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

Scientific Investigations Map 3254
Sheet 4 of 11
Pamphlet accompanies map

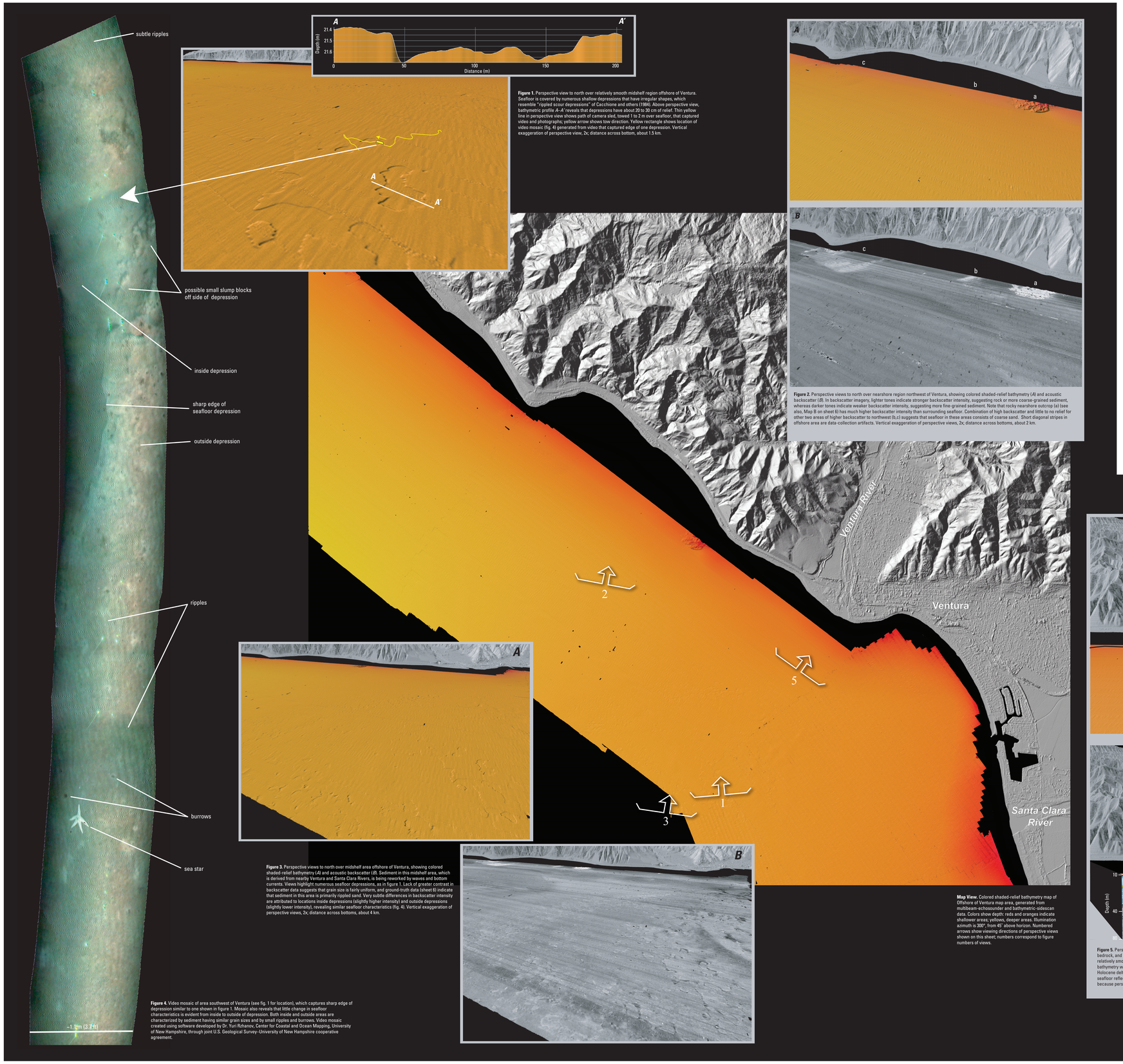

Figure 1. Perspective view to north over relatively smooth midshelf region offshore of Ventura. Seafloor is covered by numerous shallow depressions that have irregular shapes, which resemble "rippled scour depressions" of Cacchione and others (1984). Above perspective view, bathymetric profile *A–A′* reveals that depressions have about 20 to 30 cm of relief. 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 edge of one depression. Vertical exaggeration of perspective view, 2x; distance across bottom, about 1.5 km.

