

DEPARTMENT OF THE INTERIOR
UNITED STATES GEOLOGICAL SURVEY

EXPLANATION

QUATERNARY

Holocene

Qal
Alluvial deposits
Cobble-pebble gravel, sand, silt, and clay

Qls
Landslide deposits
Composed of rock and mudflow debris that moved downslope by gravity. Lithology dependent on source material. Not all landslide deposits are shown in areas where Franciscan rocks crop out or where too small to map. Qls(s); dominantly serpentinite debris

Qr
Terrace deposits
Composed of stream and marine terrace deposits. Stream terrace deposits consist of unconsolidated cobble-pebble gravel, sand, silt, and some clay. Approximately 3 to 10 feet thick. Marine terrace deposits consist of loosely consolidated white to buff sandstone and conglomerate. Clasts subrounded to angular, as large as four feet in diameter; consist of Franciscan rocks, Cambria Felsite, or Monterey Shale. In older marine terrace deposits strata are relatively flat lying or dip as much as 20 degrees. Marine terrace deposits occur at elevations of 20 to 100 feet and near 200, 400, and 600 feet. Approximately 2 to 10 feet thick. Ages unknown, but inferred to be Pleistocene and Holocene. Marine terrace deposits near Cayucos are late Pleistocene, 130,000±30,000 and 140,000±30,000 B.P. (Valentine, 1958; Veeh and Valentine, 1967). Youngest marine terrace deposits and some stream deposits are presumably Holocene

Miocene and Pliocene

UNCONFORMITY

Tpd
Lower part of Pismo Formation
Tpd; light-weight moderately well-indurated porous white diatomaceous siltstone or diatomite. Maximum thickness approximately 20 feet.
Tpc; porcelanite, claystone, and light brown thin- to thick-bedded chert. Approximately 80 feet thick.
Tpsl; well-indurated, poorly bedded, angular fracturing white claystone and siltstone. Approximately 200 feet thick.
Tpcg; light-brown pebble and cobble conglomerate. Clasts of Cambria Felsite and Franciscan chert pebbles. Coarse-grained arkosic sandstone matrix. Thickness 10 to 40 feet.
Tps; poorly to moderately well-indurated orangish-brown to light-brown sandstone. Fine- to medium-grained arkosic sandstone, locally interbedded with yellow claystone. Consists of quartz, 80%; feldspar, 15%; and fragments of siltstone, 5%. Contains a few well-rounded chert pebbles and granules. Approximately 200 feet thick.
Fossils present are: *Astrorapax* (?) sp. (UCLA loc. no. 5928), *Chione* cf. *C. semipalmata* Nonland (UCLA loc. nos. 5928, 5930), and *Leptopecten discus* (Conrad) (UCLA loc. nos. 5929, 5930).
Probably equivalent in age to parts of Edna and Miguelito Members of the Pismo Formation (Hall, 1973a, b). Mohanian or questionably Delmonian. Marine

