

Figure 1. Perspective views to north over nearshore area southeast of Carpinteria showing colored shaded-relief bathymetry (A) and acoustic backscatter (B). In backscatter imagery, lighter tones indicate stronger backscatter intensity, suggesting rock or more coarse-grained sediment, whereas darker tones indicate weaker backscatter intensity, suggesting more fine-grained sediment. Three areas of high acoustic backscatter in nearshore area (a) have about 1 to 2 m of relief, indicating rock outcrops. Another area of high backscatter (b) has little to no relief, suggesting that seafloor in this area consists of coarse sand. Diagonal dark stripes in offshore area are data-collection artifacts. Vertical exaggeration of perspective views, 2x; distance across bottom, about 5 km.

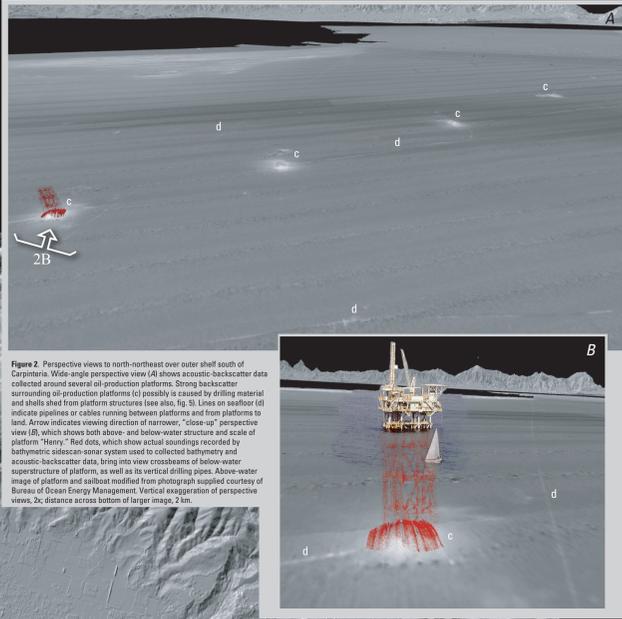


Figure 2. Perspective views to north-northeast over outer shelf south of Carpinteria. Wide-angle perspective view (A) shows acoustic backscatter data collected around several oil-production platforms. Strong backscatter surrounding oil-production platforms (c) possibly is caused by drilling material and shells shed from platform structures (see also, fig. 5). Lines on seafloor (d) indicate pipelines or cables running between platforms and from platforms to land. Arrow indicates viewing direction of narrower, "close-up" perspective view (B), which shows both above- and below-water structure and scale of platform "heavy" bed site, which show actual soundings recorded by bathymetric sidescan-sonar system used to collect bathymetry and acoustic backscatter data, bring into view cross-sections of below-water superstructure of platform, as well as its vertical drilling pipe. Above-water image of platform and seabed modified from photograph supplied courtesy of Bureau of Ocean Energy Management. Vertical exaggeration of perspective views, 2x; distance across bottom of larger image, 2 km.

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 Carpinteria map area.

The map view in the center of the sheet is similar to the colored shaded-relief bathymetry map of the Offshore of Carpinteria map area (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, 3, 5, and 6 show the colored shaded-relief bathymetry for the Offshore of Carpinteria map area, as viewed from different directions. These views highlight some relatively low-relief natural outcrops in the seafloor, as well as several man-made features in the midshelf area.

Draping the acoustic backscatter imagery (see sheet 3 of this report) over the bathymetry data (fig. 1, 2) highlights the relations between the backscatter intensity and the seafloor morphology, as well as any anthropogenic influences on the seafloor.