Figure 2. Perspective views to north over nearshore region northwest of Ventura, 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. Note that rocky nearshore outcrop (a) (see also, Map B on sheet 6) has much higher backscatter intensity than surrounding seafloor. Combination of high backscatter and little to no relief for other two areas of higher backscatter to northwest (b,c) suggests that seafloor in these areas consists of coarse sand. Short diagonal stripes in offshore area are data-collection artifacts. Vertical exaggeration of perspective views, 2x; distance across bottoms, about 2 km.

Figure 3. Perspective views to north over midshelf area offshore of Ventura, showing colored shaded-relief bathymetry (*A*) and acoustic backscatter (*B*). Sediment in this midshelf area, which is derived from nearby Ventura and Santa Clara Rivers, is being reworked by waves and bottom currents. Views highlight numerous seafloor depressions, as in figure 1. Lack of greater contrast in backscatter data suggests that grain size is fairly uniform, and ground-truth data (sheet 6) indicate that sediment in this area is primarily rippled sand. Very subtle differences in backscatter intensity are attributed to locations inside depressions (slightly higher intensity) and outside depressions (slightly lower intensity), revealing similar seafloor characteristics (fig. 4). Vertical exaggeration of perspective views, 2x; distance across bottoms, about 4 km.

Figure 4. Video mosaic of area southwest of Ventura (see fig. 1 for location), which captures sharp edge of depression similar to one shown in figure 1. Mosaic also reveals that little change in seafloor characteristics is evident from inside to outside of depression. Both inside and outside areas are characterized by sediment having similar grain sizes and by small ripples and burrows. Video mosaic created 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.

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

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 Ventura map area.

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

The perspective view and bathymetric profile in figure 1 show the colored shaded-relief bathymetry across one of the shallow depressions that are common in this map area. These views, which show the sharp edges of this depression, reveal that little change in seafloor characteristics is evident from the inside to the outside of the depression.

Draping the acoustic-backscatter imagery (see sheet 3 of this report) over the bathymetry data (figs. 2 and 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 (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. 5), 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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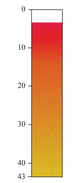
Sliter, R.W., Triezenberg, P.J., Hart, P.E., Draut, A.E., Normark, W.R., and Conrad, J.E., 2008, High-resolution chirp and mini-sparker seismic-reflection data from the southern California continental shelf—Gaviota to Muga Canyon: U.S. Geological Survey Open-File Report 2008–1246, accessed April 5, 2011, at http://pubs.usgs.gov/of/2008/1246/.

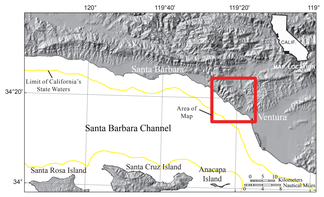
Warrick, J.A., and Farnsworth, K.L., 2009b, Dispersal of river sediment in the southern California Bight, *in* Lee, H.J., and Normark, W.R., eds., Earth science in the urban ocean—The Southern California Continental Borderland: Geological Society of America Special Paper 454, p. 53–67.

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]



