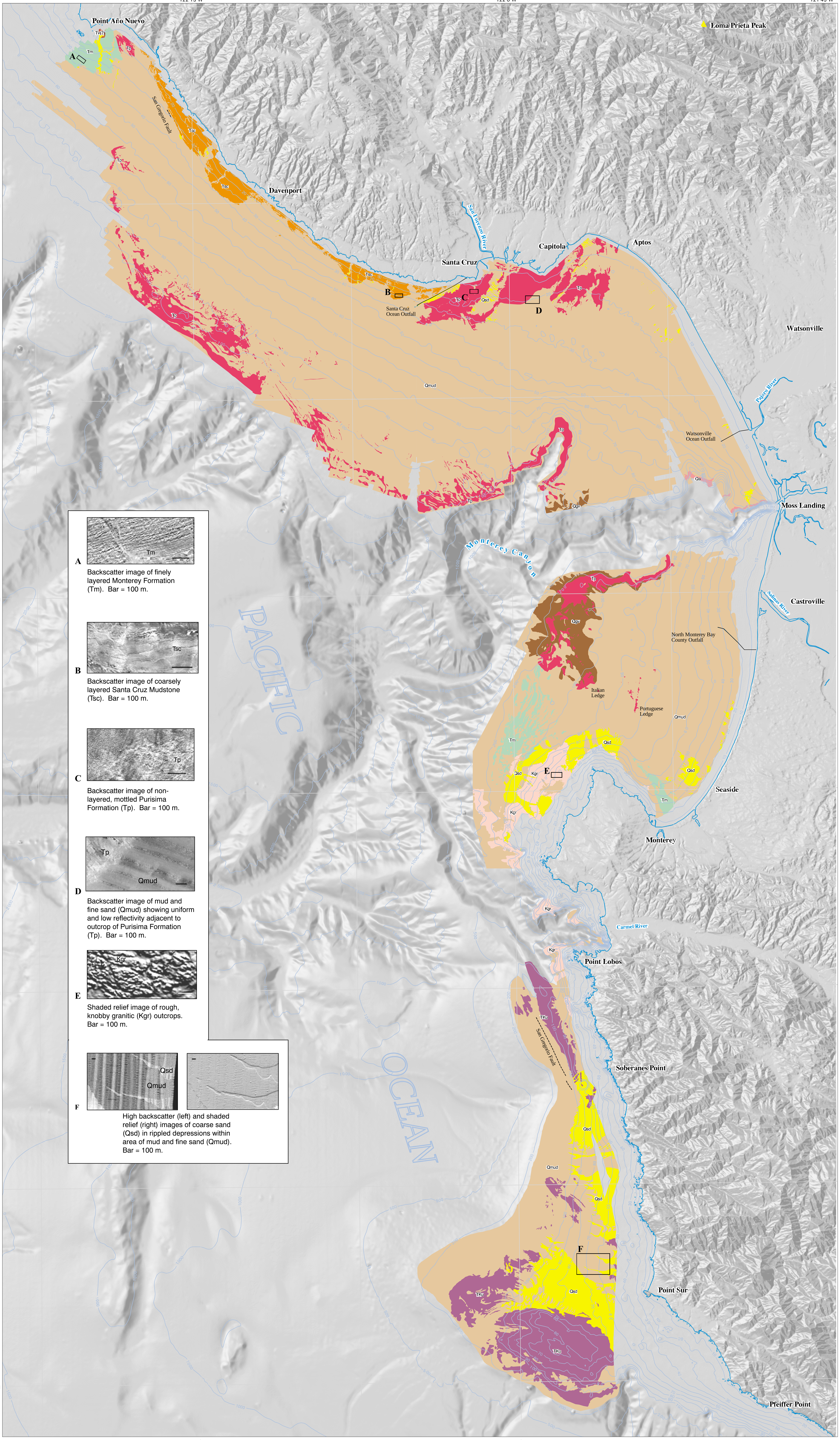

DESCRIPTION OF MAP UNITS

Rock Outcrops

- Qa — Aromas Sand (Pleistocene)
- Tp — Purisima Formation (Pliocene and Miocene)
- Tsc — Santa Cruz Mudstone (late Miocene)
- Tm — Monterey Formation (Miocene)
- Tvq — Vaqueros(?) Formation (Miocene and late Oligocene)

South of Monterey Canyon

- TKr — Rocks of Sur Platform (Tertiary and Cretaceous)—probably Franciscan Metamorphic Complex (Cretaceous)
- Kgr — Granitic rock (Late Cretaceous), predominantly porphyritic granodiorite

Other Bottom Types

- Qmud — Mud and fine sand (Quaternary)
- Qsd — Coarse sands (Quaternary)
- Qgv — Relict gravels and sands (Quaternary)

---- San Gregorio Fault, modern seafloor expression

The continental shelf of the greater Monterey Bay area has been surveyed using various techniques to give seafloor acoustic imagery from Point Año Nuevo on the north to Point Sur on the south. This map is an interpretation of this acoustic imagery in terms of bottom type. The acoustic imagery can be accessed via http://TerraWeb.wr.usgs.gov/TRS/projects/MontereySonar. Where bedrock is exposed on the seafloor, we have identified the outcropping rock type. Since the acoustic techniques cannot resolve sediment thicknesses less than about 1 m, it is possible that some of the rock outcrops are, in fact, covered by as much as 1 m of modern sediment. However, where photographic evidence is available, our interpreted outcrops are found to be uncovered.

