76-841

PRELIMINARY GEOLOGIC MAPS (1:24,000) SHOWING QUATERNARY DEPOSITS OF THE EASTERN SAN JOAQUIN VALLEY, CALIFORNIA:

EXPLANATION TO ACCOMPANY OPEN-FILE MAPS 76-836 THROUGH 76-841

by

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Purpose of Map and Basis for Recognition of Map Units

This map is one of a series showing the distribution of unconsolidated and moderately consolidated Cenozoic deposits in the San Joaquin-Sacramento Valley and is a product of a regional study of the depositional and tectonic history of the Central Valley. Emphasis in mapping was placed upon Quaternary deposits. Pre-Quaternary contacts were drawn primarily from soil survey maps, aerial photographs, and topography, augmented by local field checking, and are subject to revision. The Quaternary deposits occur as a series of nested alluvial terraces incised into Tertiary and Mesozoic rocks near the Sierra foothills and opening westward onto alluvial fans. Each fan commonly spills out west of and over the previous fan, such that the oldest fans head near the foot hills whereas the youngest fans occur close to the lower San Joaquin River. Geomorphic evidence of relative age is thus most useful near the mountains, but westward toward the basin the depositional surfaces converge such that soils and superposition of deposits separated by unconformities and buried paleosols become the primary distinguishing criteria. Relative age of Quaternary deposits was determined from superposition, degree of post-depositional soil development, position in a sequence of geomorphic surfaces, degree of erosional modification or dissection, and cross-cutting soil patterns.

Absolute ages are discussed by Marchand and Allwardt, ~~in press~~ unpub. data, and Marchand (1976). Facies representing contrasts in materials resulting from deposition in differing geologic environments were recognized from soil map units, aided by field reconnaissance.

Methods of Approach

Soil map units were reduced or enlarged to 1:24,000 scale and transferred manually onto standard 7 1/2-minute topographic maps. Some soil series were combined, others subdivided to best conform to geologic map units as determined from field observations of soils and deposits in auger holes, river bluffs, roadcuts, canal excavations, and other suitable exposures. The resulting soils contacts were then modified by means of 1:20,000 U.S. Geological Survey aerial photographs (flown primarily in 1946; some in 1959, 1962, and 1963), field reconnaissance, and topography, especially in those quadrangles having 5-foot contours. Prominent lineaments believed to be structural in nature were delineated from 1:20,000 aerial photographs and in some places extended using topography. Those which involve verifiable displacement of deposits or soils are shown as faults; the other lineaments probably represent fractures having little or no displacement, although offsets of a few feet in eroded Riverbank or pre-Riverbank deposits cannot be consistently recognized without detailed study.

Summary of Cenozoic Geologic History

Presently available structural and stratigraphic evidence would suggest a history of progressive, perhaps intermittent Sierran uplift since Eocene time. Significant westward tilting of the central Sierra

Nevada occurred between Mehrten and China Hat time and may have been responsible for the outpouring of the thick China Hat Gravel Member of the Laguna Formation. The Laguna Formation records at least two major episodes of granitic alluviation, separated by an extensive period of soil formation, and may record the earliest glaciation of the Sierra Nevada. The final major tilting and uplift of the Sierra Nevada seems to have occurred between China Hat and North Merced time. The net result of these two periods of late Tertiary Sierran uplift was a shifting of drainage direction from southwesterly to westerly, suggesting that late Tertiary uplift in the southern Sierra Nevada may have considerably exceeded that in the north. During latest Pliocene or earliest Pleistocene time, the North Merced pediment was beveled across Tertiary and older rocks along the entire eastern margin of the Sierra Nevada. Beginning in early Turlock Lake time, at least seven periods of glacial outwash deposition, followed by extensive periods of stability and soil formation and later by incision and dissection, appear to have been superimposed on a progressively subsiding San Joaquin Valley. Minor Sierran tilting may have continued through Quaternary time, providing an explanation for the converging geomorphic surfaces and westward shifts in fan position. Some of the observed lineaments and faults, especially the northwesterly trending sets, could be tensional features associated with a hinge line along the boundary between the Sierra Nevada and the subsiding San Joaquin Valley.

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EXPLANATION[1]

Description of Map Units

t

Dredge tailings

hal hed hls

Young, unconsolidated surficial deposits

Holocene

hal, alluvial sand, silt, and gravel associated with floodplains and low terraces (Riverwash, Tujunga, Grangeville, Foster, Hanford, Honcut[2], Yolo[2], Anderson[2], and Columbia soils)

hed, eolian sand associated with local, modern dunes (Duneland)

hls, swamp, lacustrine, or marsh deposits

mh

Wisconsinan and Holocene

undifferentiated Modesto and Holocene alluvial sand, silt, and gravel; includes some young colluvium in foothill valley bottoms (Tujunga, Hildreth[2], Honcut[2], Burchell[2], and Bear Creek[2] soils)

Late Wisconsinan

m2 m2b m2e

Modesto Formation, upper member

m2, alluvial sand, silt, and gravel of channels, terraces, and upper fans (Hanford, Hesperia, Grangeville, Visalia, Pachappa, Temple[3], Merced[3], and Wyman[2] soils)

m2b, alluvial sand, silt, and clay of interdistributary areas, lower fans, and floodbasins, commonly stratified (Chino, Wunjey, and Landlow[2] soils)

m2e, eolian sand associated with subdued, stabilized dunes (Delhi, Dello, and Calhi soils)

