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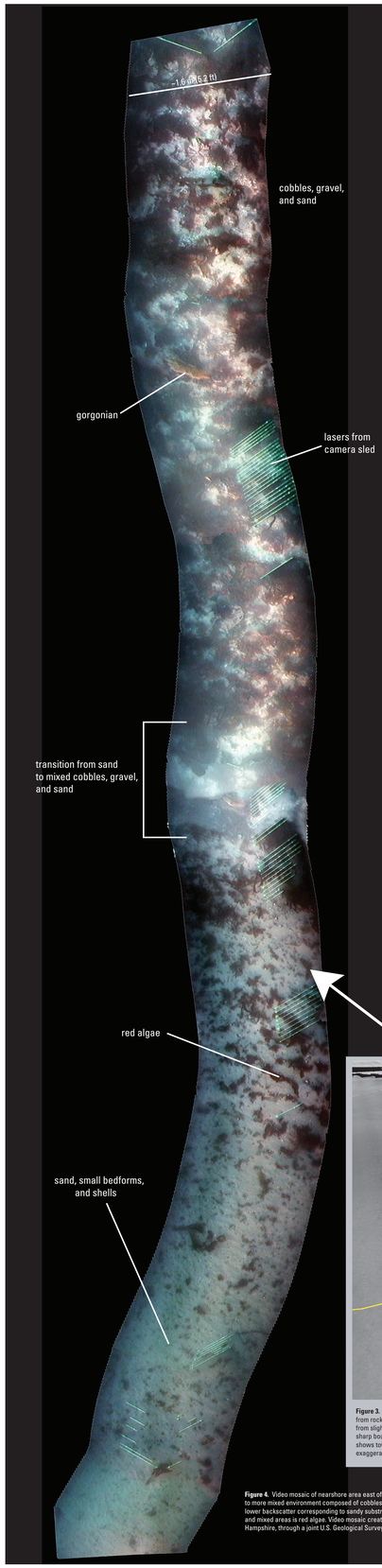
U.S. Department of the Interior
U.S. Geological Survey

Scientific Investigations Map 3281
Sheet 4 of 11
Pamphlet accompanies map



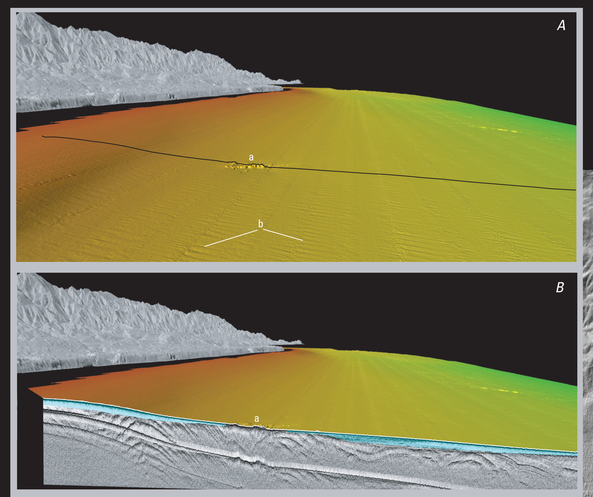


Figure 1. Perspective views to east over relatively featureless seafloor in nearshore area west of Santa Barbara. *A*, Perspective view showing small patch of rougher seafloor (a) protruding above surrounding smooth seafloor of shelf area. Rippled patterns on seafloor (b) are data-collection artifacts. 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 north-south-trending seismic-reflection profile SBC-122 (Sliter and others, 2008; see also, fig. 3 on sheet 8). Block diagram reveals that, although seafloor is relatively featureless, subsurface contains complex series of faulted anticline and syncline structures, overlain by deposits that are younger than about 20,000 years old (blue shading). Patch of rougher seafloor (a) is tentatively interpreted as asphalt mound (see sheet 8, this report). Many asphalt mounds are present in Santa Barbara Channel region (see, for example, Keller and others, 2007), most typically along faults or anticlinal axes. Vertical exaggeration in both views, 2x; distance across bottoms, about 1.5 km; base of seismic-reflection profile (as seen at lower left), about 100 m deep.