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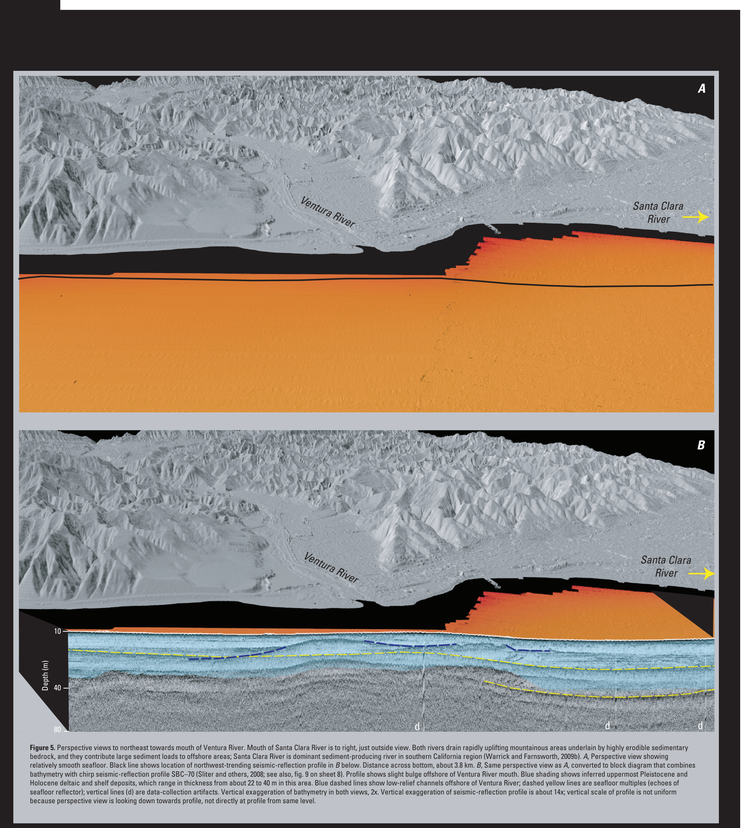

Figure 5. Perspective views to northeast towards mouth of Ventura River. Mouth of Santa Clara River is to right, just outside view. Both rivers drain rapidly uplifting mountainous areas underlain by highly erodible sedimentary bedrock, and they contribute large sediment loads to offshore areas; Santa Clara River is dominant sediment-producing river in southern California region (Warrick and Farnsworth, 2009b). *A*, Perspective view showing relatively smooth seafloor. Black line shows location of northwest-trending seismic-reflection profile in *B* below. Distance across bottom, about 3.8 km. *B*, Same perspective view as *A*, converted to block diagram that combines bathymetry with chirp seismic-reflection profile SBC–70 (Sliter and others, 2008; see also, fig. 9 on sheet 8). Profile shows slight bulge offshore of Ventura River mouth. Blue shading shows inferred uppermost Pleistocene and Holocene deltaic and shelf deposits, which range in thickness from about 22 to 40 m in this area. Blue dashed lines show low-relief channels offshore of Ventura River; dashed yellow lines are seafloor multiples (echoes of seafloor reflector); vertical lines (d) are data-collection artifacts. Vertical exaggeration of bathymetry in both views, 2x. Vertical exaggeration of seismic-reflection profile is about 14x; vertical scale of profile is not uniform because perspective view is looking down towards profile, not directly at profile from same level.

Onshore elevation data from NOAA Coastal Services Center (data collected by EarthData International in 2002-2003). Offshore shaded-relief bathymetry from map on sheet 2, this report

Universal Transverse Mercator projection, Zone 11N

NOT INTENDED FOR NAVIGATIONAL USE

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

By
Peter Dartnell

2013

Perspective views by Peter Dartnell, 2011. Bathymetric profile in figure 1 by Peter Dartnell, 2011. Acoustic-backscatter imagery in figures 2 and 3 from map on sheet 3, this report. Video-mosaic image in figure 4 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 5 from sheet 8, this report

GIS database and digital cartography by Nadine Golden and Elayne L. Phillips

Edited by Taryn A. Lindquist

Manuscript approved for publication March 11, 2013

For sale by U.S. Geological Survey, Information Services, Box 25286, Federal Center, Denver, CO 80225, 1–888–ASK–USGS

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Suggested Citation: Dartnell, P., 2013, Data integration and visualization, Offshore of Ventura map area, California, *sheet 4 in* Johnson, S.Y., Dartnell, P., Cochrane, G.R., Golden, N.E., Phillips, E.L., Ritchie, A.C., Kvitek, R.G., Greene, H.G., Krigsman, L.M., Endris, C.A., Seitz, G.G., Gutierrez, C.I., Sliter, R.W., Erdey, M.D., Wong, F.L., Yoklavich, M.M., Draut, A.E., and Hart, P.E. (S.Y. Johnson and S.A. Cochran, eds.), California State Waters Map Series—Offshore of Ventura, California: U.S. Geological Survey Scientific Investigations Map 3254, pamphlet 42 p., 11 sheets, scale 1:24,000, available at http://pubs.usgs.gov/sim/3254/.