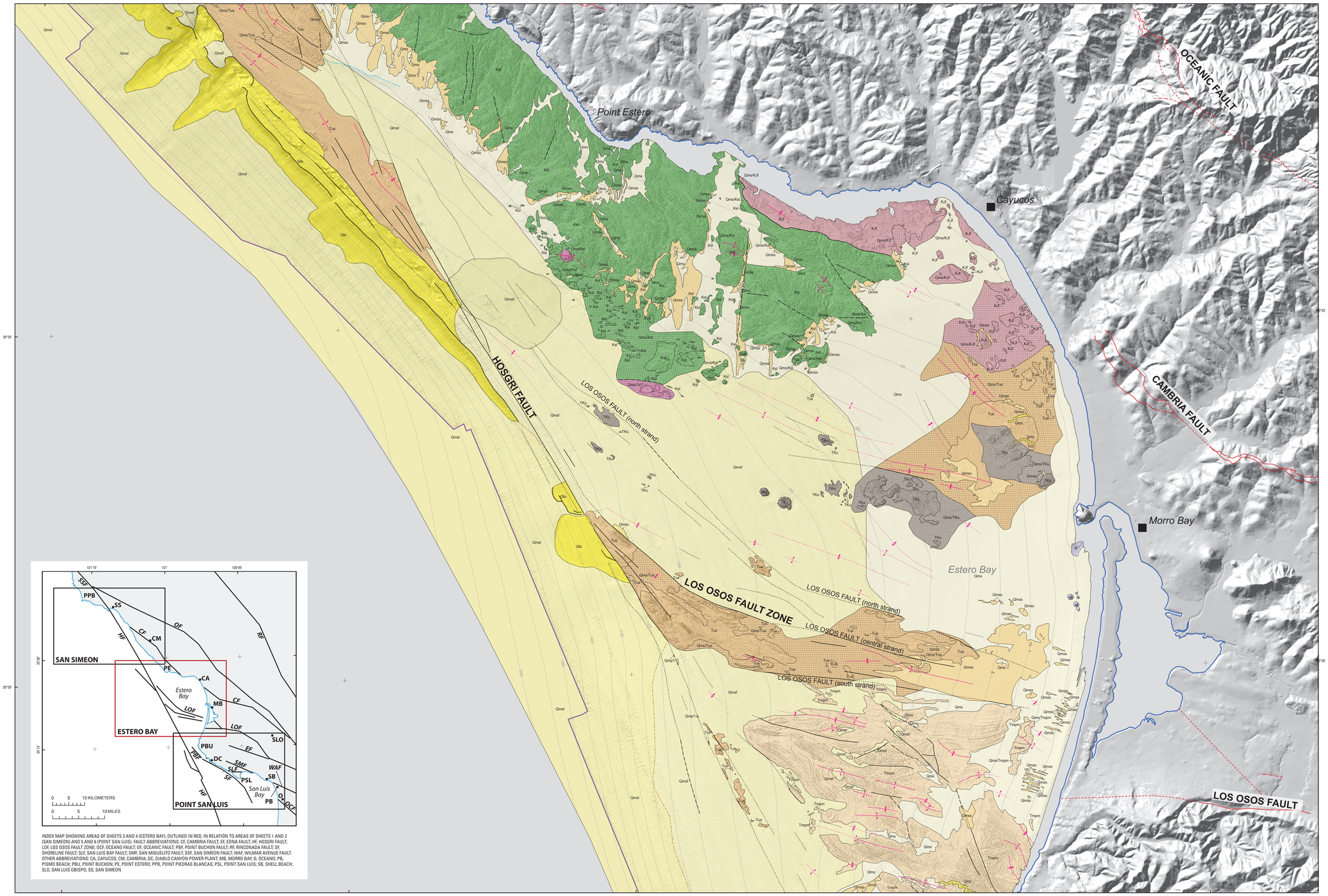
U.S. Department of the Interior
U.S. Geological Survey

