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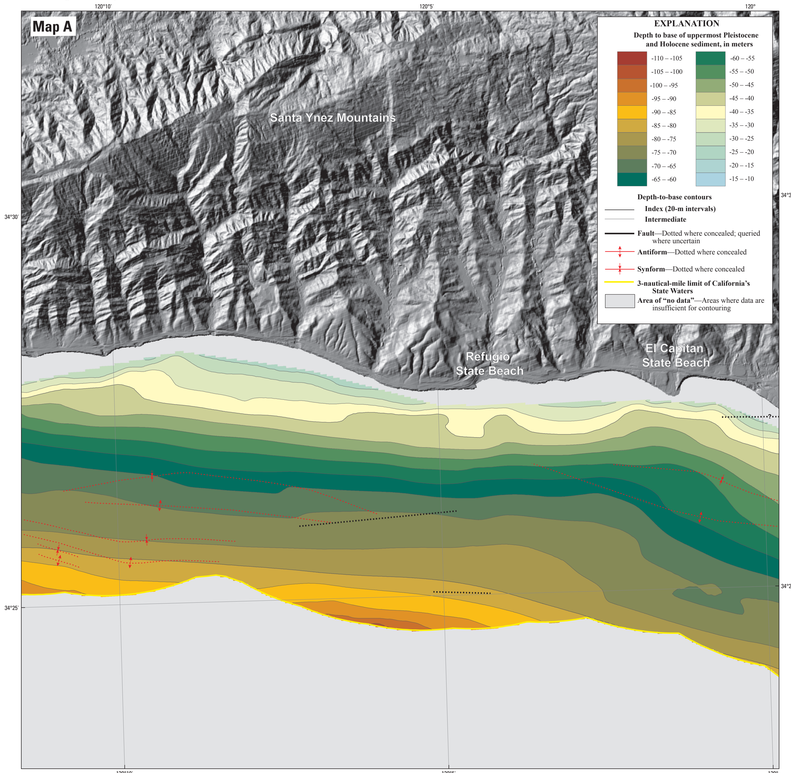
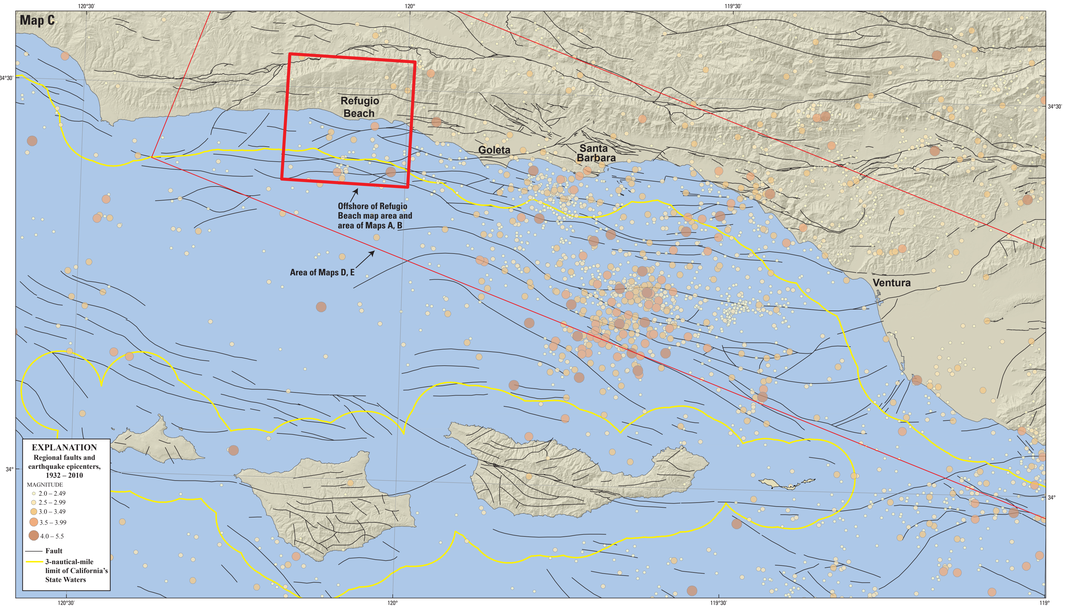
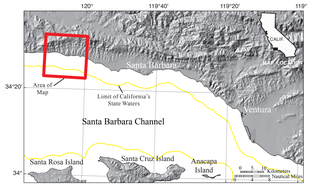
U.S. Department of the Interior
U.S. Geological Survey

