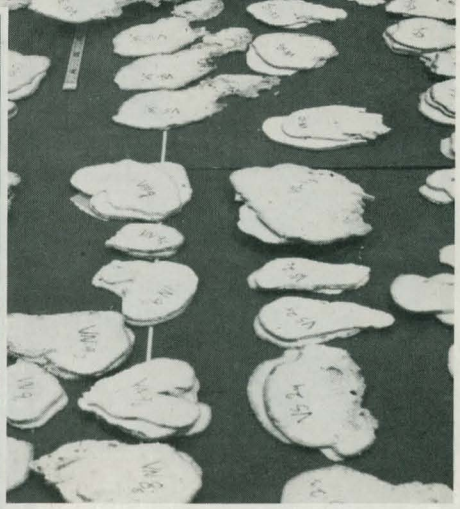

Left, Dr. Dodge holds a positive photograph made from a radiograph, illustrating how growth rings are revealed by X-rays. ***Above,*** he looks over part of coral collection in the lab prior to conducting X-ray tests.

Modern x-ray (radiography) techniques are helping approximately 10 researchers in the United States to study and document the growth patterns of coral skeletons, the hard, calcareous, hemispherical structures that are produced by soft coral tissue.

According to Dr. Richard E. Dodge, radiography is invaluable to this type of coral study. Before x-rays were used to study coral, he states, it was difficult—if not impossible—to measure coral growth rates and obtain large amounts of data.

Dodge, an assistant professor at the Ocean Sciences Center of Nova University, Dania, Florida, began studying coral off the shores of Jamaica in 1973. Since then, he has collected, studied, and presented scientific papers on coral from the waters of Puerto Rico, Barbados, Bermuda and other tropical islands.

X-ray studies of coral give Dodge a different method of determining the age of coral formations and learning more about environmental effects on the many species. And the scope of the studies is almost unlimited.

Dodge, who holds a doctorate in geology from Yale University, has used x-rays to investigate many aspects of coral reefs, from the effects of dredging on coral in Bermuda to the effects of bombings in U.S. Navy target practices. He says that in Bermuda they were able to tell from radiographs that between 1941 and 1943 many dead corals were found in Castle Harbor and had died probably at about the time that heavy dredging was being done to deepen the harbor area.

The researcher is very selective in his choices of coral to be studied, staying away from the rare corals because they are not representative of the general coral species.

The researchers go snorkeling for most of the coral they examine. Reef-building corals do not grow below 100 feet deep because they need sunlight to live. Naturalist Charles Darwin was one of the first to observe that corals do not grow abundantly below a depth of about 100 feet. He used this information in later theories about Pacific atoll formation.

Once the coral is brought ashore, Dodge prepares it for x-ray examination. First, he slices the coral into a rough slab using a common masonry saw. Then, he uses a geological rock saw to thin slice the specimen to about one-half centimeter in thickness.

The specimen is then taken to the x-ray room at the Ocean Sciences Center and readied for the exposure. Dodge

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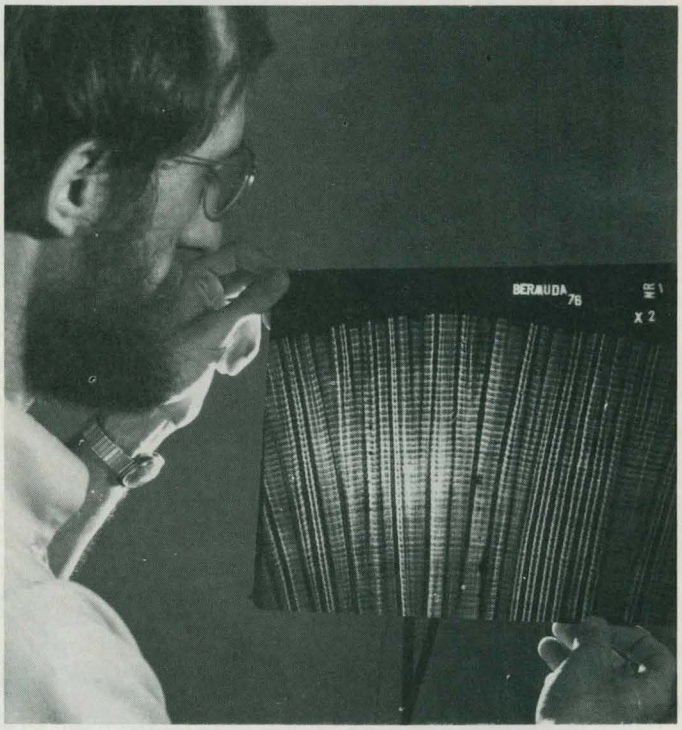
places the coral "slice" on top of a sheet of Kodak Industrex AA film (Ready Pack)—either 8" x 10" or 10" x 12", depending on the specimen size—and sets the university's x-ray machine at 100 kV. The average exposures are made between 10 and 60 seconds at a source-to-film distance of approximately 50 inches.

The film is hand-processed in an on-site darkroom and checked by Dodge for quality control purposes. He prefers this type of film for a coral examination, as it gives a wide latitude of density variations.



Coral growth rings are examined on radiograph made from Kodak Industrex AA film. The x-rays have been helpful in determining the age of coral and learning how the environment affects coral species.