UNCONFORMITY

Tm
Monterey Formation
Tm; resistant hard siliceous shale and interbedded chert. Dark brown, weathers white. Less than 100 feet thick. Presumably Luisian or Mohanian. Marine.
Tmv; diabase and basaltic rocks occurring as sills and flows in the basal part of Monterey Formation and as dikes in that unit and older formations. Brown to black, medium- to coarse-grained, usually deeply and spheroidally weathering diabase. Composition variable, laths of sodic plagioclase (An33 to An63), 40% to 50% of rock; clinopyroxene, 10% to 18%. The remaining 30% to 50% of the rock is a groundmass of plagioclase microclites, altered olivine, and mafic minerals. Maximum thickness approximately 250 feet. Probably equivalent in age to the diabase within the Obispo Formation (Hall and Corbató, 1967; Hall, 1973b).
Tmb; basal member; interbedded siltstone, tuffaceous siltstone, claystone, and minor amounts of semisiliceous shale; contains dolomitic or calcareous siltstone beds 1/2 to 2 feet thick, and minor amounts of fine-grained sandstone. Thin beds of chert rare or absent. White when weathered, brown or gray when fresh; black where adjacent to diabase. Orange dolomitic or calcareous rocks occur as pods or lenses throughout. Basal 50 to 70 feet consist of white-weathering brown tuffaceous claystone or siltstone, perhaps lithologically equivalent to the Rincon Shale. Locally 3-inch- to 1-foot-thick tuffaceous sandstone occurs at the base. Maximum thickness is between 1000 and 1800 feet in the Cypress Mountain quadrangle and 700 to 1000 feet thick in the Cambria quadrangle. The general absence of chert and porcellaneous shale beds in this member differentiates it from the basal member of the Monterey Formation south of Morro Bay (Hall, 1973b). The unit is lithologically similar to the Sandholdt Member of the Monterey Formation in the nearby Adelaida quadrangle (Durham, 1968). However, the inclusion by Durham (1968, 1969) of cherty and dolomitic rocks in the upper part of his Sandholdt Member differs from the Sandholdt Formation as originally described by Thorup (1941, 1943). There is also close lithologic similarity with the Relizian Point Sal Formation of Woodring and Bramlette (1950), mapped in the Arroyo Grande (Hall, 1973b) and Nipomo (Hall and Corbató, 1967) quadrangles. Fossils include *Deltopecten peckhami* (Gabb) (UCLA loc. nos. 6072, 6074) and *Miocoma* ? sp. (UCLA loc. no. 6074). *Acila conradi* (Gabb), in the collection of A. Fitzhugh of Cambria, is from 3/10 mi. south of Fitzhugh Ranch in sec. 4, T. 28 S., R. 10 E., approximately 800 feet above the base of the member. Megafossils suggest a Saucian or Relizian age. Bathyal foraminiferal fauna from the rocks of similar lithology in the nearby Adelaida quadrangle are of Relizian and Luisian age (Smith and Durham, 1968). Marine.
Tmt; extremely fine-grained white to gray hard tuff, maximum thickness of approximately 200 feet. Large fragments of pumice, common in the Obispo tuff, are absent. Probably in part the age equivalent of the Obispo Formation--Relizian

Miocene and Pliocene

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QUATERNARY

Holocene

Miocene and Pliocene

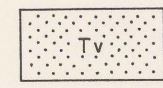
Miocene and Pliocene

Miocene

TERTIARY

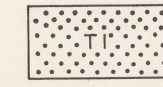
Upper Cretaceous

Upper Jurassic and Lower Cretaceous



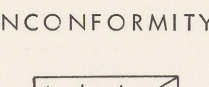
Vaqueros Sandstone

Light-brown calcareous arkosic sandstone. Moderately well indurated and fairly well sorted, medium to coarse grained, and generally without distinct bedding. Sandstone is composed of quartz, 50% to 80%; feldspar, 15% to 30%; and lithic fragments, 5% to 35%. Locally, 2% to 50% of the mineral grains are glauconite. Thickness 100 to 800 feet. Lower part of formation is commonly a poorly sorted, yellowish-brown conglomerate consisting of silty sand, chert pebbles, clasts of Cambria Felsite, and shell fragments. Northeast of Coast Union High School (Cambria quadrangle), 95% of the clasts of conglomerate are Cambria Felsite; 5% are Franciscan chert pebbles; locally in this area the arkosic lithic sandstone is composed of a large percentage of barnacle fragments. Near Green Valley (Cambria quadrangle) the basal part of the Vaqueros interfingers with green sandstone and red clay of the Lospe Formation. Fossils include *Crossostrea* cf. *C. eldridgei* (Arnold) (UCLA loc. no. 6071); *Crossostrea eldridgei vnezianus* (Loel and Corey), *Crossostrea titan subtitian* (Loel and Corey), and *Crossostrea vaquerosensis* (Loel and Corey) (UCLA loc. no. 5933); *Lyropecten* [or *Macrochlamis*] *magalia* (Conrad) (UCLA loc. nos. 5931, 6068, 6069, 6073); *Vertipecten perini* (Arnold) (UCLA loc. nos. 5935, 6068, 6069, 6070); *Leptopecten andersoni* (Arnold) (UCLA loc. no. 5936); *Crenomytilus expansus* (Arnold) (UCLA loc. nos. 5932, 6071); *Modiolus vnezianus lagunanus* Loel and Corey (UCLA loc. nos. 5931, 5932, 5936); *Mytilus* cf. *M. loeli* Grant (UCLA loc. no. 5932); *Panopaea gemmae* (Gould), *Urtilla sanctae-cruzis* (Arnold) (UCLA loc. no. 5933); *Swiftopecten hamlini* (Arnold) (UCLA loc. no. 5936); *Cancellaria* cf. *C. dalliana* Anderson (UCLA loc. no. 5933); *Balanus* sp. (UCLA loc. no. 6071); *Echinolampas* ? sp. (UCLA loc. no. 6069). Oligocene (Zemorian) or "Vaqueros" Stage. Marine



