

Seabed Photographs, Sediment Texture Analyses, and Sun-illuminated Sea Floor Topography in the Stellwagen Bank National Marine Sanctuary Region off Boston, Massachusetts

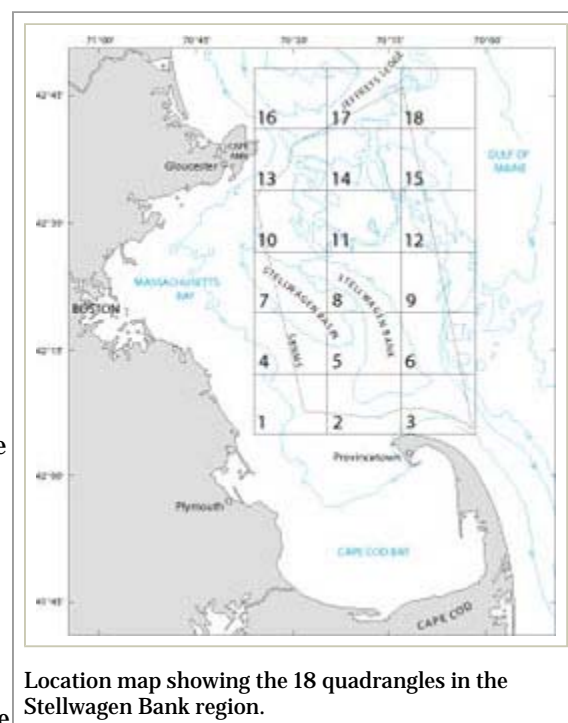
Seabed Photograph Collection and Processing

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Photograph-Collection Methods

SEABed Observation and Imaging System (SEABOSS) – As a part of the process of mapping the sea floor, the U.S. Geological Survey developed a photograph collection system to aid in the interpretation of seabed sonar imagery.

The SEABOSS is not a towed system. It incorporates a modified Van Veen sediment grab sampler, a still camera, and two color video cameras into a frame that is lowered to the seabed from a drifting vessel. A navigation receiver is placed on the ship at the location from where the SEABOSS is launched. The navigation system uses global positioning system (GPS) techniques, and locations of photographs are accurate to within 10 m. During deployment, the camera system hangs directly below the side of the ship, and the recorded navigation data closely approximate the position of the camera system near the seabed. The ship is oriented so that wind and waves will not cause it to drift over the conducting cable attached to the SEABOSS. The winch operator uses a video feed from the system to maintain the cameras at the proper height above the seabed; the scientist uses the video to decide when to trigger the still camera and record the time the photo was taken. The height of the camera above the seabed (76 cm; 30 in.) initially was determined by viewing an object hanging from the SEABOSS below the video camera; when the object touched the seabed, the camera height was appropriate for still photography. Later in the project, the camera height was determined by viewing a pattern of laser beams on the seabed. For further information on the SEABOSS, see



Location map showing the 18 quadrangles in the Stellwagen Bank region.

<http://woodshole.er.usgs.gov/operations/sfmapping/seaboss.htm>

<http://pubs.usgs.gov/fs/fs142-00/fs142-00.pdf>

Still-camera System – All photographic images were acquired with a Photosea underwater-camera system.

Camera	Photosea model no. 1000A; rated to 305 m (1,000 ft)
Strobe	Photosea model no. 1500S; rated to 457 m (1,500 ft); flash 1/750 s
Lens	Nikkor underwater 28 mm with a +1-diopter lens attachment; aperture set between f11 and f16; focus set at 0.8 m (2.5 ft)
Film	Kodak Portra 400 NC color film; bulk roll 10 m (33 ft) long with 250 exposures; exposure time 1/150 s

Photograph-Processing Methods

Photograph processing – Exposed film was developed in bulk 250-exposure rolls by a commercial film-processing company. The bulk rolls of negatives were then sent for scanning to a commercial digitizing company where the negatives were scanned by using Kodak Photo CD (PCD) software. A PCD image file of each negative was generated and archived on CD-ROM. PCD images can be used to generate images at resolutions ranging from 96 x 64 pixels to 3072 x 2048 pixels. The PCD images were converted to Joint Photographic Experts Group (JPEG) format. In this report, each image is available for downloading in two resolutions, a medium JPEG file (1536 x 1024 pixels) and a high-resolution JPEG file (3072 x 2048 pixels).

Image Information

Image characteristics - Each photographic image was taken at a height of approximately 76 cm (30 in.) above the seabed and represents an area of 0.39 m² (4.17 ft²) that measures 76 cm (30 in.) wide and 51 cm (20 in.) high. The data tag on the right-hand margin of the image displays information in the following format: NNNYYHHMM, where NNN is the image number on the film roll, YY is the last 2 digits of the year, and HH and MM are time in hours and minutes.

Metadata in Exchangeable Image File Format (EXIF) - Seabed photographs have been modified to an Exchangeable Image File Format so that important image metadata and data can be displayed in the comment EXIF tag of the JPEG images (see below).

