U.S. Department of the Interior
U.S. Geological Survey

Scientific Investigations Map 3306
Sheet 4 of 10
Pamphlet accompanies map

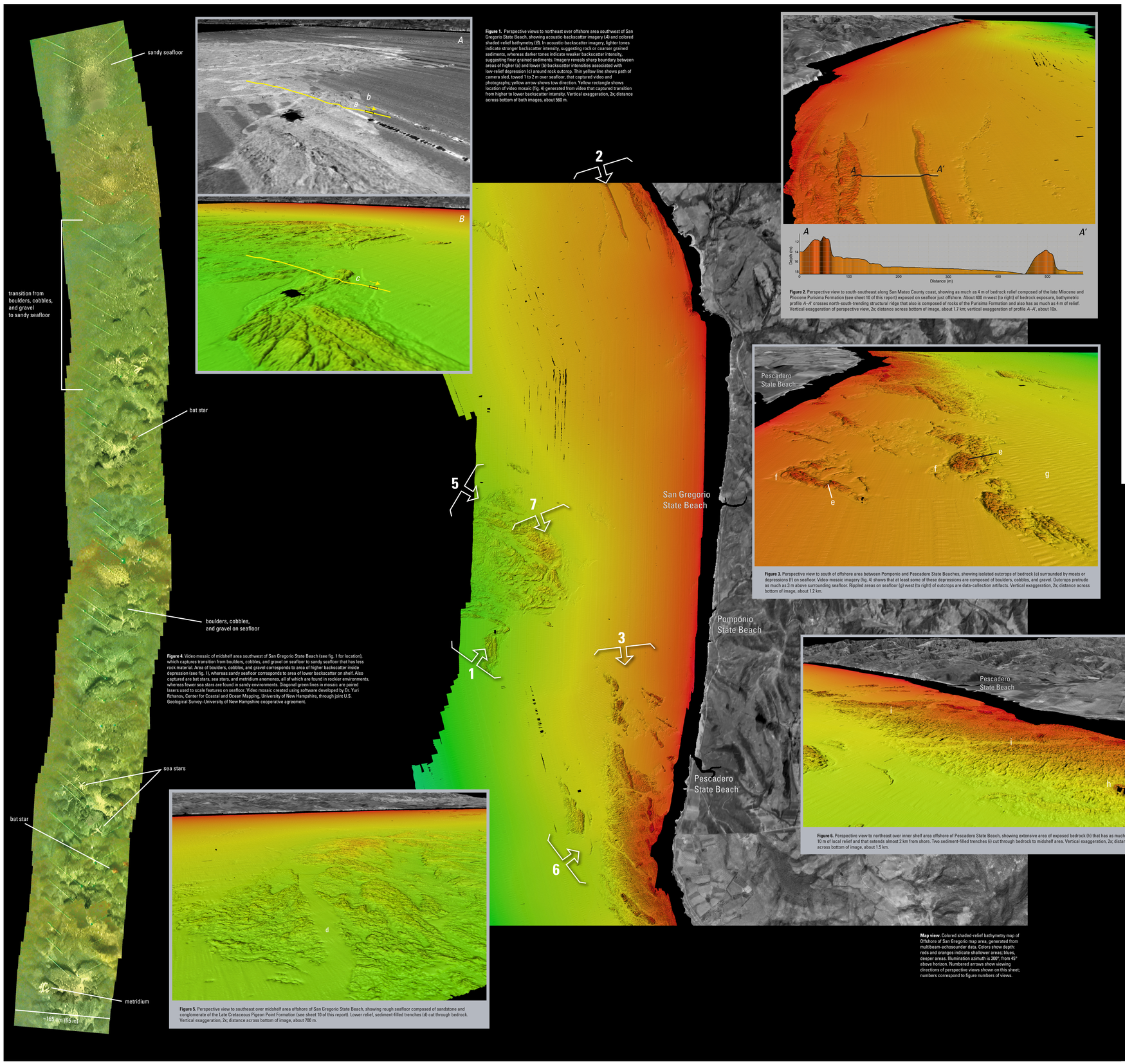


Figure 1. Perspective views to northeast over offshore area southwest of San Gregorio State Beach, showing acoustic-backscatter imagery (*A*) and colored shaded-relief bathymetry (*B*). In acoustic-backscatter imagery, lighter tones indicate stronger backscatter intensity, suggesting rock or coarser grained sediments, whereas darker tones indicate weaker backscatter intensity, suggesting finer grained sediments. Imagery reveals sharp boundary between areas of higher (a) and lower (b) backscatter intensities associated with low-relief depression (c) around rock outcrop. Thin yellow line shows path of camera sled, towed 1 to 2 m over seafloor, that captured video and photographs; yellow arrow shows tow direction. Yellow rectangle shows location of video mosaic (fig. 4) generated from video that captured transition from higher to lower backscatter intensity. Vertical exaggeration, 2x; distance across bottom of both images, about 560 m.