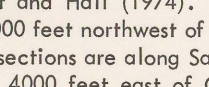
Lospe Formation

Green and red conglomerate, sandstone, and silty claystone. Conglomerate is composed of 1% to 10% cobbles and boulders and roughly 65% pebbles in a poorly sorted sandy matrix. Clasts in the basal 50 feet have the following percentage composition: dacite, similar in lithology to that of the Morro Rock - Islay Hill volcanic rock complex, 10 to 40; chert, 25 to 90; vesicular basalt, 10 to 20; and Franciscan graywacke and metavolcanic rocks, 1 to 20. Upper 550 feet consist of lenticular beds of conglomerate, tuffaceous conglomerate, and red and green claystone. In the Cypress Mountain quadrangle the formation consists of approximately 400 feet of poorly sorted massive green or, less commonly, red conglomerate. Clasts have a percentage composition of: Franciscan graywacke, 40 to 55; chert, 10 to 30; metavolcanic rocks, 20; serpentinite, 3; and blueschist, less than 1. Clasts of Cambria Felsite, which underlies conglomerate, rare or absent. Maximum thickness is approximately 600 feet. Age presumably Oligocene (below the Oligocene Vaqueros Sandstone). If dacite clasts are from the Morro Rock - Islay Hill volcanic complex, the Lospe would be younger than the 22 to 26 m.y. (Turner, 1970) age of that complex. Nonmarine



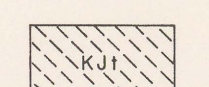
Cambria Felsite

Tc; hard rhyolite-dacite grayish-white crystalline felsite and some soft white poorly exposed tuff. Three to 30% of the rock is composed of phenocrysts of quartz, oligoclase, and biotite; groundmass aphanitic. Generally without bedding features or preferred orientation of phenocrysts. Where stratified, tuff beds are less than a foot to more than two feet thick; biotite flakes are partially aligned. Flow-banding locally common in felsite. Locally a reworked soft tuff within the formation contains clasts of Franciscan graywacke, 70%; chert, 20%; and blueschist, 10%; possibly part of the Lospe Formation. Approximately 350 feet thick.
Tcb; reddish-brown to black massive basalt.



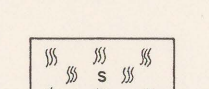
Unnamed sedimentary rocks

Feldspathic graywacke or arkosic wacke sandstone and interbedded greenish-brown or black micaceous shale and siltstone. Thick-bedded tan to dark-brown medium-grained sandstone composed of quartz, 30% to 70%; altered plagioclase and K-feldspar, 20% to 30%; claystone, chert fragments, and biotite, 2% to 7%. Convoluted and cross bedding or lamination and graded bedding locally common. Included in Asuncion Formation by Tallaferra (1944); broken formation A, Type III graywacke of Hsu (1969). Probably the same unit as the unnamed sedimentary rocks in Part San Luis quadrangle (Hall, 1973b). Exposed thickness in area is approximately 6000 feet. Late Cretaceous (Hsu, 1969). Marine



