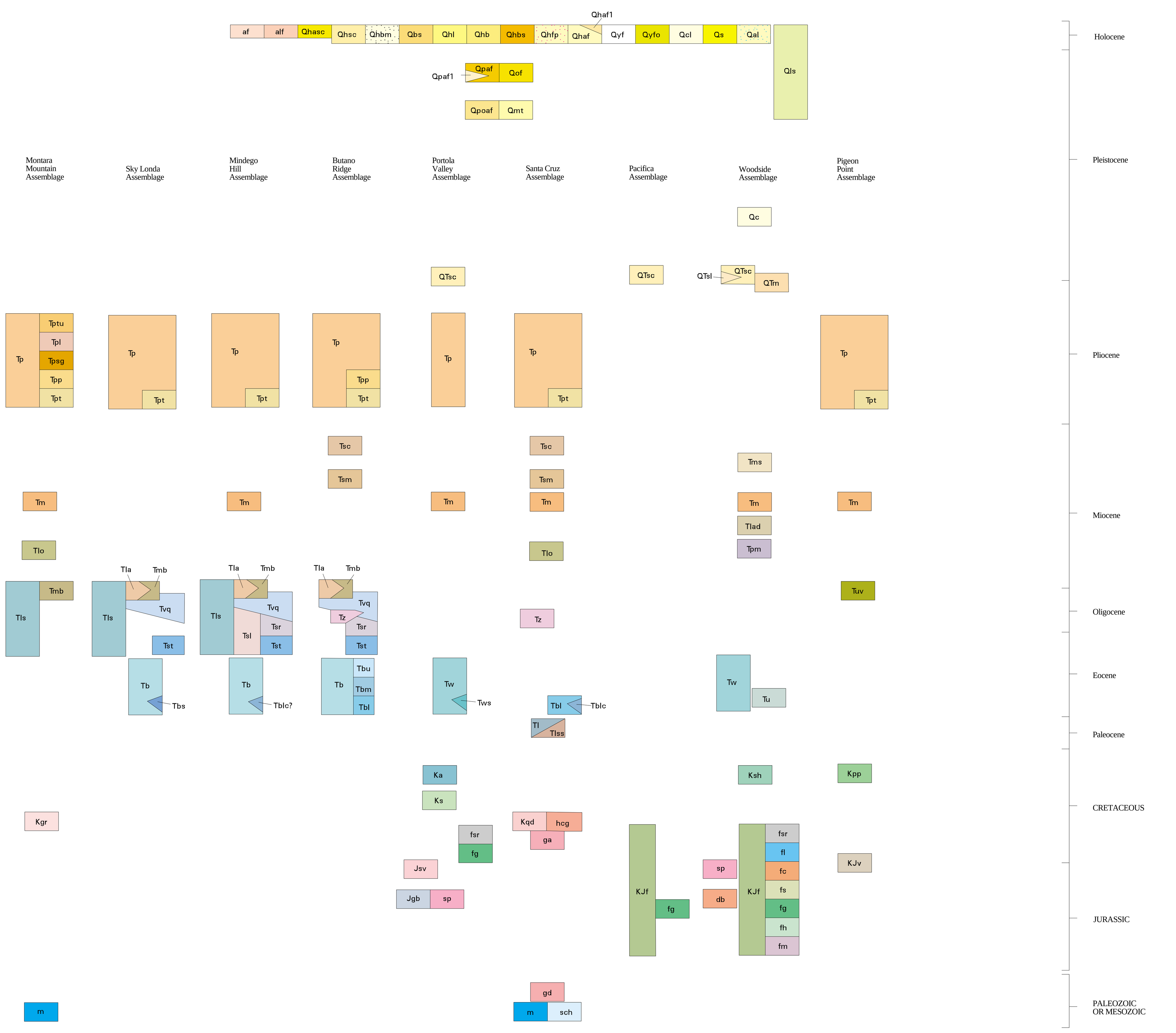
CORRELATION OF MAP UNITS



DESCRIPTION OF MAP UNITS

af **Artificial fill (Historic)**--Loose to very well consolidated gravel, sand, silt, clay, rock fragments, organic matter, and man-made debris in various combinations. Thickness is variable and may exceed 30 m in places. Some is compacted and quite firm, but fill made before 1965 is nearly everywhere not compacted and consists simply of dumped materials

alf **Artificial levee fill (Historic)**--Man-made deposits of various materials and ages, forming artificial levees as much as 6.5 m high. Some are compacted and quite firm, but fills made before 1965 are almost everywhere not compacted and consist simply of dumped materials. The distribution of levee fill conforms to levees shown on the most recent U.S. Geological Survey 7.5-minute quadrangle maps

Qhasc **Artificial stream channels (Historic)**--Modified stream channels; in most places where streams have been straightened and realigned

Qhsc **Stream channel deposits (Holocene)**--Poorly to well-sorted sand, silt, silty sand, or sandy gravel with minor cobbles. Cobbles are more common in the mountainous valleys. Many stream channels are presently lined with concrete or rip rap. Engineering works such as diversion dams, drop structures, energy dissipaters and percolation ponds also modify the original channel. Many stream channels have been straightened, and these are labeled Qhasc. This straightening is especially prevalent in the lower reaches of streams entering the estuary. The mapped distribution of stream channel deposits is controlled by the depiction of major creeks on the most recent U.S. Geological Survey 7.5-minute quadrangles. Only those deposits related to major creeks are mapped. In some places these deposits are under shallow water for some or all of the year, as a result of reservoir release and annual variation in rainfall

Qbs **Beach sand (Holocene)**--Unconsolidated, well-sorted sand. Local layers of pebbles and cobbles. Thin discontinuous lenses of silt relatively common in back-beach areas. Thickness variable, in part due to seasonal changes in wave energy; commonly less than 10 m thick. May interfinger with either well-sorted dune sand or, where adjacent to coastal cliff, poorly-sorted colluvial deposits. Iron- and magnesium-rich heavy minerals locally form placers as much as 0.7 m thick