Figure 2. Perspective view to south-southeast along San Mateo County coast, showing as much as 4 m of bedrock relief composed of the late Miocene and Pliocene Purisima Formation (see sheet 10 of this report) exposed on seafloor just offshore. About 400 m west (to right) of bedrock exposure, bathymetric profile *A–A′* crosses north-south-trending structural ridge that also is composed of rocks of the Purisima Formation and also has as much as 4 m of relief. Vertical exaggeration of perspective view, 2x; distance across bottom of image, about 1.7 km; vertical exaggeration of profile *A–A′*, about 18x.

Figure 3. Perspective view to south of offshore area between Pomponio and Pescadero State Beaches, showing isolated outcrops of bedrock (e) surrounded by moats or depressions (f) on seafloor. Video-mosaic imagery (fig. 4) shows that at least some of these depressions are composed of boulders, cobbles, and gravel. Outcrops protrude as much as 3 m above surrounding seafloor. Rippled areas on seafloor (g) west (to right) of outcrops are data-collection artifacts. Vertical exaggeration, 2x; distance across bottom of image, about 1.2 km.

Figure 6. Perspective view to northeast over inner shelf area offshore of Pescadero State Beach, showing extensive area of exposed bedrock (h) that has as much as 10 m of local relief and that extends almost 2 km from shore. Two sediment-filled trenches (i) cut through bedrock to midshelf area. Vertical exaggeration, 2x; distance across bottom of image, about 1.5 km.

Figure 5. Perspective view to southeast over midshelf area offshore of San Gregorio State Beach, showing rough seafloor composed of sandstone and conglomerate of the Late Cretaceous Pigeon Point Formation (see sheet 10 of this report). Lower relief, sediment-filled trenches (d) cut through bedrock. Vertical exaggeration, 2x; distance across bottom of image, about 700 m.

Map view. Colored shaded-relief bathymetry map of Offshore of San Gregorio map area, generated from multibeam-echosounder data. Colors show depth: reds and oranges indicate shallower areas; blues, deeper areas. Illumination azimuth is 300°, from 45° above horizon. Numbered arrows show viewing directions of perspective views shown on this sheet; numbers correspond to figure numbers of views.

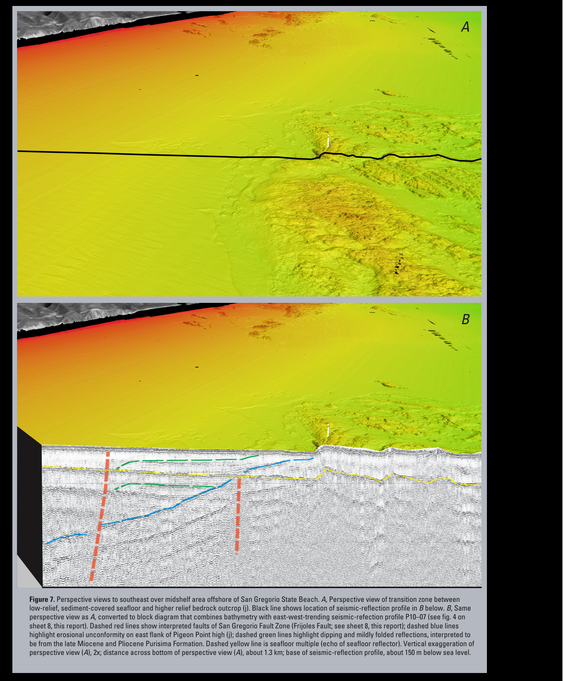


Figure 7. Perspective views to southeast over midshelf area offshore of San Gregorio State Beach. *A*, Perspective view of transition zone between low-relief, sediment-covered seafloor and higher relief bedrock outcrop (j). Black line shows location of seismic-reflection profile in *B* below. *B*, Same perspective view as *A*, converted to block diagram that combines bathymetry with east-west-trending seismic-reflection profile P1B-07 (see fig. 4 on sheet 8, this report). Dashed red lines show interpreted faults of San Gregorio Fault Zone (Frijoles Fault; see sheet 8, this report); dashed blue lines highlight erosional unconformity on east flank of Pigeon Point high (j); dashed green lines highlight dipping and mildly folded reflections, interpreted to be from the late Miocene and Pliocene Purisima Formation. Dashed yellow line is seafloor multiple (echo of seafloor reflector). Vertical exaggeration of perspective view (*A*), 2x; distance across bottom of perspective view (*A*), about 1.3 km; base of seismic-reflection profile, about 150 m below sea level.

