United States Department of the Interior

GEOLOGICAL SURVEY

BRANCH OF ATLANTIC MARINE GEOLOGY
WOODS HOLE, MASS. 02543

MEMORANDUM:

4 April 1984

TO: Staff

FROM: Bob Commeau B. t C.

SUBJECT: ALVIN dives on the West Florida Escarpment.

From March 7th to the 14th, I was involved in a series of submersible dives on the Florida escarpment. The Chief Scientist onboard the ATLANTIS II/ALVIN cruise was Charlie Paull who is now at Scripps. The major objectives were to determine the stratigraphy and depositional origin of the strata presently exposed on the escarpment face, and to determine how and by what processes erosion has modified the present escarpment.

The scope of the expedition was expanded with the discovery of sulfur-enriched "seeps" on the abyssal floor at the base of the escarpment. Associated with the "seeps" are polymetallic sulfide deposits and a hot vent-type community of living organisms.

The attached statement provides additional information on the unexpected find.

Attachment

PRESS RELEASE

DEEP SEA VENT-TYPE COMMUNITIES DISCOVERED, FLORIDA ESCARPMENT, GULF OF MEXICO

A significant discovery has recently surprised and delighted a diverse group of scientists from several institutions and organizations diving on the steep step-like cliff formed where the limestone peninsula of Florida plunges to the two mile deep floor of the eastern Gulf of Mexico. While exploring the base of the cliff, these scientists observed a rich community of sea floor organisms of types previously known only within areas immediately surrounding Pacific ridge crest hydrothermal vents. These communities were found on the abyssal Gulf of Mexico using the deep-diving research submersible ALVIN. Vent-type communities in both the Gulf and the Pacific have abundant life which is in marked contrast to the sparse biota and limited biological activity typical of the abyssal ocean floor.

The Gulf community contains the same types of organisms which characterize the Pacific vent communities: white surface mats, presumably of bacterial origin, large and dense beds of mussels, numerous small snails grazing on the mussels, thick patches of tube worms, red-fleshed clams, Galatheid-type crabs and eel-like "vent" fish. The Pacific vent communities are found immediately adjacent to hydrothermal vents associated with ocean ridge crest magma sources. Until now they have been the only known biological systems that do not receive primary energy from the sun through photosynthesis, but rather from the chemical energy supplied by bacterial oxidation of reduced sulfur coming from the hot vent, a process called chemosynthesis (or chemolithotrophy).

The deep-sea communities in the Gulf of Mexico exist in an entirely different geological setting: directly at the base of the Florida escarpment, a cliff which rises above the nearly flat-floored Gulf from 3270 meters up to 2000 meters at almost a 45 degree slope. The escarpment is composed of outcropping permeable limestones which were deposited in shallow water 100 million years ago, but which have since subsided to their present great depths. The escarpment is not associated with either hot water or magmatic sources. However, the Gulf of Mexico vent-type communities appear to thrive on the same kind of energy generation and similar food chains as the Pacific communities. Biological production presumably starts with bacterial oxidation of reduced sulfur carried in fluids which seep out of the adjacent Florida Platform.

This discovery significantly extends the known biogeographic range of deep sea chemosynthetically supported communities into the Atlantic, and demonstrates that these communities occur 1) in geologic settings other than ridge crests, and 2) without a heat dependence. This suggests that the most important component necessary to sustain these deep-sea communities is a source of reduced sulfur.

The expedition was lead by Charles Paull of the Scripps Institution of Oceanography and included biologists from Columbia

University's Lamont-Doherty Geological Observatory (Barbara Hecker), and from Boston University (Stjepko Golubic, Jamie Hook), along with geologists and chemists representing the U.S. Navy and the National Research Council (Ray Freeman-Lynde), the U.S. Geological Survey (Bob Commeau), the University of North Carolina (Conrad Neumann, Liz Sykes) and University of Texas (Bill Corso).

The scientists were employing the research vessel ATLANTIS II and the submersible ALVIN of the Woods Hole Oceanographic Institution to study the geology and biology of the limestone wall when the startling discovery was made. This work was funded by a grant of the National Science Foundation to Joe Curray, Charles Paull, and Conrad Neumann (Scripps, University of North Carolina) and a grant of the Office of Naval Research to Ray Freeman-Lynde, a postdoctoral researcher at the U.S. Navy's NORDA laboratory. John Edmond of the Massachusetts Institute of Technology donated an extra dive for the study of this unexpected find. The R/V ATLANTIS II is under the command of Captain Reuben Baker, and DSRV ALVIN under the direction of Ralph Hollis, who was piloting the submersible when the discovery was made.