To produce the seafloor imagery on the continental shelf north of Monterey Canyon, towed-fish side-scan sonar systems were deployed from the *R/V David Johnston* of the U.S. Geological Survey and the *R/V McArthur* of the National Oceanic and Atmospheric Administration. To aid in the interpretation of seafloor materials on the northern shelf, we also collected high-resolution seismic-reflection profiles using a surface-towed 1-kHz boomer as sound source and a 10-m streamer as receiver. Lines were spaced 150 m apart on the inner Santa Cruz shelf and 400 m apart on the mid- to outer-shelf. Differential global positioning system (GPS) navigation was used on all acoustic survey lines, providing boat-position accuracy better than 10 m. On the northern shelf from the sheltered area around Santa Cruz northwest to Point Año Nuevo, the innermost survey lines were run into water depths as shallow as 5 m. However in most other areas, shallowest lines were at about the 10-m isobath, leaving a significant data gap to the shoreline.

On the shelf south of Monterey Canyon, two surveys were conducted with hull-mounted multibeam swath-bathymetry/backscatter systems. The first survey used a Simrad EM1000 system on the *R/V Pacific Hunter* of California State University, Humbolt. The second survey used a Simrad EM300 system on the *R/V Ocean Alert* (contracted through the University of New Brunswick and C&C Technologies in cooperation with the Monterey Bay Aquarium Research Institute). These systems recorded both water depth and acoustic backscatter from the seafloor. Line spacing varied to accommodate the variation in seafloor coverage afforded by the systems that image swaths averaging about 5 times water depth. Nearshore coverage extended shoreward to the 20-m isobath along the coast between Monterey and Moss Landing and to approximately the 50-m isobath around and south of the Monterey Peninsula.

The side-scan sonar mosaics on the shelf north of Monterey Canyon have a pixel resolution of 0.4 m for the inner shelf and 0.8 m for the outer shelf. Although this pixel resolution allows us to resolve relatively small features on the seafloor, the accuracy of pixel location is considerably poorer than this due to inaccuracies in navigating the fish towed behind the ship for the northern surveys. The southern-shelf data, which were collected with hull-mounted systems, were processed at pixel resolutions of 2.5 m for backscatter and 5 m for bathymetry. The estimated navigational accuracy in pixel location is 50 m for the northern shelf data and 10 m for the southern shelf data. See Eittreim and others (in press) for a fuller discussion of the navigational accuracy and acoustic systems.

Based on the acoustic imagery, boundaries were drawn between areas interpreted as different bottom types. In general, mud produces a low-reflectivity bottom, whereas outcropping rocks and coarse sand have high reflectivity (fig. D). Sands show uniform reflectivity whereas rock outcrops display geometric patterns that are associated with layering, jointing, faulting and folding (figs. A, B). Granitic rocks show non-layered knobby patterns associated with weathering and jointing style (fig. E). Coarse sands usually occur in shallow troughs (fig. F) and display 1-m wavelength ripples where high-resolution data (better than 1-m per pixel) are available.

Interpretation was done at the scale of 2.4 m per pixel. At an image resolution of 72 dpi, common to most video screens, this represents a scale of 1:6,800. We emphasize that the distributions of bottom types are based largely on the acoustic imagery and not on direct samples. However, numerous sample identifications, mostly from rocks dredged from the upper continental slope and canyon walls (McCulloch and others, 1985; Stakes and others, 1999), seafloor sediment samples and published descriptions of the seafloor environment (Edwards, in press; Galliher, 1932), and samples collected by ROV (remotely operated vehicles; H.G. Greene and D. Stakes, MBARI, personal communication) support the interpretations. Most importantly, outcrops directly onshore were often used to identify the inner-shelf outcrops (Clark, 1981; Brabb, 1989; Dibblee, 1999; Clark and others, 1997). Our interpretations are largely in concert with those of McCulloch and Greene (1989), who presented a regional interpretation of the geology of the California continental margin.

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SCALE 1:100,000
1 inch represents 1.58 miles

2 0 2 4 6 Kilometers

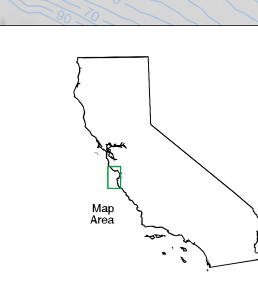
2 0 2 4 Miles

Bathymetric contour interval 10 m to 100 m depth, 500 m to maximum depth, supplementary contour 500 m

Bathymetric data from National Oceanic and Atmospheric Administration (NOAA) / National Ocean Service (NOS) multibeam swath soundings for depths greater than 100 m and from the NOS Hydrographic Data Base (NOAA, 1998) for shallower depths were gridded at 2-second intervals with GMT's (Wessel and Smith, 1998) surface algorithm and smoothed with Arcinfo (ESRI, 1998) filter methods. Contour lines were generated from the resulting 50-m grid. The grid of bathymetric data was merged with USGS 30-m DEMs to calculate the shaded relief image, which has a 2X vertical exaggeration. UTM Zone 10, NAD83

SEAFLOOR ROCKS AND SEDIMENTS OF THE CONTINENTAL SHELF FROM MONTEREY BAY TO POINT SUR, CALIFORNIA

By
Stephen L. Eittreim, Roberto J. Anima, Andrew J. Stevenson, and Florence L. Wong
2000



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