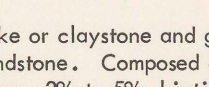
Toro Formation

Interbedded shale or claystone and sandstone. Dominantly thin-bedded greenish-brown or brown micaceous shale; contains calcareous lenses and concretions. Sandstone is composed of quartz, 60%; plagioclase, 20% to 30%; orthoclase, 5%; and lithic fragments, biotite, and hornblende, 5%. Assigned to Toro Formation by Fairbanks (1904) and Page (1970, 1972); to Marmolejo by Tallaferra (1944) and Hsu (1969). Retention of formational name "Toro" seems warranted because of priority. Type section is along Toro Creek, sections 22, 27, and 33, T. 28 S., R. 11 E., Morro Bay North quadrangle. Formation well exposed near Cienega Creek, southeastern Cypress Mountain and southwestern York Mountain quadrangles. Exposed thickness more than 1500 feet; elsewhere in the region; more than 2100 feet. Late Jurassic and Early Cretaceous (Fairbanks, 1904; Page, 1970, 1972). Marine



Serpentinite and serpentinitized ultrabasic rocks

KJfg, very fine-grained graywacke or claystone and greenish-brown graywacke. Easily weathered relatively soft sandstone. Composed of quartz, 60% to 70%; plagioclase, 15% to 25%; K-feldspar, 2% to 5%; biotite, 2% to 5%; and rock fragments of dark-gray siltstone. Sandstone is commonly massive and chattered, but locally it is well bedded or interbedded with siltstone. Exotic fragments or clasts absent or rare.
KJfmv, metavolcanic rocks, greenstone, and some weathered diabase commonly associated with red chert (ch). Contacts between the metavolcanic rocks and other units of the Franciscan rocks are everywhere inferred to be faults.
KJfme, mélange of graywacke (gw), pervasively sheared and in large part composed of sheared greenish-black claystone. Includes exotic fragments or clasts of conglomerate (cg); blueschist (bs); schist (sch); metavolcanic rocks or greenstone (mv); white, red, or green chert (ch); serpentinite (s); shale (sh); silica-carbonate rocks (sc); and gabbro (g).
No stratigraphic order can be determined for the mélange, metavolcanic rocks, and graywacke. Because the mélange contains exotic fragments or clasts of blueschist and schist and is pervasively sheared, the inference could be made that the age of tectonism of the Franciscan mélange is older than the other units of the Franciscan rocks that lack such clasts. If, however, the graywacke, metavolcanic rocks, and chert clasts are from the KJfg and KJfmv, then the age of tectonism would be younger than all of the Franciscan rocks. The Franciscan rocks are probably of Jurassic or Cretaceous age



Franciscan rocks

KJfg, very fine-grained graywacke or claystone and greenish-brown graywacke. Easily weathered relatively soft sandstone. Composed of quartz, 60% to 70%; plagioclase, 15% to 25%; K-feldspar, 2% to 5%; biotite, 2% to 5%; and rock fragments of dark-gray siltstone. Sandstone is commonly massive and chattered, but locally it is well bedded or interbedded with siltstone. Exotic fragments or clasts absent or rare.
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GEOLOGIC SYMBOLS

Contact
Dashed where approximately located or inferred

High-angle fault
Dashed where approximately located or inferred; dotted where concealed

Thrust or reverse fault
Dashed where approximately located or inferred; dotted where concealed. Saw-teeth on upper plate. Dip of fault plane between 30° and 80°

Anticline
Showing axis of surface. Dashed where approximately located; dotted where concealed

Syncline
Showing axis of surface. Dashed where approximately located; dotted where concealed

Horizontal 30° 90°
Strike and dip of beds

x5928
Megafossil locality
UCLA locality number

○ Conglomerate
— Sandstone
— Siltstone
— Tuff
— Breccia
— Marker beds

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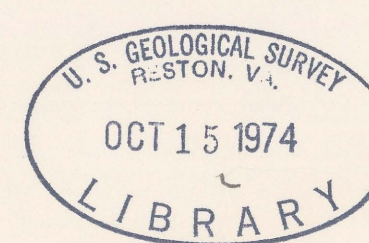
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EXPLANATION TO ACCOMPANY
GEOLOGIC MAP OF THE CAMBRIA REGION
SAN LUIS OBISPO COUNTY, CALIFORNIA

By
Clarence A. Hall
1974



California (Cambria Region) Geol. 1:24,000. 1974
Sheet 2
Cop. 1



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For sale by U.S. Geological Survey, price \$1.00