

Map produced by Eric Nissen, H. Gary Greene, Charles Endrey, and Bryan Dietrich, with contributions from Holly Ryan, 2009  
 EDITOR: H. GARY GREENE  
 Center for Habitat Studies, Moss Landing Marine Laboratories, Moss Landing, CA  
 US Geological Survey, Menlo Park, CA

# Golden Gate National Recreation Area

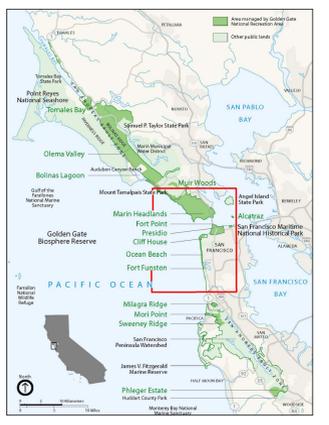
## Seabed Classification Map Series

### Map 4 of 5

#### Onshore-Offshore Geology Map

The San Francisco Bay Area, including the area shown in the map, is located on the transform boundary between the Pacific and North American plates. The San Andreas Fault Zone represents this boundary with concealed traces of faults, shown here, oriented and extending offshore northwest from land. In addition, the San Geronimo Fault (an auxiliary fault to the San Andreas Fault Zone) connects to the San Andreas Fault north of the mapped area and is considered part of this major fault zone.

Seafloor geology, both in the San Francisco Bay (estuary) and in the offshore (continental shelf), is primarily composed of Quaternary unconsolidated sediment dominated by sand, and in many places comprised of active bedforms, such as sediment waves and dunes. In the high-energy zones where bedrock and basement rocks crop out along the coastline, rock exposures composed of the Franciscan Complex are present on the seafloor. These outcrops remain unaltered and smoothed by the swift tidal currents and entrained sediment flowing through the Golden Gate. Along the outer coast south of the Golden Gate, sandy bluffs and the long Ocean Beach are composed of sand. Beach nourishment appears to occur from sediment deposited and transported from the horseshoe bar west of the Golden Gate. In San Francisco Bay, Angel and Alcatraz islands, as well as locally scattered submarine rocks, are composed of Cretaceous-Jurassic sedimentary and metamorphic rocks of the Franciscan Complex.



**Map Information**

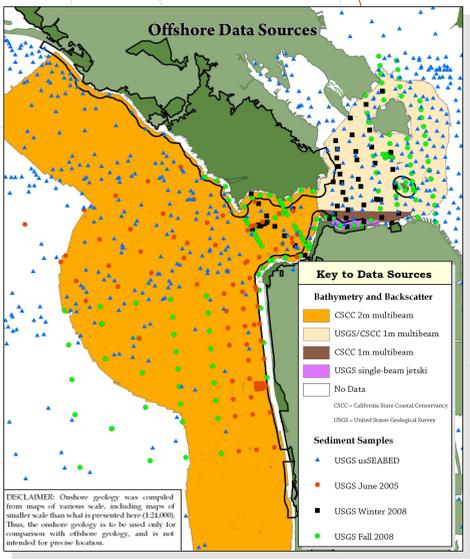
Map Scale - 1:24,000

Datum - WGS 1984

Projection - UTM Zone 10

**Geologic Units**

Terrestrial Units	
H2O	Water
af	Artificial fill
Qc	Quaternary - Holocene - Active stream channels
Qm	Quaternary - Holocene - Estuarine and marine muds
Qd	Quaternary - Holocene - Landslide deposits
Qcl	Quaternary - Holocene - Natural levee deposits (silt, clay)
Qal	Quaternary - Holocene - Unconsolidated alluvium (gravel, sand, & silt)
Qcl	Quaternary - Holocene - Colluvium (sorted boulders, gravel, sand)
Qd	Quaternary - Holocene - Marine, beach, & sand dune
Qp	Quaternary - Holocene - Undifferentiated surficial deposits
Qf	Quaternary - Holocene - Fault rocks (fractured, breccia, gouge)
Qmt	Quaternary - Holocene - Marine terrace deposits (sand & gravel)
Qc	Quaternary Colma Formation - Medium sand, friable
QfM	Pliocene - Quaternary Merced Formation - Siltstone and sandstone
Ts	Paleocene (unnamed) - Sandstone, shale, & conglomerate
Kp	Cretaceous granite - Salinian Complex - Montara Mountain
Cretaceous - Jurassic - Franciscan Complex	
KJf	Sandstone and/or shale
KJl	Limestone
KJg	Greenstone
KJc	Chert
KJgw	Greywacke
KJdb	Diorite (crops out at Point Bonita)
KJm	Metamorphic (undifferentiated, hard)
KJsp	Serpentine
KJf	Undifferentiated and melange
Offshore Units	
a	Anthropogenically modified seafloor (spoils, dredge sites, scours)
ahs	Artificial hard substrate
Qd	Quaternary - Holocene - Landslide deposits
Qp	Quaternary - Holocene - Undifferentiated sedimentary deposits
Qpsh	Quaternary - Holocene - Sand (>95%) w/ gravel
Qsw	Quaternary - Holocene - Sediment waves
Qsd	Quaternary - Holocene - Marine sediment
QfP	Purisima Formation strata under Quaternary sediment cover
QfM	Monterey Formation strata under Quaternary sediment cover
QfU	Quaternary - Tertiary - Undifferentiated sedimentary deposits (?)
Tf	Pliocene - Purisima Formation - marine sedimentary
Tm	Miocene - Monterey Formation - Sandstone & mudstone
Ts	Paleocene - Unnamed sandstone, shale, & conglomerate
Tku	Tertiary - Cretaceous - Undifferentiated sedimentary rock
Kp	Cretaceous - Granite
KJf	Cretaceous - Jurassic - Franciscan Complex rocks, undifferentiated
Structures	
Faults	
—	Well defined
---	Inferred
---	Concealed
Folds	
—	Anticline - well defined
---	Syncline - well defined
---	Anticline - inferred
---	Syncline - inferred



Map produced at the Center for Habitat Studies, Moss Landing Marine Laboratories, in conjunction with the U.S. Geological Survey (USGS) and the National Park Service

**Golden Gate**

National Recreation Area