UNITED STATES DEPARTMENT OF THE INTERIOR

GEOLOGICAL SURVEY

GEOLOGY OF THE TEJON HILLS AREA - ARVIN AND TEJON HILLS QUADRANGLES, KERN COUNTY, CALIFORNIA

by

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This report is preliminary and has not been reviewed for conformity with U. S. Geological Survey editorial standards and stratigraphic nomenclature.

The Arvin and Tejon Hills quadrangles are within the area mapped initially by Hoots (1930) as part of a study of the oil resources along the southern border of the San Joaquin Valley. This early mapping was greatly revised by Dibblee following the 1952 Arvin-Tehachapi earthquake on the White Wolf fault, although only a brief summary of the geology with a generalized geologic map was published (Dibblee, 1955). Additional field work in the Arvin and Tejon Hills quadrangles was done by the senior author in 1975 and 1979 as part of a regional study of the Cenozoic tectonic history of the San Joaquin Valley.

The Tejon Hills area is significant structurally because of the presence of the White Wolf fault and the possibly related Springs fault to the south. Stratigraphically, the area is of interest because it includes the type area of the Chanac Formation, and exposes the eastern fringe of the marine Miocene sequence that is concealed beneath the southeastern San Joaquin Valley between the Caliente Creek area east of Bakersfield to the north and the San Emigdio Mountains to the southwest.

The emphasis in geologic mapping was placed on the Tertiary units; the Quaternary deposits were mapped in reconnaissance fashion. Relative age of Quaternary deposits in this map area was inferred from their relative position in a sequence of geomorphic surfaces, degree of post-depositional soil development, and degree of erosional modification or dissection. Soils mapping (Cole and others, 1945) used to infer relative age was interpreted with the assistance of D. E. Marchand. For a further discussion of methods see Marchand and Allwardt (1981). The basement rock units shown on this map are compatible with those on the geologic map of the Cummings Mountain 15' quadrangle (Dibblee and Warne, 1970) that is adjacent to the Arvin and Tejon Hills 7.5' quadrangles on the east. For an alternative interpretation of the foliated rocks and their relations to the tonalite, see Ross (1980).

DESCRIPTION OF MAP UNITS

Qya — YOUNGER ALLUVIUM (HOLOCENE AND UPPER PLEISTOCENE)--Unconsolidated sand and gravel in present-day stream channels, floodplains and lowest terraces. Probably in part equivalent to upper Modesto Formation of northern San Joaquin Valley (see Marchand and Allwardt, 1977).

Qu — UNDIFFERENTIATED ALLUVIUM (HOLOCENE AND PLEISTOCENE)--Alluvial deposits in small isolated valleys or terraces not referrable to sequences in major drainages.

Qoa_1 / Qoa_2 — OLDER ALLUVIUM (PLEISTOCENE)--Gravel, containing clasts as large as boulders locally, sand, and silt in dissected alluvial fans and higher terraces along major streams. Units are differentiated as desribed above. Qoa_1, probably equivalent in part to Modesto Formation of northern San Joaquin Valley (see Marchand and Allwardt, 1981); Qoa_2, probably equivalent to Riverbank Formation of northern San Joaquin Valley (see Marchand and Allwardt, 1981).

QTkr — KERN RIVER FORMATION (UPPER MIOCENE, PLIOCENE AND PLEISTOCENE(?))--Small exposure in sec. 5, T. 11 N., R. 18 W., Tejon Hills quadrangle, overlying Chanac Formation is questionably referred to the Kern River Formation. The Kern River is composed of coarse granitic gravel and is lithologically similar to the Chanac Formation.

Tch — CHANAC FORMATION (MIOCENE) -Poorly bedded, light-gray, friable, coarse-grained pebbly arkosic sandstone with kaolinized feldspars and deeply weathered clasts; brown clayey sandstone; and brown sandy claystone or mudstone. Clasts are commonly angular and include granitic detritus and abundant light-colored felsite. Commonly erodes to badlands topography and has an overall light brown color. Contains continental vertebrate fossils of late Clarendonian age, late Miocene.

Tsm — 'SANTA MARGARITA' FORMATION (MIOCENE)--Light-gray to white, fine-, medium- and coarse-grained friable to locally calcareous sandstone; contains thin beds of pebbly sandstone. Contains marine molluscan fossils of late Miocene age.