Early and Middle Wisconsinan (Altonian)

m1 m1b m1e

Modesto Formation, lower member

m1, alluvial sand, silt, and gravel of channels, terraces and upper fans (Greenfield, Borden, Chualar, Ryer[2], Buchenau[2], and Jesbel[2] soils)

m1b, alluvial sand, silt, and clay of interdistributary areas, lower fans, and floodbasins, commonly stratified (Fresno, Waukena, Dinuba, Traver, Pond, and Rossi[3] soils)

m1e, eolian sand, moderately well sorted (Atwater soils)

ILLINOIAN(?)

rg r3

Riverbank Formation, upper unit

r3, alluvial sand, silt, and gravel (Snelling, Ramona, Madera Exeter, and Yokohl[2] soils, weak variants)

rg, gravel derived from regarding of North Merced and older gravels during Riverbank(?) time (Keyes[2], Redding[2], Rocklin[2], and Corning[2] soils, weak variants)

r2

Riverbank Formation, middle unit

alluvial sand, silt, and gravel (Snelling, Ramona, San Joaquin, Yokohl[2], soils, normal variants, Seville[2] and Academy[2] soils)

r1

Riverbank Formation, lower unit

alluvial sand silt, and gravel (Snelling, Ramona, and San Joaquin soils, strong variants)

KANSAN(?)

t2 t2f

Turlock Lake Formation, upper unit

t2, alluvial granitic sand and minor gravel (Montpellier, Cometa, and Rocklin soils) overlying stratified fine sand, silt, and minor clay (Rocklin, Whitney, Trigo, and Pollasky soils

t2f, Friant Pumice Member, rhyolitic alluvial sand and stratified silt with up to 95% or more glass and pumiceous fragments, along the upper San Joaquin River northeast of Fresno; K-Ar age=600,000±20,000 years (Janda, 1965)

KANSAN(?) OR NEBRASKAN(?)

tl

Turlock Lake Formation, lower unit

alluvial granitic sand (Montpellier, Cometa soils) and gravel (Corning) overlying stratified fine sand, silt, and minor clay (Rocklin soils); everywhere covered by upper unit except where locally exhumed by erosion west of Friant

LATE PLIOCENE OR EARLY PLEISTOCENE

QTnm

North Merced Gravel

thin, locally derived pediment veneer of cobble gravel capping Tertiary and pre-Tertiary rocks near the Sierran foothills (Redding[2] soils)

LATE PLIOCENE

Tlc Tl

Laguna Formation

Tlc, China Hat Gravel Member, thick cobble gravel with a granitic matrix and interbedded granitic sand and minor silt; uppermost member of Laguna Formation, exposed through topographic inversion of an old alluvial distributary system south of the Merced River (Redding and Corning soils, acid variants).

Tl, granitic sand, silt, and minor gravel underlying the China Hat Gravel Member; contains some reworked andesitic detritus near base; weakly to moderately indurated (Hopeton soils)

MIOCENE AND PLIOCENE

Tm

Mehrten Formation

andesitic fluvial sand, silt, and minor gravel, presumably reworked from volcanic mudflow deposits to the northeast; moderately indurated (Raynor, Pentz, and Peters soils)

MIOCENE

Tb Ta

Auberry Formation of Janda, 1965

Tb, olivine basalt of San Joaquin Table Mountain near Millerton Lake

Ta, cobble gravel, poorly sorted tuffaceous sand, and coarse arkosic sand, moderately indurated, underlying basalt cappings near Millerton Lake (Positas, Centerville, and some Wisheylu soils)

OLIGOCENE AND MIOCENE

Tvs

Valley Springs Formation

rhyolitic fluvial sand, silt, and gravel; moderately to strongly indurated and cemented (Amador soils)

EOCENE

Tei

Ione Formation

varicolored sandstone, conglomerate, and kaolinitic claystone, primarily fluvial but contains local marine fossils; strongly indurated and cemented, in part by lateritic weathering (Hornitos soils)

CRETACEOUS

Ku

Undifferentiated Cretaceous(?) sedimentary rocks

Sedimentary rock displaying lateritic weathering, exposed beneath the Ione Formation and overlying basement rock about 1.2 km west of the Madera Canal along Highway 145

MESOZOIC

Mzb

Mesozoic intrusive and metamorphic basement rocks

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1. Characteristic soil series of the U.S. Soil Conservation Service are given in parentheses
2. Soil series developed on alluvium of local, foothill derivation
3. Soil series developed on alluvium of mixed source along lower San Joaquin River

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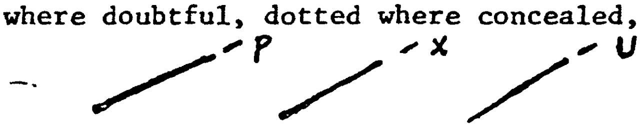
Description of Map Symbols

Contact

Fault

Queried where doubtful, dotted where concealed, dashed where inferred



Photolineament (p) or Topographic Lineament (x)
U = lineament from U-2 photos
Dashed where less evident