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

Scientific Investigations Map 3473
Sheet 3 of 3

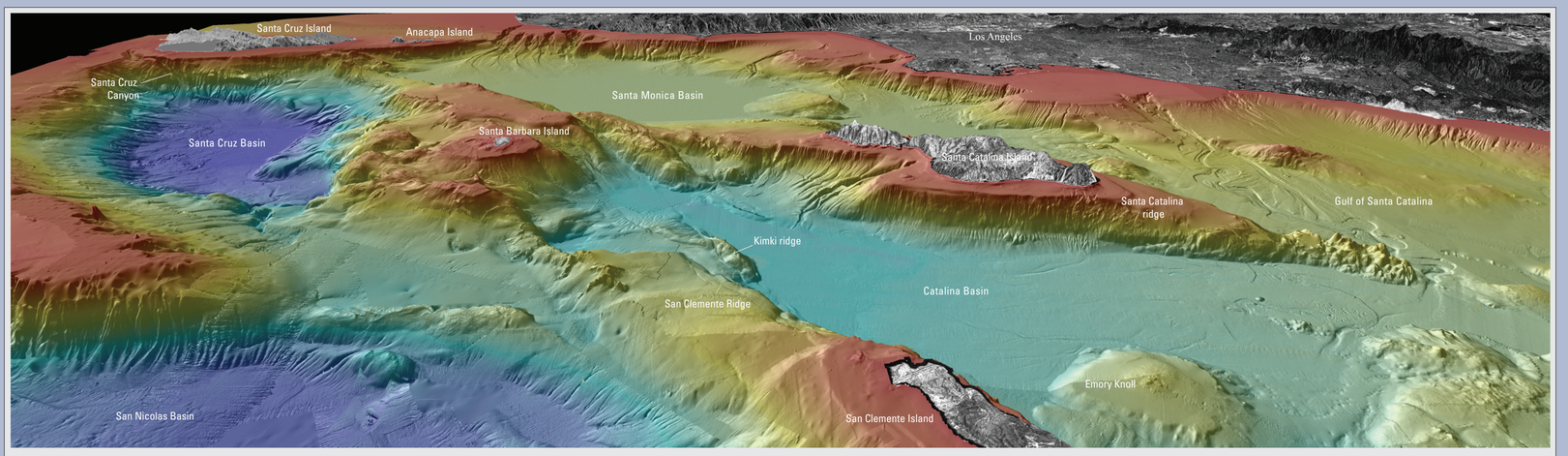


Figure 1. Regional perspective view to the northern part of the Continental Borderland in southern California, showing complex seafloor morphology that consists of the continental shelf, submarine canyons, ridges, knolls, and basins. Catalina and Santa Monica Basins are fed by sediment transported off the mainland shelf through submarine canyon systems. In contrast, Santa Cruz Basin is isolated from direct mainland sediment sources; however, it receives some terrestrial sediment input from the Channel Islands through the submarine Santa Cruz Canyon and other smaller gullies along the northern and western margins of the basin. Lack of a direct sediment source from the mainland may partly explain why the Santa Cruz Basin, which has a maximum depth of about 1,900 meters (m), is one of the deepest basins in the Continental Borderland, roughly 600 m deeper than Catalina Basin and 1,000 m deeper than Santa Monica Basin. Vertical exaggeration of perspective view, 4x; distance across bottom of image is about 100 kilometers (km). The linear distance along the coast as seen in this view is about 250 km.

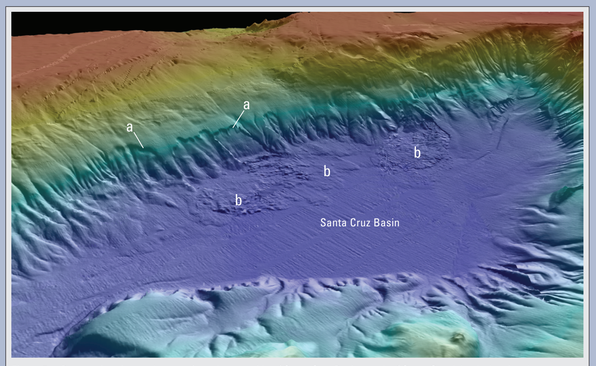


Figure 2. Perspective view to the west from the east side of Santa Cruz Basin, south of Santa Cruz Island, showing the western wall of the basin marked by numerous gullies and submarine landslides. At least 11 separate landslide masses have been recognized in this area (Brothers and others, 2018). Scarps (a) as high as 80 meters mark the slide headwalls and are visible along the lower slopes of the west side of the basin. Overlapping landslide debris fans (b) extend as far as 10 kilometers (km) onto the basin floor. The east side of the basin is marked by numerous gullies, but no landslide debris fans are observed there. Vertical exaggeration is 4x; distance across bottom of image is about 28 km.