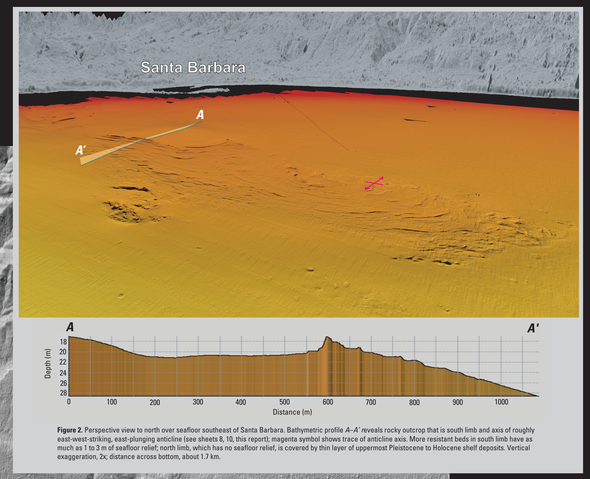
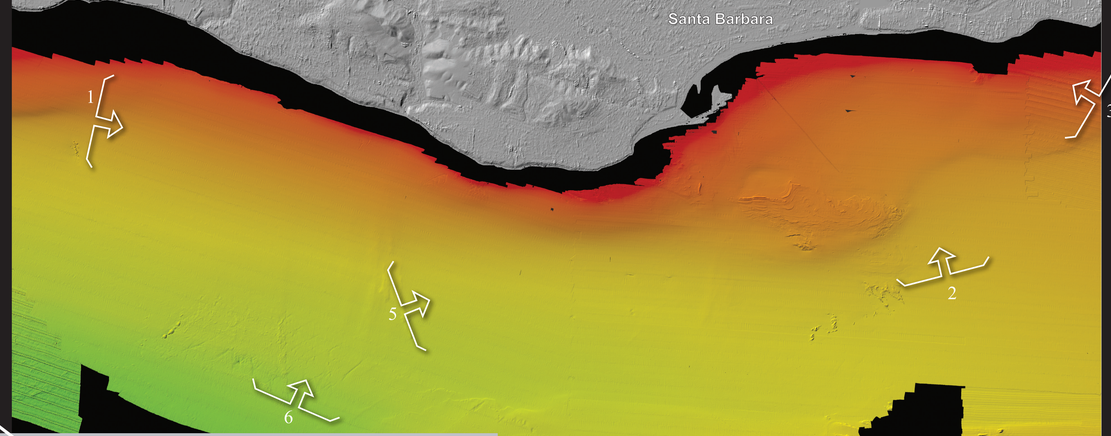


Figure 2. Perspective view to north over seafloor southeast of Santa Barbara. Bathymetric profile *A–A′* reveals rocky outcrop that is south limb and axis of roughly east-west-striking, east-plunging anticline (see sheets 8, 10, this report); magenta symbol shows trace of anticline axis. More resistant beds in south limb have as much as 1 to 3 m of seafloor relief; north limb, which has no seafloor relief, is covered by thin layer of uppermost Pleistocene to Holocene shelf deposits. Vertical exaggeration, 2x; distance across bottom, about 1.7 km.



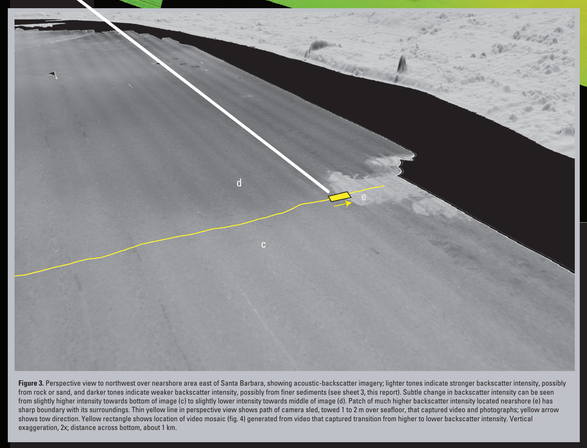


Figure 3. Perspective view to northwest over nearshore area east of Santa Barbara, showing acoustic-backscatter imagery; lighter tones indicate stronger backscatter intensity, possibly from rock or sand, and darker tones indicate weaker backscatter intensity, possibly from finer sediments (see sheet 3, this report). Subtle change in backscatter intensity can be seen from slightly higher intensity towards bottom of image (c) to slightly lower intensity towards middle of image (d). Patch of much higher backscatter intensity located nearshore (e) has sharp boundary with its surroundings. Thin yellow line in perspective view 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, about 1 km.