Scientific Investigations Map 3327
Sheet 3 of 6
Pamphlet accompanies map



INDEX MAP SHOWING AREAS OF SHEETS 3 AND 4 (ESTERO BAY), OUTLINED IN RED, IN RELATION TO AREAS OF SHEETS 1 AND 2 (SAN SIMEON) AND 5 AND 6 (POINT SAN LUIS). FAULT ABBREVIATIONS: CF, CAMBRIA FAULT; EF, EDNA FAULT; HF, HOSGRI FAULT; LOF, LOS OSOS FAULT ZONE; OCF, OCEANO FAULT; OF, OCEANIC FAULT; PBF, POINT BUCHON FAULT; RF, RINCONADA FAULT; SF, SHORELINE FAULT; SLF, SAN LUIS BAY FAULT; SMF, SAN MIGUELITO FAULT; SSF, SAN SIMEON FAULT; WAF, WILMAR AVENUE FAULT. OTHER ABBREVIATIONS: CA, CAYUCOS; CM, CAMBRIA; DC, DIABLO CANYON POWER PLANT; MB, MORRO BAY; O, OCEANO; PB, PISMO BEACH; PBU, POINT BUCHON; PE, POINT ESTERO; PPB, POINT PIEDRAS BLANCAS; PSL, POINT SAN LUIS; SB, SHELL BEACH; SLO, SAN LUIS OBISPO; SS, SAN SIMEON

Bathymetric shaded-relief imagery (10X vertical exaggeration) from gridded multibeam bathymetry acquired, processed, archived, and distributed by California State University, Monterey Bay, Seafloor Mapping Lab (CSUMB) and by U.S. Geological Survey (Hartwell and others, 2013)

Bathymetric contours derived from gridded multibeam bathymetry (CSUMB); 1/3 arc-second NOAA Tsunami Inundation DEM (Friday and others, 2011), and regional 3 arc-second NOAA DEM (National Oceanic and Atmospheric Administration National Geophysical Data Center, 2011)

Elevation data from U.S. Geological Survey National Elevation Database (1/3 arc-second); sun illumination from northwest (315°) at 45° above horizon

Universal Transverse Mercator projection, Zone 10N

NOT INTENDED FOR NAVIGATIONAL USE

APPROXIMATE MEAN DECLINATION, 2015

SCALE 1:35 000

1 0 1 MILE
1/2 0 1 KILOMETER
BASE CONTOUR INTERVAL = 50 METERS

BATHYMETRIC CONTOUR INTERVAL 10 METERS
ONE MILE = 0.869 NAUTICAL MILES

MAP LOCATION

Offshore geology and geomorphology mapped by Janet T. Watt and Samuel Y. Johnson, 2010–2013. Onshore faults from Quaternary fault and fold database (U.S. Geological Survey and California Geological Survey, 2010)

GIS database and digital cartography by Janet T. Watt, Stephen R. Hartwell, and Theresa Fregoso

Edited by Taryn A. Lindquist

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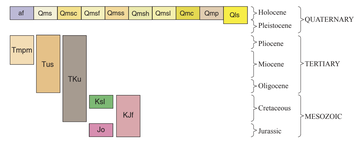
CORRELATION OF MAP UNITS



DESCRIPTION OF MAP UNITS

[Note that composite units (gray-stippled areas) are designated on map by composite label indicating both overlying sediment cover and lower (older) unit, separated by slash (for example, Qms/TKu indicates that thin sheet of Qms overlies TKu)]