Qhbm **Bay mud (Holocene)**--Water-saturated estuarine mud, predominantly gray, green and blue clay and silty clay underlying marshlands and tidal mud flats of San Francisco Bay, Pescadero, and Pacifica. The upper surface is covered with cordgrass (*Spartina* sp.) and pickleweed (*Salicornia* sp.). The mud also contains a few lenses of well-sorted, fine sand and silt, a few shelly layers (oysters), and peat. The mud interfingers with and grades into fine-grained deposits at the distal edge of Holocene fans, and was deposited during the post-Wisconsin rise in sea-level, about 12 ka to present (Imbrie and others, 1984). Mud varies in thickness from zero, at landward edge, to as much as 40 m near north County line

Qhb **Basin deposits (Holocene)**--Very fine silty clay to clay deposits occupying flat-floored basins at the distal edge of alluvial fans adjacent to the bay mud (Qhbm). Also contains unconsolidated, locally organic, plastic silt and silty clay deposited in very flat valley floors

Qhbs **Basin deposits, salt-affected (Holocene)**--Clay to very fine silty-clay deposits similar to Qhb deposits except that they contain carbonate nodules and iron-stained mottles (U.S. Soil Conservation Service, 1958). These deposits may have been formed by the interaction of bicarbonate-rich upland water and saline water of the San Francisco Bay estuary. With minor exceptions, salt-affected basin deposits are in contact with estuary deposits.

Qhfp **Flood-plain deposits (Holocene)**--Medium- to dark-gray, dense, sandy to silty clay. Lenses of coarser material (silt, sand, and pebbles) may be locally present. Flood-plain deposits usually occur between levee deposits (Qhl) and basin deposits (Qhb)

Qhl **Natural levee deposits (Holocene)**--Loose, moderately to well-sorted sandy or clayey silt grading to sandy or silty clay. These deposits are porous and permeable and provide conduits for transport of ground water. Levee deposits border stream channels, usually both banks, and slope away to flatter flood plains and basins. Abandoned levee systems, no longer bordering stream channels, have also been mapped

Qhaf1 **Younger alluvial fan deposits (Holocene)**--Brown, poorly sorted, dense, sandy or gravelly clay. May represent the modern loci of deposition for Qhaf, although small fans at mountain fronts may have a debris-flow origin

Qhaf **Alluvial fan and fluvial deposits (Holocene)**--Alluvial fan deposits are brown or tan, medium-dense to dense, gravelly sand or sandy gravel that generally grades upward to sandy or silty clay. Near the distal fan edges, the fluvial deposits are typically brown, never reddish, medium-dense sand that fines upward to sandy or silty clay

Qyf **Younger (inner) alluvial fan deposits (Holocene)**--Unconsolidated fine- to coarse-grained sand, silt, and gravel, coarser grained at heads of fans and in narrow canyons

Qyfo **Younger (outer) alluvial fan deposits (Holocene)**--Unconsolidated fine sand, silt, and clayey silt

Qcl **Colluvium (Holocene)**--Loose to firm, friable, unsorted sand, silt, clay, gravel, rock debris, and organic material in varying proportions

Qs **Sand dune and beach deposits (Holocene)**--Predominantly loose, medium- to coarse-grained, well-sorted sand but also includes pebbles, cobbles, and silt. Thickness less than 6 m in most places, but in other places may exceed 30 m

Qal **Alluvium (Holocene)**--Unconsolidated gravel, sand, silt, and clay along streams. Less than a few meters thick in most places

Qls **Landslide deposits (Holocene and/or Pleistocene)**--Poorly sorted clay, silt, sand, and gravel. Only a few very large landslides have been mapped. For a more complete map of landslide deposits, see Nilsen and others (1979)

Qpaf **Alluvial fan and fluvial deposits (Pleistocene)**--Brown, dense, gravelly and clayey sand or clayey gravel that fines upward to sandy clay. These deposits display variable sorting and are located along most stream channels in the county. All unit Qpaf deposits can be related to modern stream courses. They are distinguished from younger alluvial fans and fluvial deposits by higher topographic position, greater degree of dissection, and stronger soil profile development. They are less permeable than Holocene deposits, and locally contain fresh-water mollusks and extinct late Pleistocene vertebrate fossils. They are overlain by Holocene deposits on lower parts of the alluvial plain, and incised by channels that are partly filled with Holocene alluvium on higher parts of the alluvial plain. Maximum thickness is unknown but at least 50 m

Qpaf1 **Alluvial terrace deposits (Pleistocene)**--Deposits consist of crudely - bedded, clast-supported, gravel, cobbles, and boulders with a sandy matrix. Clasts are as much as 35 cm in intermediate diameter. Coarse sand lenses may be locally present. Pleistocene terrace deposits are cut into Pleistocene alluvial fan deposits (Qpaf) a few meters and are as much as several meters above Holocene deposits

Qpoaf **Older alluvial fan deposits (Pleistocene)**--Brown, dense, gravelly and clayey sand or clayey gravel that fines upward to sandy clay. These deposits display various sorting qualities. All Qpoaf deposits can be related to modern stream courses. They are distinguished from younger alluvial fans and fluvial deposits by higher topographic position, greater degree of dissection, and stronger profile development. They are less permeable than younger deposits, and locally contain fresh-water mollusks and extinct Pleistocene vertebrate fossils

Qof **Coarse-grained older alluvial fan and stream terrace deposits (Pleistocene)**--Poorly consolidated gravel, sand, and silt, coarser grained at heads of old fans and in narrow canyons

Qmt **Marine terrace deposits (Pleistocene)**--Poorly consolidated and poorly indurated well to poorly sorted sand and gravel. Thickness variable but probably less than 30 m