Tba — BENA GRAVELS (MIOCENE)--Nonmarine gravels in Tejon Hills originally assigned to Santa Margarita Formation by Hoots (1930) but later reassigned to Bena Gravels by Dibblee and Warne (1970). Consists of poorly bedded and poorly sorted medium- to very coarse grained pebbly sandstone, sandy pebble-cobble conglomerate, fine- to very fine grained sandstone, and light-olive-gray sandy or silty claystone and siltstone. Sandstone and conglomerate is mostly friable but clayey and is light gray to grayish yellow in color. Formation is light gray overall. Coarsens to east and southeast; predominantly cobble and boulder conglomerate where unit rests directly on basement rocks. Contains continental vertebrates of early Clarendonian age (late Miocene) (Drescher, 1941; Savage, 1955) and rare marine mollusks of late Miocene age in thin calcareous sandy mudstone near top at Comanche Point.

Tms — MARINE(?) SANDSTONE AND CONGLOMERATE (MIOCENE)--Poorly bedded and locally crossbedded coarse- to very coarse grained pebbly sandstone; fine- to medium-grained, well-sorted sandstone; and sandy pebble conglomerate. Sandstone is mostly calcareous but locally uncemented and friable. Unit is unfossiliferous but locally contains invertebrate burrows.

Tfv — FRUITVALE SHALE OF MILLER AND BLOOM (1937) (MIOCENE)--Marine, massive silty claystone containing scattered calcareous concretions and thin sandstone interbeds; common gypsum veins. Contains foraminifers of Mohnian ("Pulv. zone") age (late Miocene).

Tss — MARINE SILTSTONE AND SANDSTONE (MIOCENE)--Light-gray well-sorted fine-grained micaceous sandstone, siltstone, and claystone containing calcareous concretions and lens of calcareous medium- to coarse-grained sandstone and pebble conglomerate. The coarse sandstone contains oyster and barnacle fragments, and the siltstone contains rare small mollusks and invertebrate burrows. Massive well-sorted fine-grained sandstone is common near the base of the unit and decreases in abundance upward. The claystone contains marine diatoms of middle(?) Miocene age.

To — OLCESE SAND (MIOCENE)--Interbedded well-sorted, fine-, medium-, and coarse- to very coarse grained sandstone, and thin lenses of conglomerate or conglomeratic sandstone; calcareous in part. Mostly well bedded and locally crossbedded. Unit becomes finer and more massive upward. Barnacle and oyster fragments are common in the coarser sandstone near the base and invertebrate burrows are present locally in the finer grained beds. Contains marine mollusks of early to middle Miocene age.

Toc — Boulder conglomerate containing lenses of well-sorted medium- and coarse-grained friable sandstone. Intertongues southward (and westward?) with Olcese Sandstone. Probably nonmarine.

ht — HORNBLENDE-BIOTITE TONALITE (QUARTZ DIORITE)--Light- to medium-gray massive to gneissoid, even-grained granitic rock composed of quartz, plagioclase feldspar (andesine), biotite and/or hornblende. Contains sparse to abundant darker finer grained biotite-rich dioritic lenticular inclusions oriented parallel to gneissoid foliation where present. See Dibblee and Warne, 1970, for more detailed description.

m — METAMORPHIC ROCKS--Biotite gneiss and mica schist, in large part complexly migmatized by tonalite.

STRUCTURE

The most important structure in the Tejon Hills area is the White Wolf fault that limits the hills on the northwest and dips southeastward at angles of from 20° to 75°. Cumulative late Cenozoic slip on the fault has been oblique; the southeast side has moved relatively upward and northeast. A magnitude 7.7 earthquake on July 21, 1952 (with an epicenter under Wheeler Ridge about 22 km southwest of Comanche Point) produced surface ruptures along the fault trace as described in detail by Dibblee (1955) and Buwalda and St. Amand (1955). The surface ruptures shown on the Arvin quadrangle were compiled on the current edition (topographic) of the Arvin quadrangle by the California Division of Mines and Geology (1976).

The Springs fault has been best known as the subsurface structure that forms the updip closure in the Tejon Hills oil field. This fault is marked at the surface by a line of springs and by a 6 m high northwest-facing scarp across the alluvium of El Paso Creek and the Tunis Creek fan. The scarp has usually been interpreted as a fault-line scarp. Subsurface evidence suggests an apparent down to the southeast vertical separation on the top the basement rocks, but as the basement surface slopes generally westward, the discrepancy between the apparent separation on the basement surface and the vertical separation on the land surface can be resolved by a left-lateral up-on-the-southeast slip like that on the White Wolf fault. This seems more reasonable than the interpretation of the scarp in the alluvium as a faultline scarp. The series of north-trending normal faults northeast of Tejon Creek might be the result of simple tension within the left-lateral couple between the White Wolf and Springs faults.

