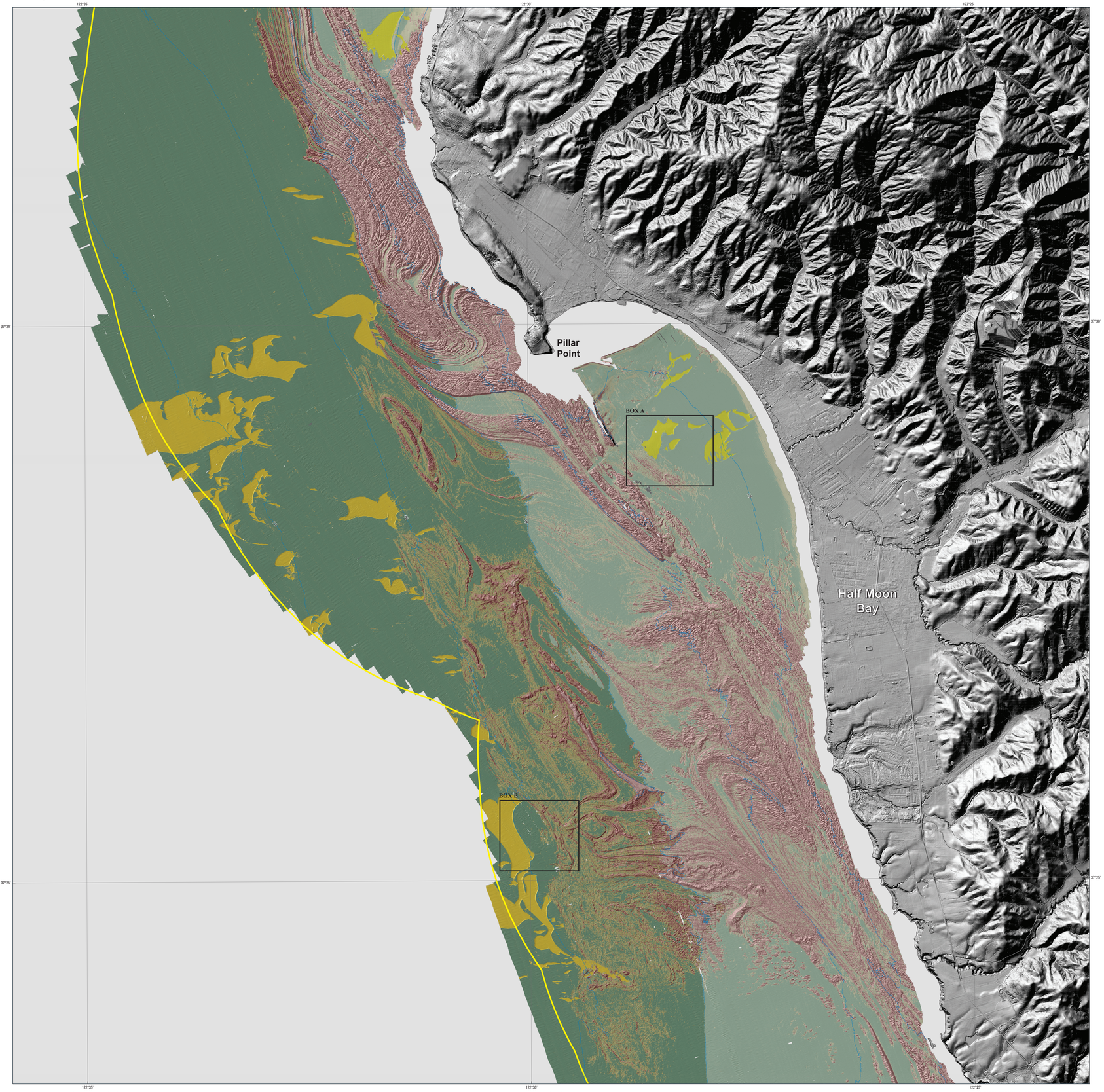
U.S. Department of the Interior
U.S. Geological Survey

Open-File Report 2014–1214
Sheet 5 of 10
Pamphlet accompanies map



Onshore elevation data collected by Photoscience in 2005 for U.S. Geological Survey and County of San Mateo. Offshore shaded-relief bathymetry from map on sheet 2, this report. California's State Waters limit from NOAA Office of Coast Survey

Universal Transverse Mercator projection, Zone 10N

NOT INTENDED FOR NAVIGATIONAL USE

APPROXIMATE MEAN DECLINATION, 2014

SCALE 1:24 000

1 MILE 1/2 0 1 MILE
1000 0 1000 2000 3000 4000 5000 6000 7000 FEET
1 0 1 KILOMETER

BATHYMETRIC CONTOUR INTERVAL 10 METERS
ONE MILE = 0.869 NAUTICAL MILES

MAP LOCATION

Seafloor character mapped by Elayne L. Phillips and Guy R. Cochrane, 2011
GIS database and digital cartography by Elayne L. Phillips and Mercedes D. Erdey