QTsc **Santa Clara Formation (lower Pleistocene and upper Pliocene)** --Gray to red-brown poorly indurated conglomerate, sandstone, and mudstone in irregular and lenticular beds. Conglomerate consists mainly of subangular to subrounded cobbles in a sandy matrix but locally includes pebbles and boulders. Cobbles and pebbles are mainly chert, greenstone, and graywacke with some schist, serpentinite, and limestone. On Coal Mine Ridge, south of Portola Valley, conglomerate contains boulders of an older conglomerate as long as one meter. Gray to buff claystone and siltstone beds on Coal Mine Ridge contain carbonized wood fragments as large as 60 cm in diameter. Included in Santa Clara Formation are similar coarse-grained clastic deposits near Burlingame. Sarna-Wojcicki (1976) found a tuff bed in Santa Clara Formation near Woodside, and correlated it with a similar tuff in the Merced Formation. Later work indicated that the tuff correlates with the 435 ka Rockland ash (Sarna-Wojcicki, oral commun., 1997). Thickness of Santa Clara Formation is variable but reaches a maximum of about 500 m along Coal Mine Ridge

QTsl **Lake beds (upper Pliocene)**--Fine-grained sandstone, calcareous mudstone, and marl. Locally contains vertebrate fossils of late Pliocene (Blancan) age. Fossiliferous marl is best exposed near Stevens Creek Reservoir, where it is about 30 m thick

QTm **Merced Formation (lower Pleistocene and upper Pliocene)** --Medium-gray to yellowish-gray and yellowish-orange, medium- to very fine grained, poorly indurated to friable sandstone, siltstone, and claystone, with some conglomerate lenses and a few friable beds of white volcanic ash. In many places sandstone is silty, clayey, or conglomeratic. Some of the conglomerate, especially where fossiliferous, is well cemented. Volcanic ash is in beds as much as 2 m thick and consists largely of glass shards. In type section of Merced Formation north of the map area, the ash was originally reported by Sarna-Wojcicki (1976) to be 1.5 ± 0.8 m.y. old, but more recent work by Sarna-Wojcicki and others (1991) indicates that the formation contains both the 738 ± 3 ka Bishop ash and the 435 ka Rockland ash (Sarna-Wojcicki, oral commun., 1997). Merced Formation is about 1,525 m thick in the sea cliffs north of Mussel Rock

Tp **Purisima Formation (Pliocene and upper Miocene)**--Predominantly gray and greenish-gray to buff, fine-grained sandstone, siltstone, and mudstone, but also includes some porcelaneous shale and mudstone, chert, silty mudstone, and volcanic ash. West of Portola Valley, this unit consists of fine- to medium-grained silty sandstone. Locally divided into:

Tptu **Tunitas Sandstone Member (Pliocene)**--Greenish-gray to light-gray, pale-orange, or greenish-brown, very fine- to medium-grained sandstone with clay matrix. Concretions generally less than 30 cm across are present locally. Tunitas ranges in thickness from 76 m at type section to 122 m elsewhere

Tpl **Lobitos Mudstone Member (Pliocene)**--Dark-gray to light-gray and shades of brown, unbedded, silty mudstone. Lobitos has a maximum thickness of 140 m

Tpsg **San Gregorio Sandstone Member (Pliocene)**--Greenish-gray to light-brown, fine- to coarse-grained sandstone containing calcareous concretions less than 30 cm across. San Gregorio Member ranges in thickness from 45 m at type section to about 140 m elsewhere

Tpp **Pomponio Mudstone Member (Pliocene)**--Gray to white porcelaneous shale and mudstone, in places rhythmically bedded with alternating layers of nonsiliceous mudstone. This unit resembles Monterey Shale, Santa Cruz Mudstone, and Lambert Shale. At its type section in Pomponio Creek the member is 700 m thick

Tpt **Tahana Member (Pliocene and upper Miocene)**--Greenish-gray to white or buff, medium- to very fine grained sandstone and siltstone, with some silty mudstone. Locally, such as at San Gregorio State Beach, sandstone is tuffaceous and weathers white. Near Memorial Park, this member includes dark-gray porcelaneous mudstone. Pebble conglomerate crops out near base from Memorial Park eastward. Maximum thickness is 655 m. A tuff bed in this member west of the San Gregorio fault has been tentatively correlated with the 2.6 Ma Ishi Tuff (Sarna-Wojcicki and others, 1991)

Tsc **Santa Cruz Mudstone (upper Miocene)**--Brown and gray to light-gray, buff, and light-yellow siliceous mudstone with nonsiliceous mudstone and siltstone and minor amounts of sandstone. Santa Cruz Mudstone is more than 1,000 m thick

Tsm **Santa Margarita Sandstone (upper Miocene)**--Light-gray to grayish-orange to white, friable, very fine to very coarse grained arkosic sandstone. Fine-grained sandstone commonly contains glauconite. A quartz and feldspar pebble conglomerate crops out locally at the base of section. Santa Margarita Sandstone is as thick as 60 m

Tms **Unnamed marine sandstone and shale (upper Miocene)**--Light-gray, grayish-orange, and white, soft, friable, very fine to medium-grained, well-sorted, poorly cemented quartzose sandstone with minor interbeds of siliceous mudstone and semi-siliceous shale. Contains late Miocene, shallow-water marine fossils (Sorg and McLaughlin, 1975)

Tlad **Ladera Sandstone (upper(?) and middle Miocene)**--Medium- to light-gray to yellowish-gray and buff, fine-grained, poorly cemented sandstone and siltstone, with minor amounts of coarse-grained sandstone, yellow-brown dolomitic claystone, and white to light-gray porcelaneous shale and porcelanite. Fine-grained sandstone and siltstone comprise more than 90 percent of formation. Coarse-grained sandstone crops out in beds less than a few meters thick in lower half of section; dolomitic claystone and porcelaneous shale beds are less than a meter thick and outcrop through the upper half of the section; porcelanite crops out in thin-bedded lenses less than a few meters thick in the lower part of the section. At and near base of Ladera Sandstone are medium to thick lenticular beds of well-cemented, fossiliferous, chert-granule sandstone which interfingers with fine-grained sandstone. About 450 m thick