Explanation of Metadata Tagged to Photographs in EXIF

Item	Explanation																
Station No.	number assigned to station																
Image No.	file name of image <table><tr><td colspan="2">Example Andr95036_q6_1128A_025.jpg</td></tr><tr><td>Andr</td><td>vessel name code (Peter W. Anderson)</td></tr><tr><td>95036</td><td>USGS Woods Hole Coastal and Marine Science Center field activity number</td></tr><tr><td>95</td><td>last two digits of year</td></tr><tr><td>036</td><td>36th field activity of the year</td></tr><tr><td>q6</td><td>location is Quadrangle 6</td></tr><tr><td>1128A</td><td>station number in Quadrangle 6</td></tr><tr><td>025</td><td>image number on archived CD-ROM for the cruise (multiple images at a station are numbered in the sequence they were collected)</td></tr></table>	Example Andr95036_q6_1128A_025.jpg		Andr	vessel name code (Peter W. Anderson)	95036	USGS Woods Hole Coastal and Marine Science Center field activity number	95	last two digits of year	036	36th field activity of the year	q6	location is Quadrangle 6	1128A	station number in Quadrangle 6	025	image number on archived CD-ROM for the cruise (multiple images at a station are numbered in the sequence they were collected)
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1128A	station number in Quadrangle 6																
025	image number on archived CD-ROM for the cruise (multiple images at a station are numbered in the sequence they were collected)																
Water Depth, m	depth of water at station location																
Field of View, cm	dimensions of area of seabed in image																
Geographic Location	quadrangle number in Stellwagen Bank National Marine Sanctuary region																
Time Zone	GMT, Greenwich Mean Time																
Original YYYY:MM:DD HH:MM:SS	original date and time (GMT) image was collected YEAR:MONTH:DAY HOUR:MINUTES:SECONDS																
Julian Date and Time GMT	Julian Day HH:MM:SS																
Latitude N	latitude north (decimal degrees) of image location																
Longitude W	longitude west (decimal degrees) of image location																

Instrument	instrument used to collect image						
Link to Instrument Description	link to description of instrument on web						
Organization	organization that collected the image						
WHCMSC Field Activity (cruise) No.	USGS Woods Hole Coastal and Marine Science Center field activity (cruise) number <table border="1"> <tr> <td colspan="2">Example 95036</td></tr> <tr> <td>95</td><td>last two digits of year</td></tr> <tr> <td>036</td><td>36th activity of the year</td></tr> </table>	Example 95036		95	last two digits of year	036	36th activity of the year
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95	last two digits of year						
036	36th activity of the year						
Principal Investigator	Page Valentine						
Photo Credit	organization to credit for use of this image						

Spreadsheets for photographic images - The navigation data for each photograph, as well as other information pertinent to each photograph such as date and time of collection, is available in both Excel spreadsheet format and ESRI shapefile format with **Federal Geographic Data Committee** (FGDC) compliant metadata and is available for download. The spreadsheet version is the source of the EXIF metadata displayed on the JPEG images.

Explanation of Photograph Spreadsheet Columns

Column	Explanation																
Column A	Station No.																
Column B	Image No. — file name of photo image <table border="1"> <tr> <td colspan="2">Example Andr95036_q6_1128A_025.jpg</td></tr> <tr> <td>Andr</td><td>vessel name code (Peter W. Anderson)</td></tr> <tr> <td>95036</td><td>USGS Woods Hole Science Center field activity number</td></tr> <tr> <td>95</td><td>last two digits of year</td></tr> <tr> <td>036</td><td>36th field activity of the year</td></tr> <tr> <td>q6</td><td>location is Quadrangle 6</td></tr> <tr> <td>1128A</td><td>station number in Quadrangle 6</td></tr> <tr> <td>025</td><td>image number on archived CD-ROM for the cruise</td></tr> </table>	Example Andr95036_q6_1128A_025.jpg		Andr	vessel name code (Peter W. Anderson)	95036	USGS Woods Hole Science Center field activity number	95	last two digits of year	036	36th field activity of the year	q6	location is Quadrangle 6	1128A	station number in Quadrangle 6	025	image number on archived CD-ROM for the cruise
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Column C	Water Depth, m — water depth at which image was taken, in meters																
Column D	Field of View, cm — dimensions of area of seabed in image (76 cm wide, 51 cm high)																
Column E	Geographic Location — Quadrangle number in Stellwagen Bank National Marine Sanctuary region																
Column F	Time Zone — GMT, Greenwich Mean Time (same as UTC, Universal Coordinated Time, and ZULU, military time)																
Column G	Year — year image was collected																
Column H	Month — month image was collected																
Column I	Day — day image was collected																
Column J	Time GMT — time image was collected, GMT; HH:MM:SS																
Column K	Julian Date and Time GMT — Julian Day:HH:MM:SS image was collected																

Column L	Latitude N — latitude north (decimal degrees) of image location						
Column M	Longitude W — longitude west (decimal degrees) of image location						
Column N	Instrument — instrument used to collect image (down-looking still camera on USGS SEABOSS sampling system)						
Column O	Link to Instrument Description — link to SEABOSS information sheet on Web						
Column P	Organization — collected by U.S. Geological Survey, Woods Hole Coastal and Marine Science Center						
Column Q	WHCMSC Field Activity (cruise) No. — USGS Woods Hole Coastal and Marine Science Center field activity (cruise) number <table border="1"> <tr> <td colspan="2">Example 95036</td></tr> <tr> <td>95</td><td>last two digits of year</td></tr> <tr> <td>036</td><td>thirty-sixth field activity of the year</td></tr> </table>	Example 95036		95	last two digits of year	036	thirty-sixth field activity of the year
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Column R	Principal Investigator — Page Valentine						
Column S	Photo Credit — U.S. Geological Survey						

Vessel Names

Vessel Name Abbrevation	Vessel Name
ABLJ	Abel J
ANDR	Peter W. Anderson
ARGO	Argo Maine
CAND	Christopher Andrew
CONN	Connecticut
DIAN	Diane G
DLWR	Delaware II
FERL	Ferrel
FSTR	Nancy Foster
ISBL	Isabel S