Scientific Investigations Map 3319
Sheet 9 of 11
Pamphlet accompanies map







DISCUSSION

This sheet includes maps that show the thickness and the depth to base of uppermost Pleistocene and Holocene (in other words, post–Late Glacial Maximum) deposits for the Offshore of Refugio Beach map area (Maps A, B), as well as for a larger area that extends about 115 km along the coast from Hueneme Canyon to Refugio Beach (Maps D, E) to establish a regional context. To make these maps, water bottom and depth to base of the post–Last Glacial Maximum horizons were mapped from seismic-reflection profiles. The difference in the two horizons was exported for every shot point as XY coordinates (UTM zone 11) and two-way travel time (TWT). The thickness of the post–Last Glacial Maximum unit (Maps B, E) was determined by applying a sound velocity of 1,600 m/sec to the TWT. The thickness points were interpolated to a preliminary continuous surface, overlaid with zero-thickness bedrock outcrops (sheet 10 of this report), and contoured (Wong and others, 2012). Data within Hueneme Canyon were excluded from the contouring because the seismic-reflection data are too sparse to adequately image the highly variable changes in sediment thickness that characterize the canyon (Maps D, E).

Several factors required manual editing of the preliminary sediment-thickness maps to make the final products. The Red Mountain Fault Zone (RMFZ), Pitas Point Fault (PPF), and Oak Ridge Fault (ORF) disrupt the sediment sequence in the region (Maps D, E). The data points also are dense along tracklines (about 1 m apart) and sparse between tracklines (1–2 km apart), resulting in contouring artifacts. To incorporate the effect of the faults, to remove irregularities from interpolation, and to reflect other geologic information and complexity, the resulting interpolated contours were modified. Contour modifications and regridding were repeated several times to produce the final regional sediment-thickness map (Wong and others, 2012).

Data to determine the depth to base of the post–Last Glacial Maximum unit was similarly processed and contoured. However, this preliminary dataset was set aside in favor of a surface determined by subtracting the modified thickness data from multibeam bathymetry collected separately (see sheet 1). The depth of this surface in the Hueneme Canyon to Refugio Beach area ranges from 12 to 190 m (Map D; see also, Wong and others, 2012).

Five different "domains" of sediment thickness, which are bounded either by faults or by Hueneme Canyon, are recognized on the regional maps (Maps D, E): (1) Refugio Beach to the south strand of the Red Mountain Fault Zone (RMFZ); (2) between the south strand of the Red Mountain Fault Zone and the Pitas Point Fault (PPF); (3) between the Pitas Point Fault and the Oak Ridge Fault (ORF); (4) between the Oak Ridge Fault and Hueneme Canyon; and (5) south of Hueneme Canyon. These data highlight the contrast among three general zones of sediment thickness: (1) the uplifted, sediment-poor Santa Barbara shelf (domain 1; mean sediment thickness of 3.5 m); (2) a transitional zone (domain 2; mean sediment thickness of 18.0 m); and (3) the subsiding, sediment-rich delta and shelf offshore of the Ventura and Santa Clara Rivers and Calleguas Creek (domains 3, 4, and 5; mean sediment thicknesses of 39.2, 38.9, and 28.3 m, respectively).