Tm **Monterey Formation (middle Miocene)**--Grayish-brown and brownish-black to very pale orange and white, porcelaneous shale with chert, porcelaneous mudstone, impure diatomite, calcareous claystone, and with small amounts of siltstone and sandstone near base. Monterey is generally thinner bedded than the Santa Cruz Mudstone but closely resembles parts of Purisima Formation, especially Pomponio Mudstone Member. Thickness ranges from 120 to more than 600 m

Tlo **Lompico Sandstone (middle Miocene)**--Very pale orange, fine- to coarse-grained, mostly well cemented and hard arkosic sandstone. Maximum thickness about 300 m

Tpm **Page Mill Basalt (middle Miocene)**--Interlayered, columnar-jointed basaltic flows and agglomerate. Flows are dark greenish gray to light gray, dense to vesicular, and finely crystalline; agglomerate is light gray to reddish brown. Volcanic rocks are pyritiferous in part. Ranges in thickness from 0 to 15 m. The Page Mill Basalt has yielded a K/Ar age of 14.8 ± 2.4 Ma (Turner, 1970; recalculated by Fox and others, 1985)

Tuv **Unnamed Sedimentary and Volcanic Rocks (Miocene and Oligocene)**--Mainly dark-gray, hard mudstone in Año Nuevo area and thick-bedded, coarse-grained and pebbly, crossbedded, hard sandstone in Pescadero Point area. Mapped as Vaqueros(?) Formation by Hall and others (1959), but rocks do not resemble those of Vaqueros Sandstone in Santa Cruz Mountains. Includes andesite breccia. Intrusive rocks associated with the andesite have yielded a K/Ar age of 22.0 ± 0.7 Ma (Taylor, 1990). Contains foraminifers and mollusks of Zemorrian (Oligocene) and Saucesian (Miocene) age according to Clark and Brabb (1978). About 135 m thick near Pescadero Point and at least 85 m thick near Año Nuevo

Tls **Lambert Shale and San Lorenzo Formation, undivided (lower Miocene, Oligocene, and middle and upper Eocene)**--Brown and dark-gray to gray, brown, and red mudstone, siltstone, and shale. Includes some beds of fine- to coarse-grained sandstone. Lambert Shale is generally more siliceous than San Lorenzo Formation, but the two units cannot be distinguished where out of stratigraphic sequence and without fossils

Tla **Lambert Shale (lower Miocene and Oligocene)**--Dark-gray to pinkish-brown, moderately well cemented mudstone, siltstone, and claystone. Chert crops out in a few places in upper part of section, and sandstone bodies as much as 30 m thick, glauconitic sandstone beds, and microcrystalline dolomite are present in places. Lambert Shale is generally more siliceous than San Lorenzo Formation and less siliceous than the Monterey Shale. It resembles Santa Cruz Mudstone and parts of Purisima Formation. Lambert Shale is about 1,460 m thick

Tmb **Mindego Basalt and related volcanic rocks (Miocene and/or Oligocene)**--Basaltic volcanic rocks, both extrusive and intrusive. Extrusive rock is primarily dark-gray to orange-brown to greenish-gray flow breccia, but includes lesser amounts of tuff, pillow lavas, and flows. Extrusive rocks have a maximum thickness of 120 m. Intrusive rock is dark greenish gray to orange brown and medium to coarsely crystalline. It commonly weathers spheroidally, and crops out as roughly tabular bodies as much as 180 m thick intruding older sedimentary rocks. Minor amounts of sandstone and mudstone are locally included. The Mindego Basalt has yielded a K/Ar minimum age of 20.2 ± 1.2 Ma (Turner, 1970; recalculated by Fox and others, 1985)

Tvq **Vaqueros Sandstone (lower Miocene and Oligocene)**--Light-gray to buff, fine- to medium-grained, locally coarse-grained, arkosic sandstone interbedded with olive- and dark-gray to red and brown mudstone and shale. Sandstone beds are commonly from 0.3 to 3 m thick and mudstone and shale beds are as much as 3 m thick. Vaqueros varies from a few meters to as much as 700 m in thickness

Tz **Zayante Sandstone (Oligocene)**--Thick- to very thick bedded, yellowish-orange arkosic non-marine sandstone containing thin interbeds of greenish and reddish siltstone and lenses and thick interbeds of pebble and cobble conglomerate. Thickness 550 m along Lompico Creek.

Tsl **San Lorenzo Formation (Oligocene and upper and middle Eocene)**--Dark-gray to red and brown shale, mudstone, and siltstone with local interbeds of sandstone. About 550 m thick. Locally divided into:

Tsr **Rices Mudstone Member (Oligocene and upper Eocene)**--Olive-gray to red and brown unbedded mudstone and siltstone with some laminated shale. Spheroidal weathering is common, as are elongate carbonate concretions. About 300 m thick

Tst **Twobar Shale Member (upper and middle Eocene)**--Olive-gray to red and brown laminated shale with some mudstone. Includes a few thin interbeds of very fine grained sandstone which thicken to as much as 30 m near Big Basin. About 240 m thick

Tb **Butano Sandstone (middle and lower Eocene)**--Light-gray to buff, very fine to very coarse grained arkosic sandstone in thin to very thick beds interbedded with dark-gray to brown mudstone and shale. Conglomerate, containing boulders of granitic and metamorphic rocks and well-rounded cobbles and pebbles of quartzite and porphyry, is present locally in lower part of section. Amount of mudstone and shale varies from 10 to 40 percent of volume of formation. About 3,000 m thick

Tbu **Upper sandstone member**--Thin-bedded to very thick bedded medium-gray, fine- to medium-grained arkosic sandstone containing thin interbeds of medium-gray siltstone. Thickness about 215 m