Figure 4. Video mosaic of nearshore area east of Santa Barbara (see fig. 3 for location), which reveals transition in seafloor environments from sandy seafloor to more mixed environment composed of cobbles, gravel, and sand. Transition corresponds to sharp change in backscatter intensity visible in figure 3, with lower backscatter corresponding to sandy substrate and higher backscatter corresponding to mixed cobbles, gravel, and sand. Reddish material in both sandy and mixed areas is red algae. Video mosaic created using software developed by Dr. Yuri Rzhanov, Center for Coastal and Ocean Mapping, University of New Hampshire, through a joint U.S. Geological Survey–University of New Hampshire cooperative agreement.

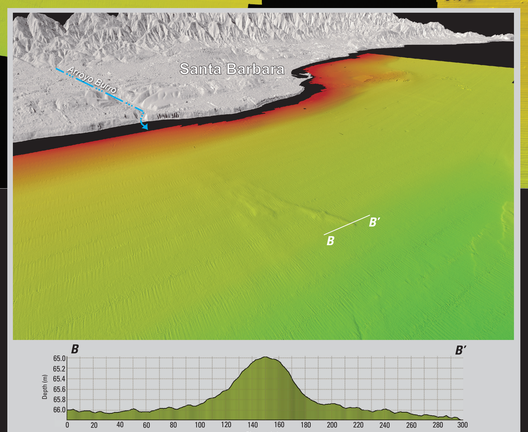


Figure 5. Perspective view to east-northeast towards Santa Barbara, over sediment lobe on midshelf that has slightly higher backscatter than surrounding seafloor (see sheet 3, this report). Bathymetric profile *B–B′* shows that toe of lobe has about 1 m of relief. Although lobe is located directly offshore of Arroyo Burro (cyan dash-dot arrow shows path of arroyo), its nearshore head lies 1,300 m from shoreline. Nevertheless, location and texture of lobe suggest that it may have been deposited as nearshore deltaic deposits at mouth of Arroyo Burro during lower sea level. Similar lobes have been mapped farther west in northern Santa Barbara Channel (Dartnell and others, 2009). Vertical exaggeration, 2x; distance across bottom, about 1.5 km.

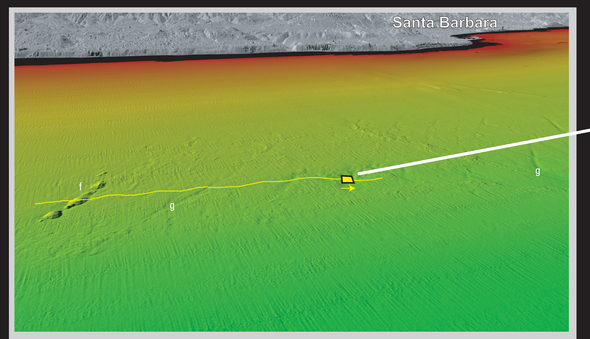


Figure 6. Perspective view to north-northeast over slightly rougher seafloor southwest of Santa Barbara, showing linear ridges (f) and depressions (g). Seafloor geology in this area is mapped as undifferentiated field of hydrocarbon-seep-related features (see, for example, Keller and others, 2007) and marine sediment (see sheet 10, this report). 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. 7) generated from video that captured natural hydrocarbon seep within pockmark (see inset high-resolution photograph). Vertical exaggeration, 2x; distance across bottom, about 1.5 km.

