Project Oceanography
Coral Reefs VII:
Fossil Coral Reefs

October 24, 1997

MARK HAFEN, USF Marine Science

Included in this packet:

1. A brief summary for the instructor of the important concepts in this presentation.

2. A one-page reading for the students to recap some of the ideas from the presentation
   regarding the tools used in the investigation of the Florida Middle Ground.

3. A "Student Exercise #1" and "Student Exercise #2" for the students in matching up features between two of the different
   types of images that were used in studying the Middle Ground.

4. A suggested answer key (two pages) for the instructor to use as a guide

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Teacher Bachground

This portion of the coral reefs series looks at a partially active reef system, the Florida Middle Ground, which occurs in an area that is hostile to reef growth: the water is too cold, too deep,and too nutrient rich. The Middle Ground represents a dying reef system, probably leftover from when sea level was much lower, but which, for a variety of reasons, has not completely been eliminated.

Important to the investigation of the Middle Ground are the tools used and discussed in the broadcast. The actual instruments, and the images they record, shown during this broadcast will be: video from a remotely operated vehicle (ROV), side-scan sonar, and seismic sonar.

The attached reading and exercises are intended for use by the students after the presentation. It is a chance for them to look at some of the remotely sensed images we collected in the Florida Middle Ground and to try to match up, as we do, features that are identified on the two different types of sonar data. The main concepts for them to understand are:

* side-scan sonar provides images which look directly down on the surface of the sea floor, like looking at the top of a cake.
* seismic sonar provides images at and below the surface of the sea floor, like looking at the side of a slice of cake.
* for these images from the Florida Middle Ground, dark patches on the side-scan correspond to elevated areas of the sea floor (coral and rock), while lighter patches on the side-scan correspond to lower areas of the sea floor (sandy sediments).

Not all features will correspond exactly. The scales of the images are different, and variables such as the ship's speed and heading while the data are being collected will cause distortions of the images. The seismic sonar line does not

necessarily correspond to the center line of the side-scan image, so that one small feature to either side of the side-scan image may appear as an elevation or depression on the seismic image. The key here is to see if the students can make some connections between the two different types of images, as geologists must do.

There are no absolute right or wrong answers to the exercise. Most of the suggested connections are included in a key for the instructor.

Using Different Types of Sonar Images to Look at the Florida Middle Ground Reefs

Student Summary Reading

In studying features on the ocean floor, scientists use a variety of tools to provide a three-dimensional picture. We viewed the Florida Middle Ground reefs using several tools: video from a remotely operated vehicle (ROV), side-scan sonar, and seismic sonar.

The *ROV video* allowed us to see the composition of the reefs and how active the biological community is in the Middle Ground. This showed us how the reefs are being bio-eroded and how sediments are being created.

Side-scan sonar gave us a two-dimensional view of the sea bed, as if we were looking straight down on the top of a flat cake. Variations in the composition and elevation of the bottom are revealed in side-scan sonar by changes in color between black and white. Dark areas show rock or coral, and lighter areas represent low spots filled in with sediments (sand).

Seismic sonar gave us a different two-dimensional view of the sea floor and what lies below it, like looking at the side of a slice of a cake. By combining a series of the side-scan and seismic images, we get a three-dimensional picture of the sea bed and the structure beneath it. Combined with the ROV video, this can tell us how the Middle Ground formed, what processes have altered it over geologic time, and what currently might be happening to it.

We saw from the ROV video that the coral structures protruded up from the sea bed and had various organisms living on them, some of which were eroding the coral rocks. In between these protruding structures, we could see sediments accumulating in the low spots. On the side-scan sonar images, the protruding coral rock structures appeared dark, while the sediments in the troughs appeared light gray. Using the seismic sonar images, we could actually see where the different high and low elevations were on the sea bed. We can then match up features between the side-scan and the seismic images. The two types of sonar are also geo-referenced by satellites, meaning that we know exactly where the images are located on the sea bed, so we can also match them up by using this information.

Now, here's your chance to try matching up side-scan and seismic sonar images that we collected in the Florida Middle Ground. Just pretend you're looking at pictures of a cake: the side-scan looks at the top surface of the cake, and the

seismic looks at the side of a slice. See how many features you can link up between each set of images.