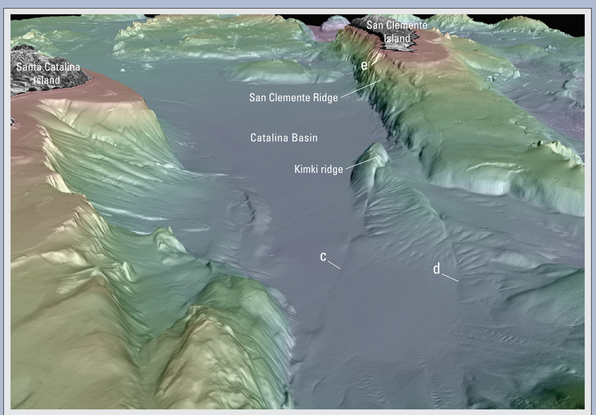


Figure 3. Perspective view to the south across Catalina Basin, showing the San Clemente Fault, which strikes northwest-southeast along the eastern base of the San Clemente Ridge, offsetting Kimki ridge and basin sediments (c) to the north. The Kimki Fault splays off of the San Clemente Fault on the southwest side of Kimki ridge (Ford and Normark, 1980) and continues northwest, forming a scarp (d) on the basin floor. The steep slope (e) northeast of San Clemente Island begins at a depth of about 100 meters (m) at the edge of the island shelf and ends at a depth of almost 1,200 m at the base of the slope, which has an average gradient of about 25°. Vertical exaggeration is 4x; distance across bottom of image is about 16 kilometers.

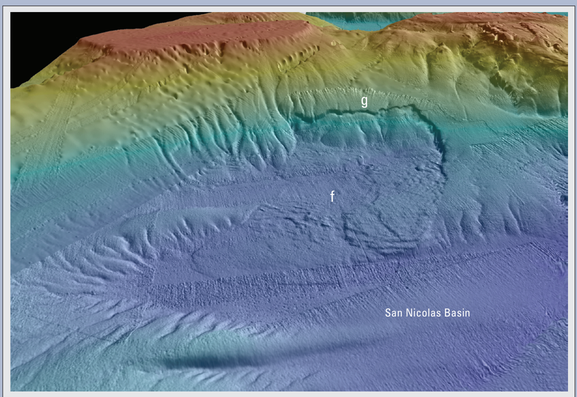
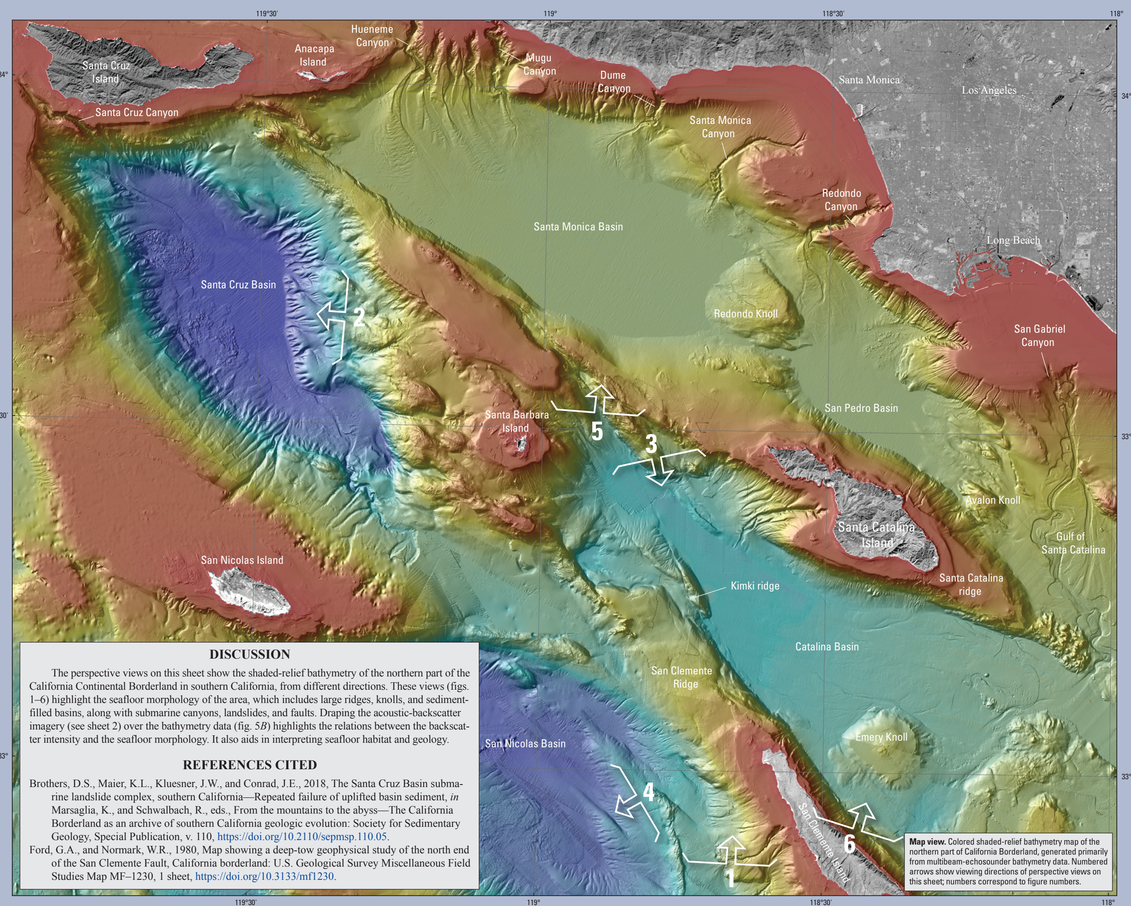