In the Offshore of Refugio Beach map area, sediment thickness ranges from 0 to 12 m, with a mean thickness of 2.7 m. The thickest sediment accumulations are in a prominent, discontinuous, shore-parallel, nearshore to inner shelf delta-mouth bar directly sourced by steep, local watersheds in the Santa Ynez Mountains to the north. Sediment is notably either absent or very thin in the midshelf to outer shelf area.

The regional pattern of faults and of earthquakes occurring between 1932 and 2010 that have inferred or measured magnitudes greater than 2.0 is shown on Map C.

Fault locations are based on our mapping within California's State Waters and on a generalized compilation of mapping from Heck (1998), Minor and others (2009), and Jennings and Bryant (2010). Earthquake data are from the Southern California Earthquake Catalog (Southern California Earthquake Data Center, 2010). Although earthquake locations have been determined by the CalTech network since 1932, significantly greater precision began in 1969 with installation of a U.S. Geological Survey (USGS) seismographic network (Lee and Vedder, 1973; Southern California Earthquake Data Center, 2010). Epicentral data indicate that recent seismicity in the eastern and central Santa Barbara Channel is characterized by earthquake swarms, relatively frequent minor earthquakes, and infrequent major earthquakes.

REFERENCES CITED

Caldwell, R.J., Taylor, L.A., Eakins, B.W., Carignan, K.S., Grothe, P.R., Lim, E., and Friday, D.Z., 2010, Digital elevation models of Santa Monica, California—Procedures, data sources and analysis: NOAA Technical Memorandum NESDIS NGDC-46, NOAA National Geophysical Data Center, available at http://www.ngdc.noaa.gov/dem/squareCellGrid/download/663.

Carignan, K.S., Taylor, L.A., Eakins, B.W., Warnken, R.R., Lim, E., and Medley, P.R., 2009, Digital elevation model of Santa Barbara, California—Procedures, data sources, and analysis: NOAA Technical Memorandum NESDIS NGDC-29, NOAA National Geophysical Data Center, available at http://www.ngdc.noaa.gov/dem/squareCellGrid/download/603.

Heck, R.G., 1998, Santa Barbara Channel regional formline map, top Monterey Formation, *in* Kunitomi, D.S., Hopps, T.E., and Galloway, J.M., eds., Structure and petroleum geology, Santa Barbara Channel, California: American Association of Petroleum Geologists, Pacific Section, and Coast Geological Society, Miscellaneous Publication 46, 1 plate.

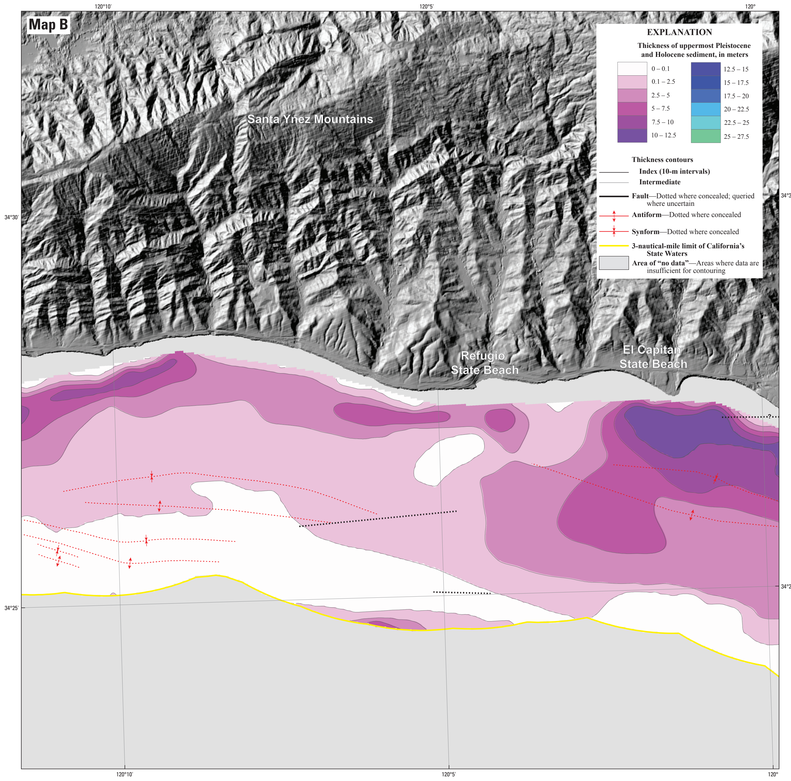
Jennings, C.W., and Bryant, W.A., 2010, Fault activity map of California: California Geological Survey Geologic Data Map no. 6, scale 1:750,000.