- af — **Artificial fill (Holocene)**—Rock, sand, and mud; placed and (or) dredged. Also includes seafloor significantly modified by human activity
- Qms — **Marine nearshore and shelf deposits (Holocene)**—Mostly sand; ripples common
- Qmsc — **Coarse-grained marine nearshore and shelf deposits (Holocene)**—Predominantly coarse sand, gravel, and cobbles. Recognized primarily on basis of high backscatter and flat relief
- Qmsf — **Fine-grained marine nearshore and shelf deposits (Holocene)**—Predominantly mud to muddy sand
- Qmss — **Marine shelf sorted bedforms (Holocene)**—Inferred to be coarse sand and possibly gravel; found as single depressions or in fields of depressions interspersed with elevated shelf sediments (unit Qms). Although no direct camera observations of these bedforms were made in map area, their composition is inferred from similar features directly observed elsewhere on California shelf
- Qmsh — **Marine shelf hummocky deposits (Holocene)**—Sand and mud; forms hummocky surface relief on shelf over large areas (4 to 8 km²)
- Qmsl — **Marine slope deposits (Holocene)**—Sand and mud; found offshore of shelf break (more than about 80 m deep) on seaward-dipping (6°–8°) surface
- Qmc — **Marine channel deposits (Holocene)**—Predominantly coarse sand; characterized by high backscatter
- Qmp — **Marine pockmarks (Holocene)**—Sand and mud; forms pockmarks on outer shelf and slope. Pockmarks are solitary, circular features that are found along trace of Hosgri Fault and, thus, may be associated with fluid venting along fault zone
- Qls — **Landslide deposits (Holocene and latest Pleistocene)**—May represent various forms of submarine sediment instabilities, including slumps, slides, and collapse depressions. Characterized by hummocky bathymetry and headscarps incised into shelf (unit Qmsf) or slope (unit Qmsl) deposits
- Tmpm — **Pismo Formation, Miguelito Member (Pliocene and late Miocene)**—Predominantly brown claystone and siltstone; shale, locally thin-bedded chert, and diatomaceous shale. Stippled areas (composite unit Qms/Tmpm) indicate where thin sheets of Qms overlie unit
- Tus — **Sedimentary bedrock (Tertiary)**—Includes sedimentary rocks from the Monterey and Pismo Formations; distinguished on basis of bedding character in shallow seismic-reflection data and (or) multibeam imagery. Stippled areas (composite unit Qms/Tus) indicate where thin sheets of Qms overlie unit
- TKu — **Bedrock, undivided (Tertiary and Cretaceous)**—May include rocks of any of Tertiary- to Jurassic-age units mapped herein, as well as of Oligocene dacite and dacite flow facies associated with Islay Hill–Morro Rock complex (Hall, 1973a). Stippled areas (composite unit Qms/TKu) indicate where thin sheets of Qms overlie unit
- Ksl — **Unnamed sandstone and interbedded shale (Late Cretaceous)**—Sandstone and interbedded shale and siltstone; mapped in San Simeon and Morro Bay areas, in accordance with adjacent onland mapping (Hall, 1973a, 1974). Correlated with the unnamed sandstone and interbedded claystone unit (Kslc), mapped in Point San Luis area (see sheet 5). Stippled areas (composite unit Qms/Ksl) indicate where thin sheets of Qms overlie unit
- KJf — **Franciscan Complex (Cretaceous and Jurassic)**—Includes fine- to coarse-grained sandstone, siltstone, and some claystone, as well as mélange. Mélange is mainly composed of sheared claystone that contains exotic clasts of conglomerate, blueschist, schist, greenstone, chert, graywacke, and shale. Stippled areas (composite unit Qms/KJf) indicate where thin sheets of Qms overlie unit
- Jo — **Coast Range ophiolite (Jurassic)**—Includes diabase, basalt, microdiorite, dikes and sills, diorite, and serpentinite. Ophiolite sequences mapped onland at Point Piedras Blancas and Point San Luis (Hall, 1973a, 1976). Serpentinite, which often is faulted and sheared within the Franciscan Complex, is found in lenses along fault zones. Stippled areas (composite unit Qms/Jo) indicate where thin sheets of Qms overlie unit

EXPLANATION OF MAP SYMBOLS

- **Contact**—Approximately located
- **Fault (offshore)**—Solid where location is certain, dashed where location is inferred, dotted where location is concealed, queried where existence is questionable
- **Fault (onshore)**—Solid where location is certain, long-dashed where location is approximate, short-dashed where location is inferred
- **Folds**—Solid where location is certain, dotted where location is concealed
  - **Antiform**
  - **Synform**
- **Headscarp of submarine landslide**—Sharp, distinct scarp at head of landslide; in places, forms contact between landslide deposits (Qls) and other units. Hachures point downscarp
- **Shelf break**—Boundary between continental shelf and upper slope, mapped on basis of distinct break in slope that is visible in multibeam bathymetry or on seismic-reflection profiles. Forms contact between shelf (Qmsf) and slope (Qmsl) deposits. Coincident with submarine landslide scarps offshore of Point Estero
- **Slope break**—Break in slope along top of latest Pleistocene nearshore bar
- **Boundary of multibeam-bathymetry survey**
- **Area of "no data"**—Areas not mapped owing to insufficient high-resolution seafloor mapping data

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Offshore Geology and Geomorphology of Estero Bay Map Area

Offshore Geology and Geomorphology from Point Piedras Blancas to Pismo Beach, San Luis Obispo County, California

By

Janet T. Watt, Samuel Y. Johnson, Stephen R. Hartwell, and Michelle Roberts

2015

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