Tbm **Middle siltstone member**--Thin- to medium-bedded, nodular, olive-gray pyritic siltstone. Thickness about 215 m

Tbl **Lower conglomerate and sandstone member**--Thick to very thick interbeds of sandy pebble conglomerate and very thick bedded to massive, yellowish-gray, granular, medium- to coarse-grained arkosic sandstone. Thickness as much as 1,500 m

Tblc **Conglomerate**--Thick to very thick interbeds of sandy pebble conglomerate mapped locally in the lower member

Tbs **Shale in Butano Sandstone (lower Eocene)**--Greenish-gray, light-gray, red, and reddish-brown clay shale, mudstone, siltstone, and a few thin interbeds of light-gray sandstone. Exposed near the head of Corte Madera Creek. Total thickness is unknown, but at least 200 m of this material is exposed

Tw **Whiskey Hill Formation (middle and lower Eocene)**--Light-gray to buff, coarse-grained arkosic sandstone, with light-gray to buff silty claystone, glauconitic sandstone, and tuffaceous siltstone. Sandstone beds constitute about 30 percent of map unit. Tuffaceous and silty claystone beds are expansive. Locally, sandstone beds are well cemented with calcite. At apparent base of section on north side of Jasper Ridge, just east of Searsville Lake, a thin greenstone-pebble conglomerate is present. In places within this map unit, sandstone and claystone beds are chaotically distributed. Total thickness is about as much as 900 m thick

Tws **Shale in Whiskey Hill Formation (lower Eocene)**--Brown and reddish-brown claystone, mudstone, siltstone, and shale. Locally contains lenses of sandstone as much as 50 m thick. Exposed along Highway 84 and along Highway 92, east of Half Moon Bay, where a small patch of red mudstone can be seen in a drainage ditch. Total thickness is unknown, but at least 200 m of this material is exposed along Highway 84

Tu **Unnamed sedimentary rocks (Eocene?)**--Mudstone, shale, and argillite with minor sandstone

Tl **Locatelli Formation (Paleocene)**--Nodular, olive-gray to pale-yellowish-brown micaceous siltstone. Thickness 245-275 m. Locally near base includes:

Tlss **Sandstone**--Massive, medium-gray, fine- to medium-grained arkosic sandstone. Maximum thickness 25 m

Kpp **Pigeon Point Formation (Upper Cretaceous)**--Sandstone and conglomerate, interbedded with siltstone and mudstone and pebbly mudstone. Sandstone is fine- to coarse-grained, arkosic, and gray to greenish gray; mudstone and siltstone are gray to black to buff. Conglomerate contains well-rounded pebbles, cobbles, and boulders of red and greenish-black and porphyritic felsic volcanic rocks, granitic rocks, chert, quartzite, dark metamorphic rock, limestone, and clastic sedimentary rocks. Pigeon Point Formation is estimated to be more than 2,600 m thick

Ksh **Unnamed shale (Upper Cretaceous)**--Dark-gray, thin-bedded, nodular shale and silty shale. Unit is exposed only in the bed of San Francisquito Creek, in Menlo Park, where about 15 m of section is visible

Ka **Conglomerate of strata of Anchor Bay (Wentworth, 1968) (Cretaceous)**--Massive sandstone and conglomerate with pebbles and cobbles of diabase, gabbro, and minor granitic rocks; contains abundant shell fragments of a rudistid bivalve similar to *Coralliochama orcutti* of Late Cretaceous (Campanian) age

Ks **Unnamed sandstone and shale (Cretaceous(?))**--Rhythmically interbedded, indurated micaceous sandstone and greenish-gray argillite; age uncertain, but probably Cretaceous based on lithologic similarity to other Cretaceous strata in the Santa Cruz Mountains

Kgr **Granitic rocks of Montara Mountain (Cretaceous)**--Very light gray to light-brown, medium- to coarsely crystalline foliated granitic rock, largely quartz diorite with some granite. These rocks are highly fractured and deeply weathered. Foliation is marked by an alignment of dark minerals and dark dioritic inclusions. Tabular bodies of aplite and pegmatite generally parallel foliation. Rocks from this unit have yielded K/Ar ages of 91.6 Ma (Curtis, Evernden, and Lipson, 1958) and 86.2 ± 3.4 Ma (Calif. Div. Mines and Geol., 1965), fission track ages of 84.1 ± 7.8 Ma and 81.7 ± 6.3 Ma (Naeser and Ross, 1976), and most recently Rb/Sr and Ar/Ar ages of 93 ± 2.5 Ma (Kistler and Champion, 1997)

Kqd **Granitic rocks of Ben Lomond Mountain (Cretaceous)**--Predominantly dark-weathering, white to light-gray, fine- to coarse-grained hornblende-biotite quartz diorite. Also includes stocks and plugs of medium- to coarse-grained, light-gray alaskite and granite, and dark, fine- to coarse-grained, hornblende-cummingtonite gabbro. Alaskite dikes similar to the larger alaskite body, locally intrude the quartz diorite. The gabbro body appears in map view to intrude the quartz diorite as well, but contact relations have not been observed because of poor exposure of the gabbro. The quartz diorite is very similar to that of Montara Mountain, but is distinguished by having fewer dark minerals and virtually lacking metallic opaque minerals (Ross, 1972), as well as by association with other types of plutonic rocks. Rocks from this unit have yielded fission track ages of 86.9 ± 6.6 Ma (Naeser and Ross, 1976) and K/Ar ages of 71.0 ± 0.9 Ma (Calif. Div. Mines and Geol., 1965) and 86.9 ± 6.6 Ma (Lea, 1967). This unit includes, mapped locally:

ga **Granite and alaskite**

hcg **Hornblende-cummingtonite gabbro**

KJv **Unnamed volcanic rocks (Cretaceous or older)**--Dark-gray, dense, finely-crystalline felsic volcanic rock, with quartz and albite phenocrysts. Exposed only west of Pescadero. Thickness unknown