Actual growth ring measurements are made from positive prints. Using the radiograph as a negative, prints are made on photographic papers.

By this method, the scientists have been able to map out the relation between coral growth rates and nutrient supply in Bermuda. From the x-ray studies, the researchers found that nutrients are a major variable in the long-term growth of coral. It appears that coral grows faster during periods when nutrient supplies are high even though upwelling periods are classically colder periods, and coral is supposed to grow slower in colder water. A combination of data taken from the radiographs and some computer analysis led the researchers to the conclusion that nutrient supply was the key to growth—despite the decrease in water temperature.

Dodge was assisted in much of the coral research by colleagues at Yale's Department of Geology and Geophysics.

The Ocean Sciences Center, at Nova University, under the direction of Dr. George Lawniczak, Jr., is concerned with studies and investigations in experimental and theoretical ocean sciences. These include: (1) ocean currents, eddies, fronts, temperature distributions, waves and swells; (2) the interactions between the surface layers of the oceans and the overlying atmospheric marine boundary layer; (3) geology; and (4) marine biology.

In Dodge's area of study, plans are being readied to expand research of coral off the beaches of Fort Lauderdale, Dania, and Hollywood—locations adjacent to the center, and along the South Florida shore. He expects to find a wide variety of coral species in Florida, and hopes some will exceed the age of his oldest finding. This coral is the "grandfather" of his collection, estimated by radiographs to have been born in the 1770s. □

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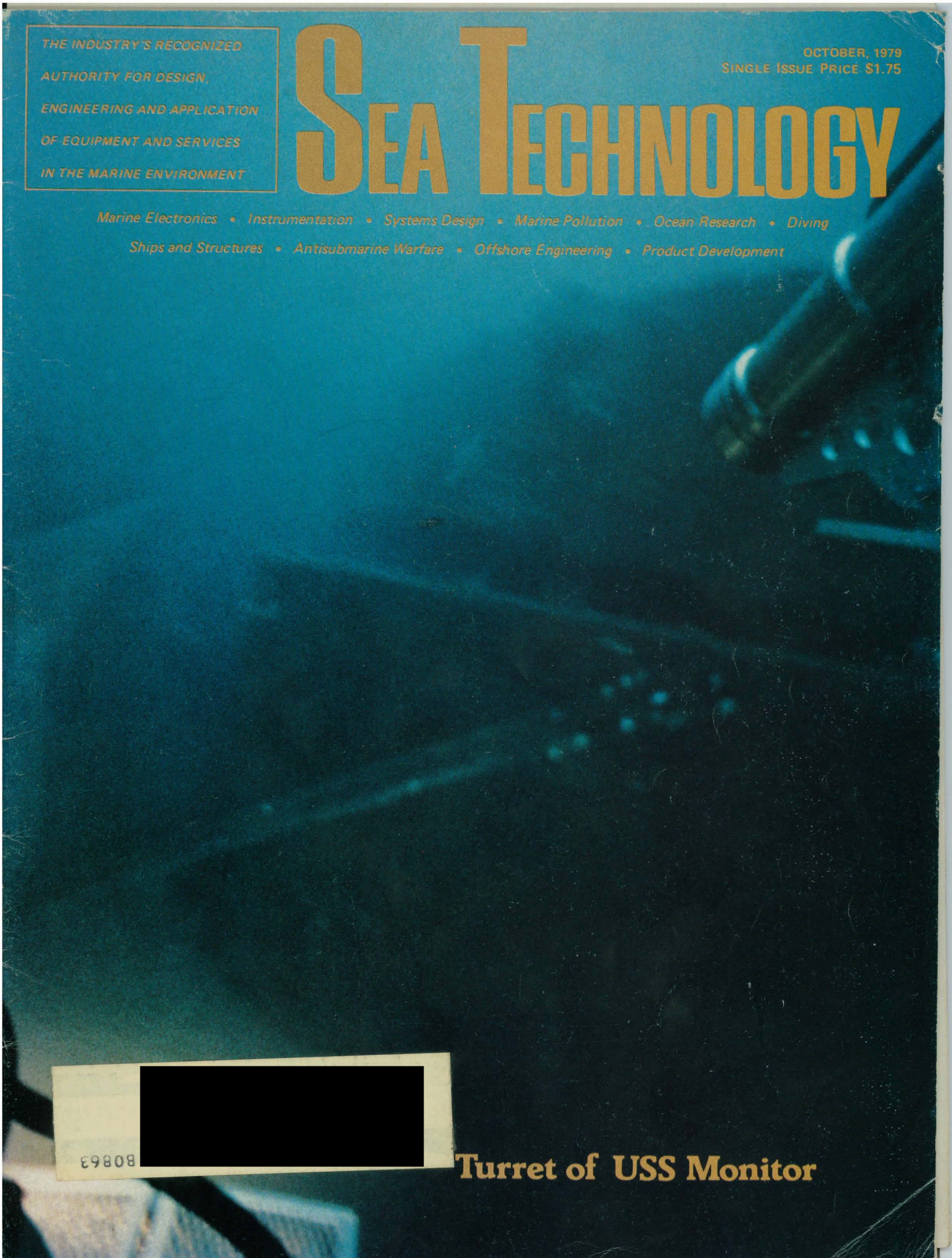

Turret of USS Monitor