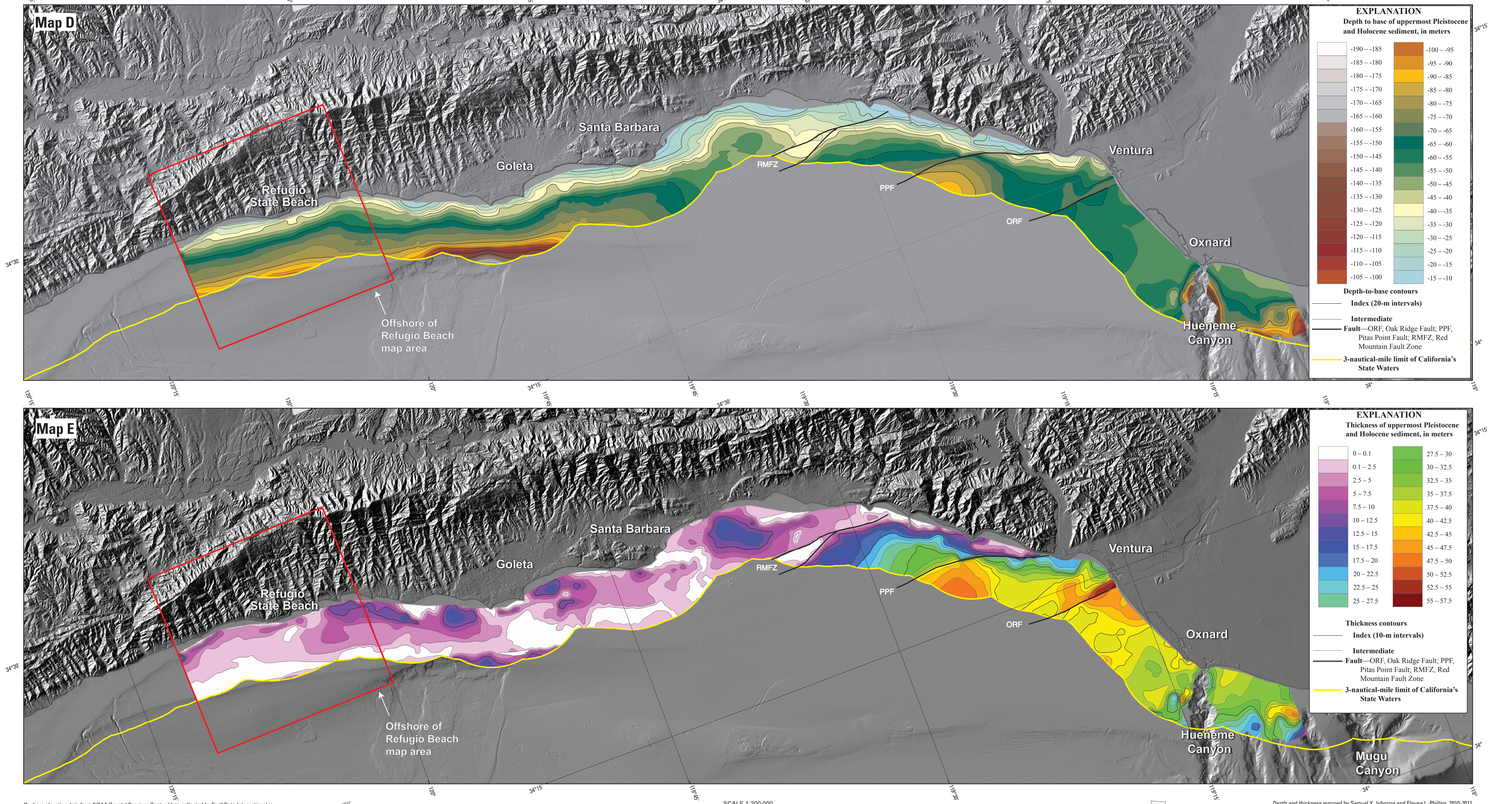
Lee, W.H.K., and Vedder, J.G., 1973, Recent earthquake activity in the Santa Barbara Channel region: Bulletin of the Seismological Society of America, v. 63, p. 1,757–1,773.