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Seafloor Character, Offshore of Half Moon Bay Map Area, California

By
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2014

DESCRIPTION OF MAP UNITS

DEPTH ZONE 2—INTERTIDAL TO 30 METERS WATER DEPTH

SLOPE CLASS 1—0 TO 5 DEGREES

Fine- to medium-grained smooth sediment—Low backscatter, low rugosity; typically mud to medium-grained sand; often rippled and (or) burrowed

Mixed smooth sediment and rock—Moderate to very high backscatter, low rugosity; typically coarse-grained sand, gravel, cobbles, and bedrock

Rock and boulder, rugose—High backscatter, high rugosity; typically boulders and rugose bedrock

Medium- to coarse-grained sediment—Very high backscatter, low rugosity; typically medium- to coarse-grained sediment, with varying amounts of shell hash; in scour depressions

DEPTH ZONE 3—30 METERS TO 100 METERS WATER DEPTH

SLOPE CLASS 1—0 TO 5 DEGREES

Fine- to medium-grained smooth sediment—Low backscatter, low rugosity; typically mud to medium-grained sand; often rippled and (or) burrowed

Mixed smooth sediment and rock—Moderate to very high backscatter, low rugosity; typically coarse-grained sand, gravel, cobbles, and bedrock

Rock and boulder, rugose—High backscatter, high rugosity; typically boulders and rugose bedrock

Medium- to coarse-grained sediment—Very high backscatter, low rugosity; typically medium- to coarse-grained sediment, with varying amounts of shell hash; in scour depressions

EXPLANATION OF MAP SYMBOLS

Area of "no data"—Areas near shoreline not mapped owing to insufficient high-resolution seafloor mapping data; areas beyond 3-nautical-mile limit of California's State Waters were not mapped as part of California Seafloor Mapping Program

3-nautical-mile limit of California's State Waters

10 **Bathymetric contour (in meters)**—Derived from modified 2-m-resolution bathymetry grid. Contour interval: 10 m

DISCUSSION

This seafloor-character map of the Offshore of Half Moon Bay map area in northern California was produced using video-supervised, maximum-likelihood classification of the bathymetry and backscatter (intensity of return) signals from sonar systems (a summary of the video data collected for the purpose of supervising the classification is shown on sheet 6). Rugosity (a GIS-derived characterization of roughness) and backscatter intensity were used as variants in the classification. The interpreted classifications were then draped over shaded-relief bathymetry (see sheet 2).

The substrate classes mapped in this area have been divided into the following California Marine Life Protection Act depth zones: Depth Zone 2 (intertidal to 30 m), and Depth Zone 3 (30 to 100 m). In addition, the following slope class is represented on this map (Coastal and Marine Ecological Classification Standard slope zone is shown in parentheses): Slope Class 1, 0° to 5° (flat). Depth Zone 1 (intertidal), Depth Zones 4 and 5 (greater than 100 m), and Slope Classes 2 to 5, greater than 5° (sloping to overhang) are not present in this map area.

Fine to medium-grained smooth sediment (sand and mud) makes up 56.5 percent (71.6 km^2) of the map area: 19.2 km^2 is in Depth Zone 2, and 52.4 km^2 is in Depth Zone 3. Mixed smooth sediment (sand and gravel) and rock (sediment typically forming a veneer over bedrock, or rock outcrops having little to no relief) make up 16.2 percent (20.5 km^2) of the map area: 10.8 km^2 is in Depth Zone 2, and 9.7 km^2 in Depth Zone 3. Rock and boulder, rugose (rock outcrops and boulder fields having high surficial complexity) makes up 22.6 percent (28.6 km^2) of the map area: 24.0 km^2 in Depth Zone 2, and 4.6 km^2 is in Depth Zone 3. Medium- to coarse-grained sediment (in large sand-wave fields) makes up 4.8 percent (6.0 km^2) of the map area: 0.8 km^2 is in Depth Zone 2, and 5.2 km^2 is in Depth Zone 3 (table 1).

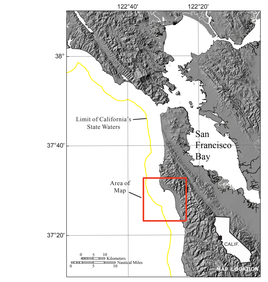

Table 1. Coverage of classified seafloor, in square kilometers (sq km) and percent of total area, broken into California Marine Life Protection Act Depth Zones 2 and 3.