KJf **Franciscan Complex, undivided (Cretaceous and Jurassic)** --Mostly graywacke and shale (fs). May be variably sheared. Partly coeval with Pigeon Point Formation (Kpp), granitic rocks of Montara Mountain (Kgr) and Ben Lomond Mountain (Kqd), unnamed shale (Ksh), Conglomerate of strata of Anchor Bay (Ka), unnamed sandstone and shale (Ks), and unnamed volcanic rocks (KJv). Locally divided into:

fs **Sandstone**--Greenish-gray to buff, fine- to coarse-grained sandstone (graywacke), with interbedded siltstone and shale. Siltstone and shale interbeds constitute less than 20 percent of unit, but in places form sequences as much as several tens of meters thick. In many places, shearing has obscured bedding relations; rock in which shale has been sheared to gouge constitutes about 10 percent of unit. Gouge is concentrated in zones that are commonly less than 30 m wide but in places may be as much as 150 m wide. Total thickness of unit is unknown but is probably at least many hundreds of meters

fg **Greenstone**--Dark-green to red, altered basaltic rocks, including flows, pillow lavas, breccias, tuff breccias, tuffs, and minor related intrusive rocks, in unknown proportions. Unit includes some Franciscan chert and limestone bodies that are too small to show on map. Greenstone crops out in lenticular bodies varying in thickness from a few meters to many hundreds of meters

fc **Chert**--White, green, red, and orange chert, in places interbedded with reddish-brown shale. Chert and shale commonly are rhythmically banded in thin layers, but chert also crops out in very thick layers. In San Carlos, chert has been altered along faults to tan- to buff-colored clay. Chert and shale crop out in lenticular bodies as much as 75 m thick; chert bodies are commonly associated with Franciscan greenstone

fl **Limestone**--Light-gray, finely to coarsely crystalline limestone. In places limestone is unbedded, in other places it is distinctly bedded between beds of black chert. Limestone crops out in lenticular bodies as much as 120 m thick, in most places surrounded by Franciscan greenstone

fm **Metamorphic rocks**--Dusky-blue to brownish-gray blocks of metamorphic rock, commonly glaucophane schist, but some quartz-mica granulite. These rocks are finely to coarsely crystalline and commonly foliated. They almost always crop out as tectonic inclusions in sheared Franciscan rocks (fsr) and serpentinite (sp), and they reach maximum dimensions of several tens of meters though many are too small to show on map

fh **Argillite**--Dark-gray to grayish-black argillite and shale with minor beds of sandstone

fsr **Sheared rock (melange)**--Predominantly graywacke, siltstone, and shale, substantial portions of which have been sheared, but includes hard blocks of all other Franciscan rock types. Total thickness of unit is unknown, but is probably at least several tens of meters

sp **Serpentinite (Cretaceous and/or Jurassic)**--Greenish-gray to bluish-green sheared serpentinite, enclosing variably abundant blocks of unsheared rock. Blocks are commonly less than 3 m in diameter, but range in size from several centimeters to several meters; they consist of greenish-black serpentinite, schist, rodingite, ultramafic rock, and silica-carbonate rock, nearly all of which are too small to be shown on the map

Jsv **Siliceous volcanic rocks and keratophyre (Jurassic?)**--Highly altered intermediate and silicic volcanic and hypabyssal rocks. Feldspars are almost all replaced by albite. Recent biostratigraphic and isotopic analyses yielded a Jurassic age for similar rocks in Alameda and Contra Costa Counties (Jones and Curtis, 1991)

Jgb **Gabbro (Jurassic?)**--Light greenish-gray, dark-gray weathering, mafic intrusive rock, mostly gabbro but also includes some diabase locally. The age of this unit is unknown, but the unit is probably part of the Jurassic Coast Range Ophiolite

db **Diabase and gabbro (Jurassic?)**

gd **Gneissic granodiorite (Mesozoic or Paleozoic)**--Strongly foliated, black and white gneiss. Foliation due to alignment of lenses of dark minerals in a light-colored matrix

sch **Metasedimentary rocks (Mesozoic or Paleozoic)**--Mainly pelitic schist and quartzite

m **Marble (Mesozoic or Paleozoic)**--White to gray finely crystalline marble and graphitic marble, in places distinctly bedded, in places foliated. Near Montara Mountain, this unit also includes quartz-mica hornfels and crops out as rare isolated bodies as much as 75 m long in granitic rocks. Near Ben Lomond Mountain, the unit locally includes schist and calc-silicate rocks

MAP SYMBOLS

Contact--Depositional or intrusive contact, dashed where approximately located, dotted where concealed

Fault--Dashed where approximately located, small dashes where inferred, dotted where concealed, queried where location is uncertain.

Reverse or thrust fault--Dashed where approximately located, dotted where concealed