Minor, S.A., Kellogg, K.S., Stanley, R.G., Gurrola, L.D., Keller, E.A., and Brandt, T.R., 2009, Geologic map of the Santa Barbara coastal plain area, Santa Barbara County, California: U.S. Geological Survey Scientific Investigations Map 3001, scale 1:25,000, 1 sheet, pamphlet 38 p., available at http://pubs.usgs.gov/sim/3001/.

Southern California Earthquake Data Center, 2010, Southern California Earthquake Catalog: Southern California Earthquake Data Center database, accessed April 5, 2011, at http://www.data.scec.org/eq-catalogs/index.html.

Wong, F.L., Phillips, E.L., Johnson, S.Y, and Sliter, R.W., 2012, Modeling of depth to base of Last Glacial Maximum and seafloor sediment thickness for the California State Waters Map Series, eastern Santa Barbara Channel, California: U.S. Geological Survey Open-File Report 2012–1161, 16 p., available at http://pubs.usgs.gov/of/2012/1161/.





Onshore elevation data from NOAA Coastal Services Center (data collected by EarthData International in 2002-2003). California's State Waters limit from NOAA Office of Coast Survey
Universal Transverse Mercator projection, Zone 10N

APPROXIMATE MEAN DECLINATION, 2015

SCALE 1:50 000
ONE MILE = 0.869 NAUTICAL MILES

MAP LOCATION

Depth and thickness mapped by Samuel Y. Johnson and Eleyne L. Phillips, 2010-2011
GIS database and digital cartography by Eleyne L. Phillips, Andrew C. Ritchie, and Florence L. Wong

Onshore elevation data from NOAA Coastal Services Center (data collected by EarthData International in 2002-2003). Shaded-relief bathymetry from data collected by Monterey Bay Aquarium Research Institute in 1998, by U.S. Geological Survey in 2006, by California State University, Monterey Bay, Seafloor Mapping Lab in 2006-2007, and by Fugro Pelagos for U.S. Army Corps of Engineers in 2009; data compiled in NOAA Tsunami Inundation Project 1/3 arc-second DEMs for Santa Barbara, CA (Carignan and others, 2009) and Santa Monica, CA (Caldwell and others, 2010). California's State Waters limit from NOAA Office of Coast Survey
Universal Transverse Mercator projection, Zone 11N

NOT INTENDED FOR NAVIGATIONAL USE

APPROXIMATE MEAN DECLINATION, 2015

SCALE 1:200 000
ONE MILE = 0.869 NAUTICAL MILES

MAP LOCATION

Depth and thickness mapped by Samuel Y. Johnson and Eleyne L. Phillips, 2010-2011
GIS database and digital cartography by Andrew C. Ritchie, Eleyne L. Phillips, and Florence L. Wong
Edited by Sarah E. Nagorsen
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Local (Offshore of Refugio Beach Map Area) and Regional (Offshore from Refugio Beach to Hueneme Canyon) Shallow-Subsurface Geology and Structure, Santa Barbara Channel, California

By

Samuel Y. Johnson, Eleyne L. Phillips, Andrew C. Ritchie, Florence L. Wong, Ray W. Sliter, Amy E. East, James E. Conrad, and Patrick E. Hart

2015

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