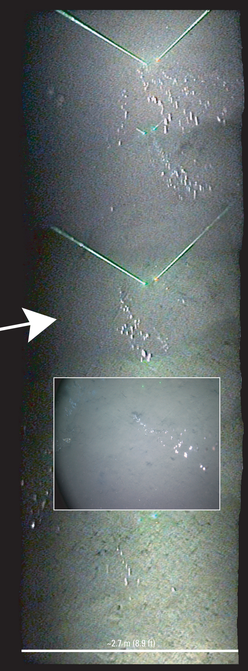


Figure 7. Video mosaic within field of hydrocarbon-seep-related features southwest of Santa Barbara (see fig. 6 for location), which captures natural hydrocarbon seeps within pockmark. Three seeps bubble out of fine-grained sediment on seafloor; uppermost seep consists of five separate but aligned sets of bubbles. Although rising bubbles degrade quality of video mosaic, inset high-resolution photograph clearly shows one seep.

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 are 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 Santa Barbara map area.

The map view in the center of the sheet is similar to the colored shaded-relief bathymetry map of the Offshore of Santa Barbara 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); the numbers indicate the figure number of the perspective view.

The perspective views and bathymetric profiles in figures 1, 2, 5, and 6 show the colored shaded-relief bathymetry of the Offshore of Santa Barbara map area, as viewed from different directions. These views show a few examples of the relatively low-relief features offshore of the Santa Barbara area.

Draping the acoustic-backscatter imagery (see sheet 3 of this report) over the bathymetry data (fig. 3) highlights the relations between the backscatter intensity and the seafloor morphology, as well as any anthropogenic influences on the seafloor (although none are visible in these views).

Video-mosaic images created from seafloor digital video (figs. 4, 7) 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 (for example, see inset high-resolution photograph in fig. 7), video mosaics can capture larger areas and, thus, can show transitional zones between different seafloor environments.

Block diagrams (fig. 1), 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.

REFERENCES CITED

Dartnell, P., Finlayson, D., Conrad, J.E., Cochrane, G.R., and Johnson, S.Y., 2009, Bathymetry and acoustic backscatter—Northern Santa Barbara Channel, southern California: USGS Open-File Report 2009–1289, available at http://pubs.usgs.gov/of/2009/1289/.

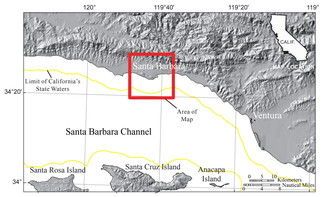
Keller, E.A., Duffy, M., Kennett, J.P., and Hill, T., 2007, Tectonic geomorphology and hydrocarbon potential of the Mid-Channel anticline, Santa Barbara Basin, California: Geomorphology, v. 89, p. 274–286.

Sliter, R.W., Triezenberg, P.J., Hart, P.E., Draut, A.E., Normark, W.R., and Conrad, J.E., 2008, High-resolution chirp and mini-sparker seismic-reflection data from the southern California continental shelf—Gaviota to Mugu Canyon: U.S. Geological Survey Open-File Report 2008–1246, available at http://pubs.usgs.gov/of/2008/1246/.

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]



Map view. Colored shaded-relief bathymetry map of Offshore of Santa Barbara map area, generated from multibeam-echosounder and bathymetric-sidescan data. Colors show depth: reds and oranges indicate shallower areas; greens, 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.

Coastal Conservancy

CALIFORNIA OCEAN PROTECTION COUNCIL

NOAA

BOEM
Bureau of Ocean Energy Management

Pacific Coastal & Marine Science Center

Onshore elevation data from NOAA Coastal Services Center (data collected by EarthData International in 2002-2003). Offshore shaded-relief bathymetry from map on sheet 1, this report

Universal Transverse Mercator projection, Zone 11N

NOT INTENDED FOR NAVIGATIONAL USE

MAP LOCATION

Data Integration and Visualization, Offshore of Santa Barbara Map Area, California

By
Peter Dartnell

2013

Perspective views by Peter Dartnell, 2012. Seismic-reflection profile in figure 1 from sheet 8, this report. Bathymetric profiles in figures 2 and 5 by Peter Dartnell, 2012. Acoustic-backscatter imagery in figure 3 from map on sheet 3, this report. Video-mosaic images in figures 4 and 7 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

GIS database and digital cartography by Nadine E. Golden and Eleyne L. Phillips

Edited by Taryn A. Lindquist

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