Anticline--Shows fold axis, dotted where concealed

Syncline

35 **Strike and dip of bedding**

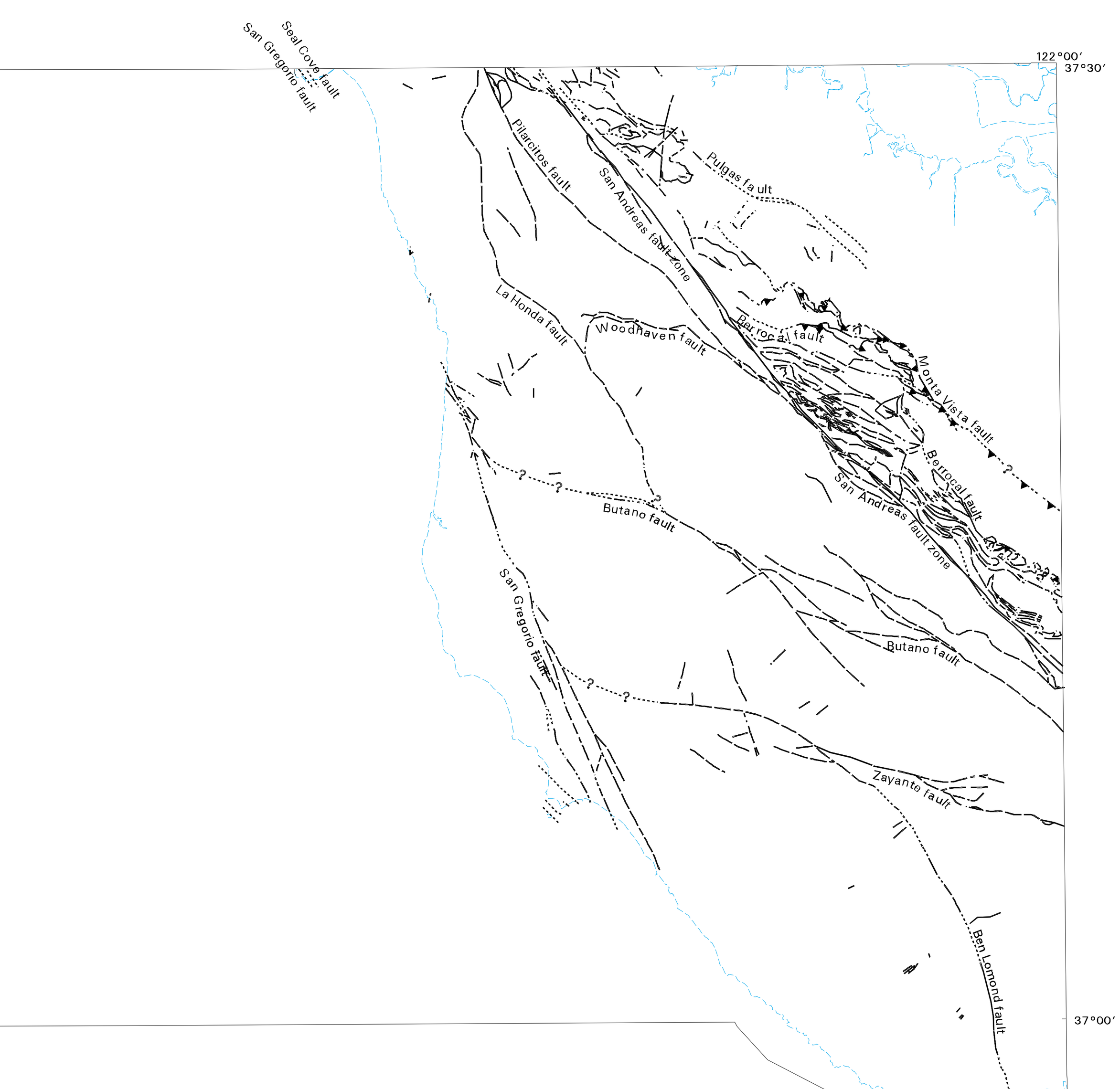
83 **Overturned bedding**

Horizontal bedding

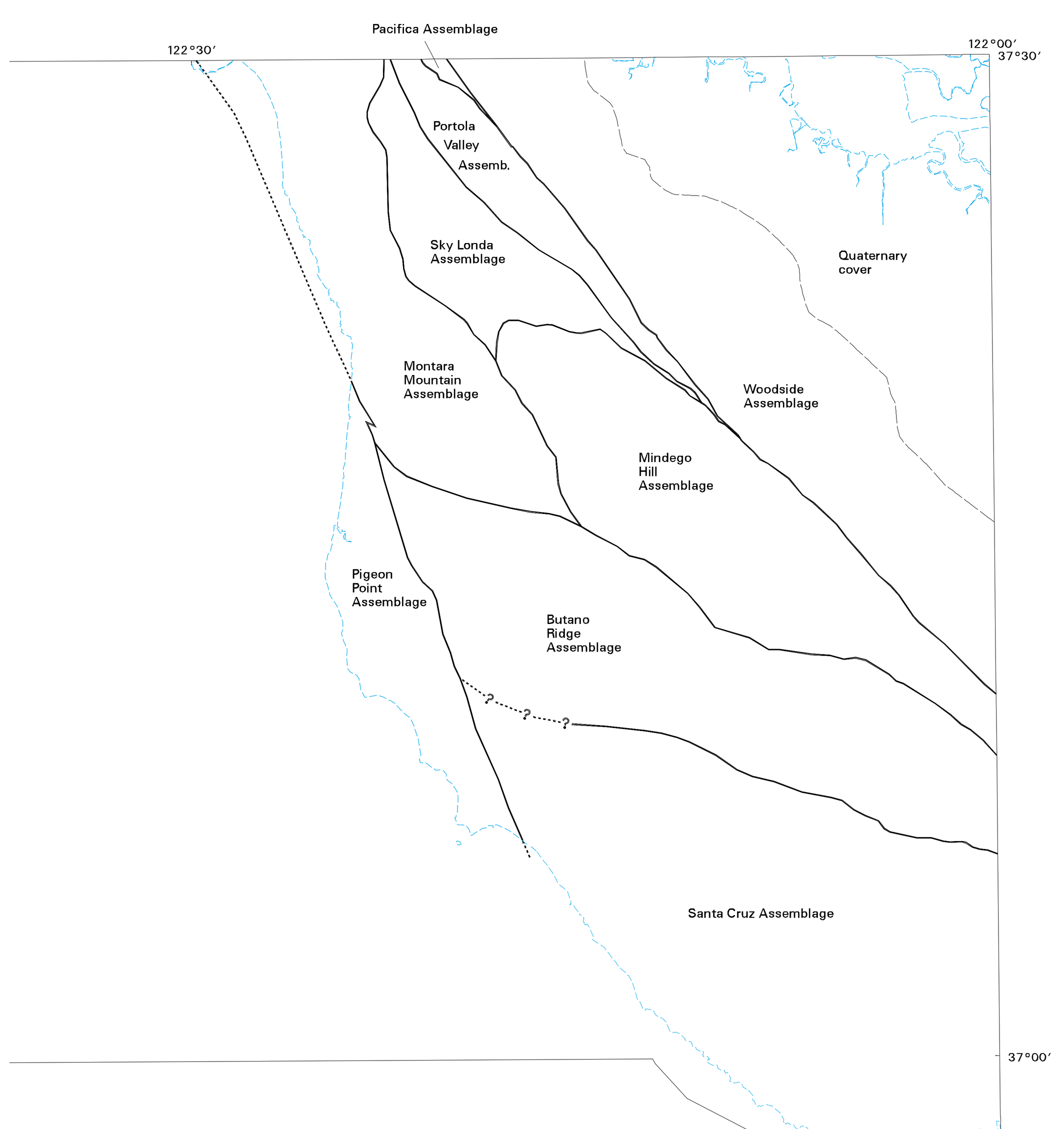
Vertical bedding

35 **Strike and dip of foliation**

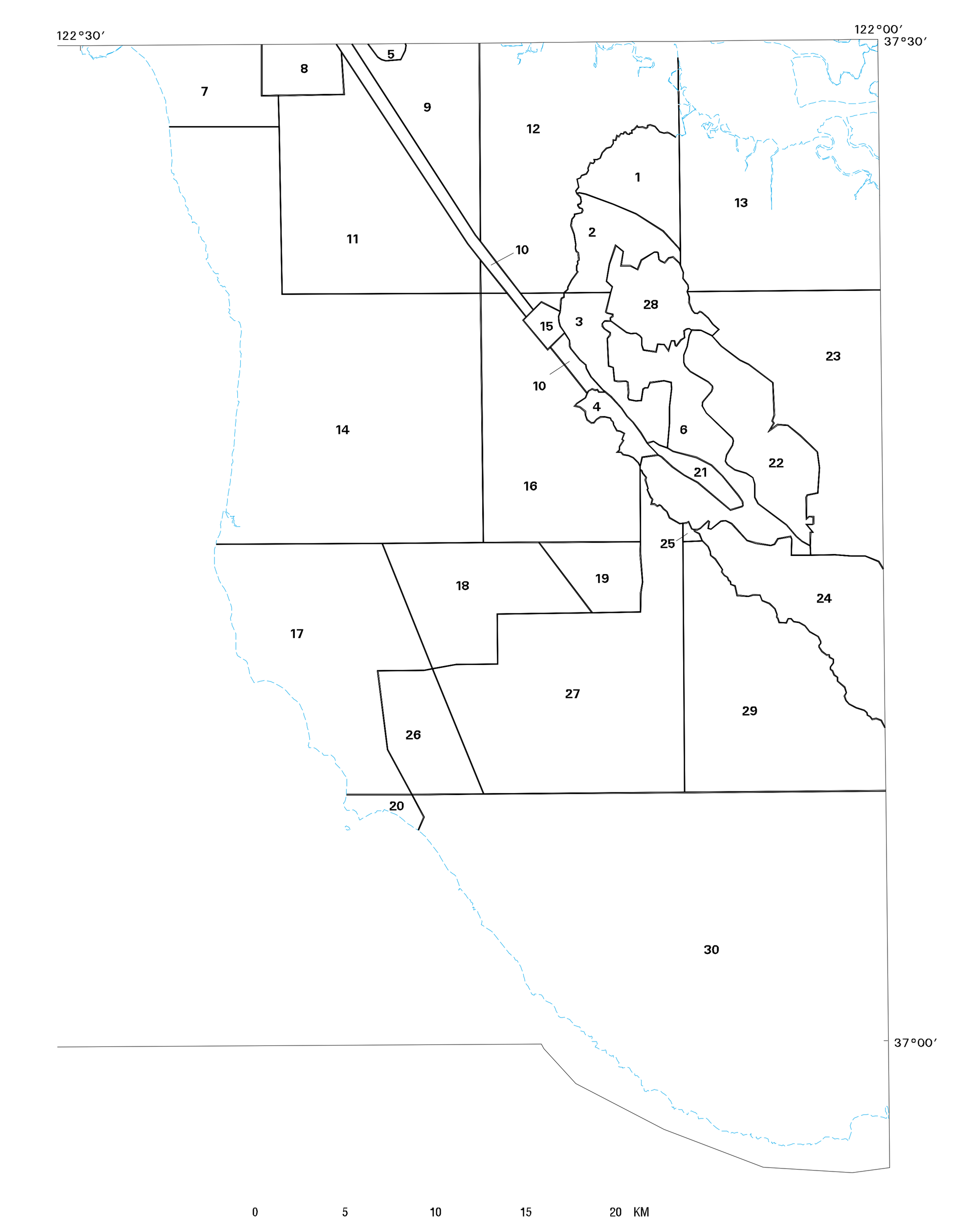
Vertical foliation



INDEX MAP OF FAULTS AND FAULT NAMES



INDEX MAP OF ASSEMBLAGES



INDEX MAP SHOWING SOURCES OF DATA

The key to the sources of data index map, as well as a complete list of references cited, can be found in the accompanying map description pamphlet (pamf.txt, pamf.ps, or pamf.pdf)

This publication also includes a digital geologic map (GIS) database. The data files, as well as digital versions of the map sheets and pamphlet, are available from the USGS Geologic Division Publications web-site: http://greenwood.cr.usgs.gov/mf/mf2332

Digital data and cartography prepared using Arc/Info 7.1.2 running under Solaris 2.6 on a UNIX workstation.

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This map was produced on request, directly from digital files, on an electronic plotter

GEOLOGIC MAP AND MAP DATABASE OF THE PALO ALTO 30 ′ X 60′ QUADRANGLE, CALIFORNIA

By

E.E. Brabb, R.W. Graymer, and D.L. Jones

2000