The Tertiary strata of the northern Tejon Hills form a broad westward-plunging nose that probably reflects a pre-existing salient of basement rocks into the basin. Comanche Point is formed by a small dome on the westward extension of this nose that was present as a basement high in Miocene time. These structures may have been accentuated by later arching of the basement rocks, perhaps in reponse to the same compressive stress that results in left-lateral and reverse slip on the White Wolf fault.

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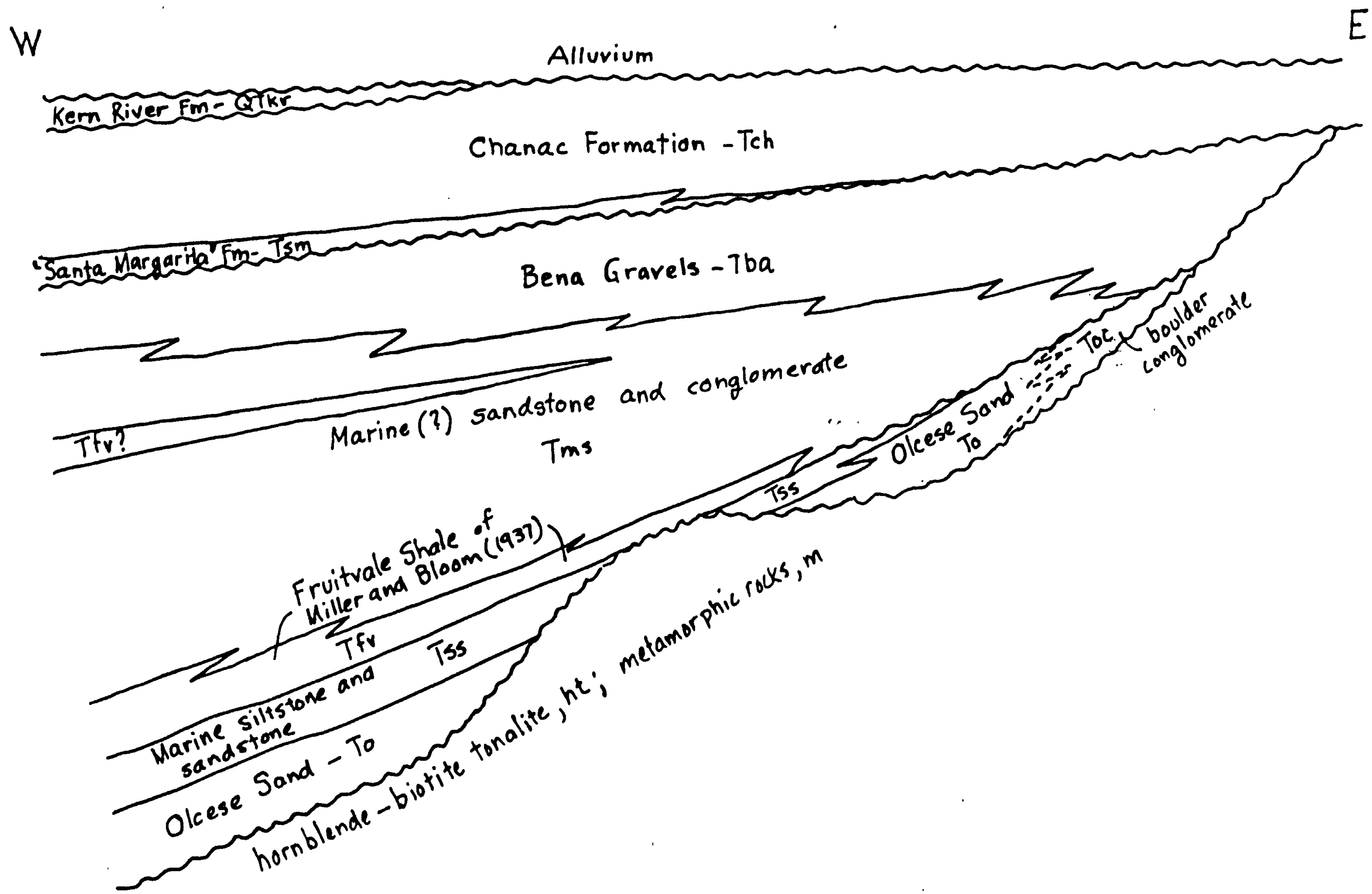

Generalized diagrammatic section of Tertiary stratigraphic units in the Comanche Point area.

CORRELATION OF MAP UNITS