	Total		Depth Zone 2 (water depth 0–30 m)		Depth Zone 3 (water depth >30 m)	
	percent	sq km	percent of total	sq km	percent of total	sq km
Fine- to medium-grained smooth sediment	56.5	71.6	15.1	19.2	41.4	52.4
Mixed smooth sediment and rock	16.2	20.5	8.5	10.8	7.7	9.7
Rock and boulder, rugose	22.6	28.6	18.9	24.0	3.6	4.6
Medium- to coarse-grained sediment	4.8	6.0	0.6	0.8	4.1	5.2

BOX A

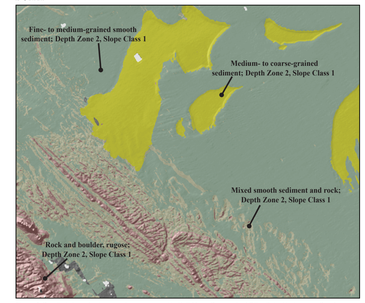

Figure 1. Detailed view of substrate classes mapped in Half Moon Bay south of Pillar Point Harbor (see Box A, on map, for location): Depth Zone 2 (intertidal to 30 m), and Slope Class 1 (0°–5°). Fine- to medium-grained smooth sediment is shown in shades of green; mixed smooth sediment and rock is shown in shades of tan; rock is shown in shades of pink; and medium- to coarse-grained sediment is shown in shades of yellow.

BOX B

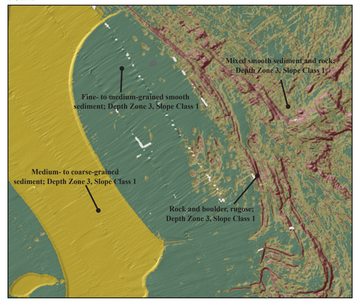

Figure 4. Detailed view of substrate classes mapped in area offshore of city of Half Moon Bay (see Box B, on map, for location): Depth Zone 3 (30 to 100 m), and Slope Class 1 (0°–5°). Fine- to medium-grained smooth sediment is shown in shades of green; mixed smooth sediment and rock is shown in shades of tan; rock is shown in shades of pink; and medium- to coarse-grained sediment is shown in yellow.

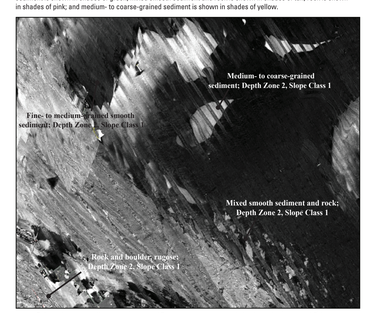

Figure 2. Acoustic-backscatter image (see sheet 3) draped over shaded-relief bathymetry (see sheet 2) for same area as figure 1 (Box A on map). Brighter areas indicate coarse-grained, rough, or hard seafloor; darker areas indicate unconsolidated (loosely packed) sediment; northwest-southeast-trending lines are data-collection artifacts. Interpreted substrate classes from figure 1 included for comparison.

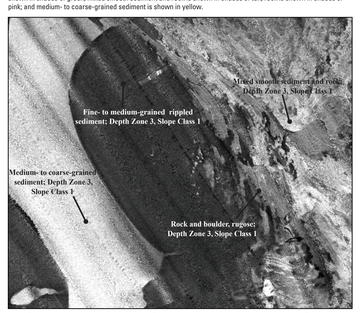

Figure 5. Acoustic-backscatter image (see sheet 3) draped over shaded-relief bathymetry (see sheet 2) for same area as figure 4 (Box B on map). Brighter areas indicate coarse-grained, rough, or hard seafloor; darker areas indicate unconsolidated (loosely packed) sediment; northwest-southeast-trending lines are data-collection artifacts. Interpreted substrate classes from figure 4 included for comparison.

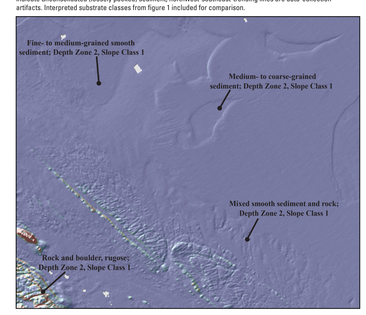

Figure 3. Rugosity (characterization of roughness derived from bathymetry) draped over shaded-relief bathymetry (see sheet 2) for same area as figure 1 (Box A on map). Rugosity values are displayed in muted "rainbow" color spectrum that ranges from purple (low rugosity) through green (medium rugosity) to red (high rugosity). Areas of high slope are indicated by high-rugosity values (red); areas of low slope, by medium- to low-rugosity values (green to purple). Interpreted substrate classes from figure 1 included for comparison.

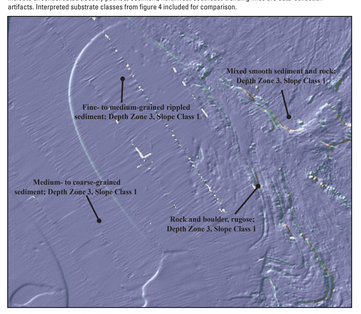

Figure 6. Rugosity (characterization of roughness derived from bathymetry) draped over shaded-relief bathymetry (see sheet 2) for same area as figure 4 (Box B on map). Rugosity values are displayed in muted "rainbow" color spectrum that ranges from purple (low rugosity) through green (medium rugosity) to red (high rugosity). Areas of high slope are indicated by high-rugosity values (red); areas of low slope, by medium- to low-rugosity values (green to purple). Interpreted substrate classes from figure 4 included for comparison.

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