Figure 4. Perspective view to southwest toward the San Nicolas submarine landslide (f) along the southwest slope of the San Nicolas Basin. Width of the slide is more than 11 kilometers (km) wide along its headwall (g) and disturbed debris material can be mapped as far as 24 km from the headwall. Vertical exaggeration is 4x; distance across bottom of image is about 20 km.



DISCUSSION

The perspective views on this sheet show the shaded-relief bathymetry of the northern part of the California Continental Borderland in southern California, from different directions. These views (figs. 1–6) highlight the seafloor morphology of the area, which includes large ridges, knolls, and sediment-filled basins, along with submarine canyons, landslides, and faults. Draping the acoustic-backscatter imagery (see sheet 2) over the bathymetry data (fig. 5*B*) highlights the relations between the backscatter intensity and the seafloor morphology. It also aids in interpreting seafloor habitat and geology.

REFERENCES CITED

Brothers, D.S., Maier, K.L., Kluesner, J.W., and Conrad, J.E., 2018, The Santa Cruz Basin submarine landslide complex, southern California—Repeated failure of uplifted basin sediment, *in* Marsaglia, K., and Schwalbach, R., eds., From the mountains to the abyss—The California Borderland as an archive of southern California geologic evolution: Society for Sedimentary Geology, Special Publication, v. 110, https://doi.org/10.2110/sepmsp.110.05.

Ford, G.A., and Normark, W.R., 1980, Map showing a deep-tow geophysical study of the north end of the San Clemente Fault, California borderland: U.S. Geological Survey Miscellaneous Field Studies Map MF–1230, 1 sheet, https://doi.org/10.3133/mf1230.

Map view. Colored shaded-relief bathymetry map of the northern part of California Borderland, generated primarily from multibeam-echosounder bathymetry data. Numbered arrows show viewing directions of perspective views on this sheet; numbers correspond to figure numbers.

Onshore imagery modified from LANDSAT-8 satellite data from U.S. Geological Survey's Earth Explorer (available at http://earthexplorer.usgs.gov/)

Universal Transverse Mercator projection, Zone 11N

NOT INTENDED FOR NAVIGATIONAL USE

APPROXIMATE MEAN DECLINATION, 2021

10 5 0 10 MILES
10 5 0 10 KILOMETERS
ONE MILE = 0.869 NAUTICAL MILES

CALIF.
MAP LOCATION

Perspective views by Peter Dartnell, 2018

Parts of the map used data provided by the Ocean Exploration Trust's Nautilus Exploration Program, Cruises NA066, NA067, NA074, NA078, NA079, NA080, NA083, and NA088

Parts of the map used data acquired, processed, archived, and distributed by the Seafloor Mapping Lab of California State University, Monterey Bay

GIS database and digital cartography by Peter Dartnell

Edited by Phil Frederick; digital cartographic production by Katie Sullivan

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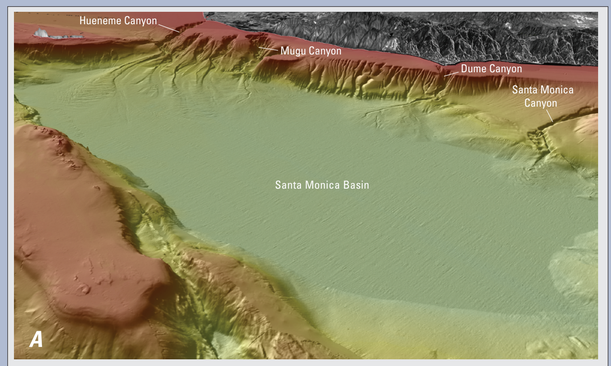
EXPLANATION