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. 6), 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

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Silber, R. W., Trezzenberg, P. J., Hart, P. E., Druat, A. E., Noemark, W. R., and Conrad, J. E., 2008, High-resolution chirp and mini-sparker seismic-reflection data from the southern California continental shelf—Garvito to Mugu Canyon, U.S. Geological Survey Open-File Report 2008-1246, accessed April 5, 2011, 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)

0 Shallow
20
40
60
80 Deep

Direction of illumination from false sun—Position of false sun is at 300° azimuth, 4° above horizon (arrows included in explanation for illustration purposes only; not shown on map)

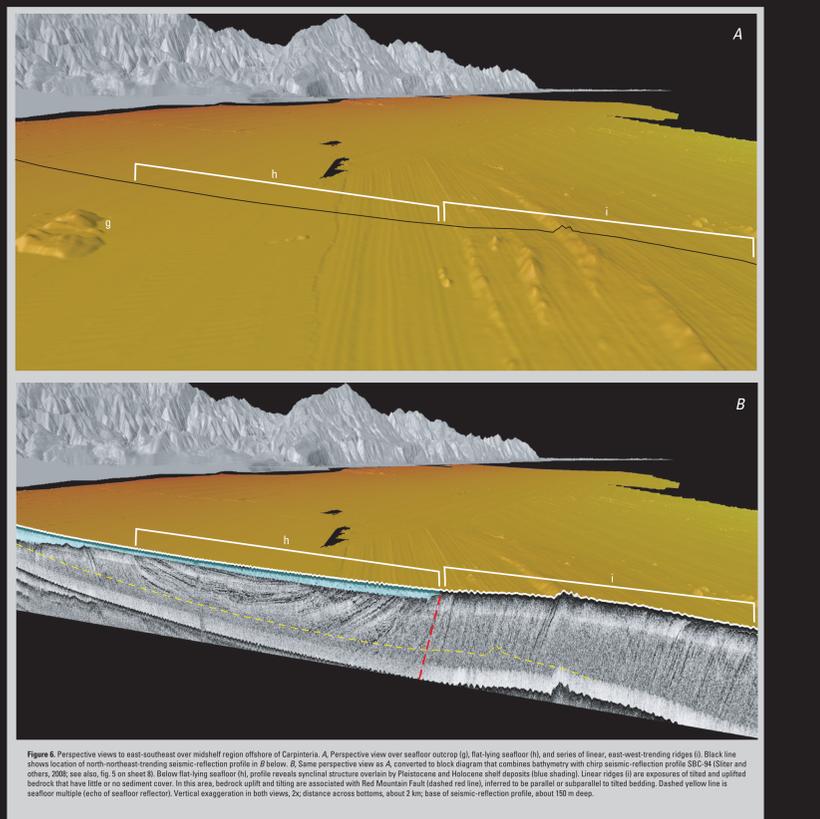


Figure 6. Perspective views to east-southeast over midshelf region offshore of Carpinteria. A, Perspective view over seafloor outcrop (g), flat-lying seafloor (h), and series of linear, east-west-trending ridges (i). Black line shows location of north-northeast-trending seismic-reflection profile in B below. B, Same perspective view as A, converted to block diagram that combines bathymetry with chirp seismic-reflection profile SBC-94 (Silber and others, 2008; see also, fig. 5 on sheet 8). Below flat-lying seafloor (h), profile reveals synclinal structures overlain by Pleistocene and Holocene shell deposits (blue shading). Linear ridges (i) are exposures of tilted and uplifted bedrock that have little or no sediment cover. In this area, bedrock uplift and tilting are associated with Red Mountain Fault (dashed red line), inferred to be parallel or subparallel to tilted bedrock. Dashed yellow line is seafloor multiple (echo of seafloor reflector). Vertical exaggeration in both views, 2x; distance across bottom, about 2 km; base of seismic-reflection profile, about 150 m deep.