DISCUSSION

Mapping California's State Waters has produced a vast amount of acoustic and visual data, including bathymetry, acoustic backscatter, seismic-reflection profiles, and seafloor video and photography. These data are used by researchers to develop maps, reports, and other tools to assist in the coastal and marine spatial-planning capability of coastal-zone managers and other stakeholders. Seafloor-character, habitat, and geologic maps may be used for fisheries management, for designation of Marine Protected Areas, for monitoring of environmental change such as sea-level-rise impacts, for prediction of sediment and contaminant budgets and transport, and for assessment of earthquake and tsunami hazards. To achieve these goals, it is helpful to integrate the different datasets and then view the results in three-dimensional representations such as those displayed on this data integration and visualization sheet for the Offshore of San Gregorio map area.

The map view in the center of the sheet is similar to the colored shaded-relief bathymetry map of the Offshore of San Gregorio map area (see sheet 1 of this report). Numbered arrows show viewing directions of the perspective views on this sheet (figs. 1, 2, 3, 5, 6, 7); the numbers indicate the figure number of the perspective view.

The perspective views and bathymetric profiles in figures 1, 2, 3, 5, 6, and 7 show the colored shaded-relief bathymetry of the Offshore of San Gregorio map area, as viewed from different directions. These views show a few examples of the complexity of bedrock exposed in this high-energy nearshore environment.

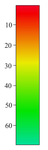
Draping the acoustic-backscatter imagery (see sheet 3 of this report) over the bathymetry data (fig. 1) highlights the relations between the backscatter intensity and the seafloor morphology, and it also aids in seafloor habitat and geology interpretations.

Video-mosaic images created from seafloor digital video (fig. 4) display the geologic (rock, sand, mud) and biologic complexity of the seafloor. Whereas photographs capture high-quality snapshots of a small area of the seafloor, video mosaics can capture larger areas and, thus, can show transitional zones between different seafloor environments.

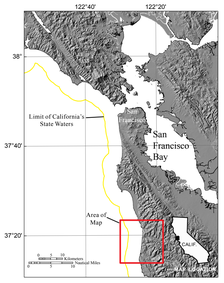
Block diagrams (fig. 7), which combine the bathymetry with seismic-reflection-profile data (see sheet 8 of this report), help reveal the stratigraphic and structural relations between the surface and subsurface.

EXPLANATION

Depth (in meters) and illumination (bright areas are illuminated, facing false sun; dark areas are in shadow, facing away from false sun)



Direction of illumination from false sun—Position of false sun is at 300° azimuth, 45° above horizon [arrow included in explanation for illustration purposes only; not shown on map]



Oceanographic Commission
Coastal Conservancy
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NOAA
CALIFORNIA GEOLOGICAL SURVEY
CGS
CSUMB SEAFLOOR MAPPING LAB

Onshore imagery from digital orthophotographs available at Cal-Atlas Geospatial Clearinghouse, http://atlas.ca.gov/ (last accessed January 2013). Offshore shaded-relief bathymetry from map on sheet 1, this report

Universal Transverse Mercator projection, Zone 10N

NOT INTENDED FOR NAVIGATIONAL USE

MAP LOCATION

Data Integration and Visualization, Offshore of San Gregorio Map Area, California

By
Peter Dartnell

2014

Perspective views by Peter Dartnell, 2012. Acoustic-backscatter imagery in figure 1 from map on sheet 3, this report. Bathymetric profile in figure 2 by Peter Dartnell, 2012. Video-mosaic image in figure 3 by Peter Dartnell, 2010, using software developed by Dr. Yuri Rzhanov, Center for Coastal and Ocean Mapping, University of New Hampshire, through joint U.S. Geological Survey–University of New Hampshire cooperative agreement. Seismic-reflection profile in figure 7 from sheet 8, this report

GIS database and digital cartography by Nadine E. Golden and Florence L. Wong

Edited by Taryn A. Lindquist

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