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

0 Shallow
200
400
600
800
1,000
1,200
1,400
1,600
1,800
1,943 Deep

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

Area of "no data"—Areas near shoreline not mapped owing to insufficient high-resolution seafloor mapping data



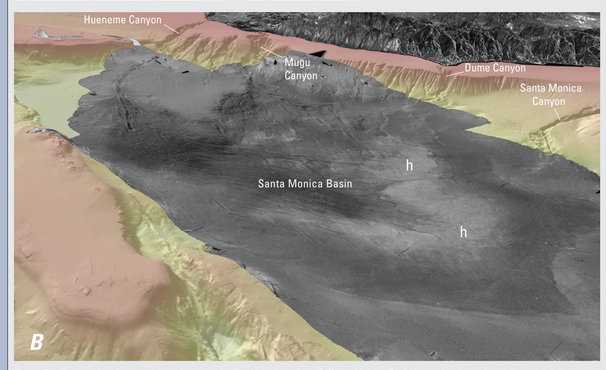


Figure 5. Perspective views to the north across the flat (slope less than 1°) Santa Monica Basin floor, showing colored shaded-relief bathymetry (*A*) and acoustic-backscatter imagery partly draped over shaded-relief bathymetry (*B*). The colored shaded-relief background is slightly lighter in this view to highlight the backscatter imagery. In backscatter imagery, lighter tones indicate stronger backscatter intensity, suggesting harder seafloor or coarser grained sediment, whereas darker tones indicate weaker backscatter intensity, suggesting softer, finer grained sediment. The basin is supplied sediment through numerous gullies and larger submarine canyons, such as the Hueneme, Mugu, Dume, and Santa Monica Canyons. Bathymetry data show relatively flat, featureless seafloor in the Santa Monica Basin and little evidence of channels or other features related to sediment transport on the basin floor. Acoustic-backscatter imagery, however, reveals basin-floor sediment pathways originating from submarine canyons along the northeast side of the basin. In addition, the variability in backscatter intensity shows that surface sediments have variable hardness or variable grain size, consistent with deposition by sediment gravity flows; light-colored imagery at distal part of apparent sediment flows (h) indicate presence of coarser grained sediment on submarine fans. Vertical exaggeration is 4x; distance across bottom of images is about 23 kilometers.

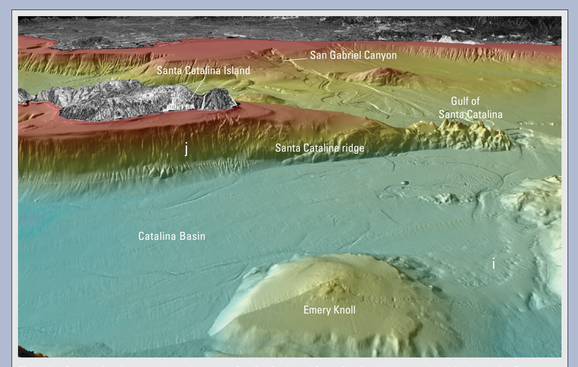


Figure 6. Perspective view to north-northeast over Catalina Basin and Santa Catalina Island toward mainland, showing Emory Knoll in the foreground and pockmarks (i), as wide as 300 meters (m), to the east (right) of it. The slight change in shading over Emory Knoll is a seam between different bathymetry datasets. Emory Knoll is a resistant bedrock high that, at one time, may have been a small island, surrounded by a broad, gently sloping wave-cut terrace that is now located about 800 m below present sea level. San Gabriel Canyon extends for about 85 kilometers (km) from the outer edge of the mainland shelf, into the Gulf of Santa Catalina, around the southern tip of the Santa Catalina ridge and into southern Catalina Basin. Similar to the east slope of San Clemente Island (see figure 3), the steep slope (j) southwest of Santa Catalina Island drops from 100 m depth at the edge of the island shelf to about 1,200 m at the base of the slope, an average gradient of about 23°. Vertical exaggeration is 4x; distance across bottom of image is 32 km.

Colored Shaded-Relief Bathymetry, Acoustic Backscatter, and Selected Perspective Views of the Northern Part of the California Continental Borderland, Southern California

By

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