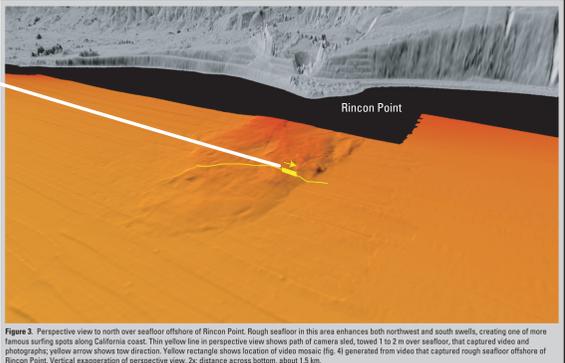


Figure 3. Perspective view to north over seafloor offshore of Rincon Point. Rough seafloor in this area enhances both northwest and south swells, creating one of more famous surfing spots along California coast. Thin yellow line in perspective view shows path of camera sled, towed 1 to 2 m over seafloor, that captured video and photographs; yellow arrow shows tow direction. Yellow rectangle shows location of video mosaic (fig. 4) generated from video that captured rough seafloor offshore of Rincon Point. Vertical exaggeration of perspective view, 2x; distance across bottom, about 1.5 km.

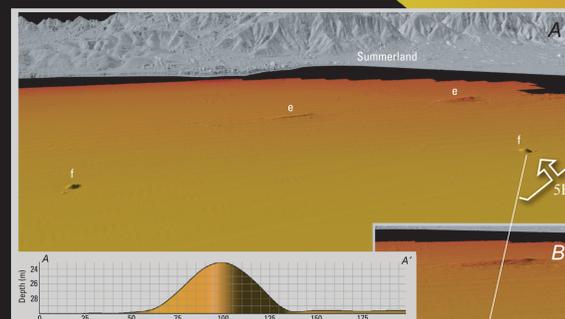


Figure 5. Perspective views to northeast towards Summerland. Wide-angle perspective view (A) shows that seafloor in this area is generally flat, except for two areas of low-relief outcrop (a) and two almost perfectly symmetrical mounds (b). Arrow indicates viewing direction of narrower, "close-up" perspective view (B). Bathymetric profile A-A' shows that mound protrudes above surrounding seafloor by as much as 7 m (23 ft). Mounds, which are composed of approximately 5 m of drilling material (cuttings) and 1 m of mussel shells (Blascom and others, 1976), are remnants of decommissioned oil-production platforms "Nazar" (erected in 1960) and "Hilda" (erected in 1960), both of which were demolished in 1996. Vertical exaggeration, 2x; distance across bottom of larger image, about 1.5 km.

Map view. Colored shaded-relief bathymetry map of Offshore of Carpinteria map area, generated from multibeam-echosounder and bathymetric-sidescan data. Colors show depth: reds and oranges indicate shallower areas; light greens, deeper areas. Illumination azimuth is 300°, from 4° above horizon. Horizontal stripes in southwestern part of map area are data-collection artifacts from bathymetric-sidescan survey. Numbered arrows show viewing directions of perspective views shown on this sheet; numbers correspond to figure numbers of views.

Derivative elevation data from NOAA Coastal Services Center (data collected by EarthData International in 2002-2003) and from U.S. Army Corps of Engineers (data collected by Hugo Pelagos in 2006). California's State Waters limit from NOAA Office of Coast Survey.



Data Integration and Visualization, Offshore of Carpinteria Map Area, California

By
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2013

Perspective views by Peter Dartnell, 2013. Acoustic backscatter imagery in figures 1 and 2 from map on sheet 1, this report. Underwater structure of oil-production platforms in figure 2 by Peter Dartnell, 2005. Video mosaic image in figure 4 by Peter Dartnell, 2013, using software developed by Dr. Tom Robinson, Center for Coastal and Ocean Mapping, University of New Hampshire, through joint U.S. Geological Survey-University of New Hampshire cooperative agreement. Bathymetry profile in figure 5 by Peter Dartnell, 2013. Seismic reflection profile in figure 6 from sheet 8 of this report.

GIS Database and digital cartography by Nadine L. Gustin and Daryn L. Phillips.

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California State Waters Map Series—Offshore of Carpinteria, California, U.S. Geological Survey Scientific Investigations Map 3261, pamphlet 42, 10 sheets, using 1:50,000 horizontal scale (vertical scale).