UNITED STATES DEPARTMENT OF THE INTERIOR

GEOLOGICAL SURVEY

PRELIMINARY GEOLOGIC MAPS SHOWING QUATERNARY DEPOSITS OF THE LOWER TUOLUMNE AND STANISLAUS ALLUVIAL FANS AND ALONG THE LOWER SAN JOAQUIN RIVER, STANISLAUS COUNTY, CALIFORNIA

(WESTLEY, BRUSH LAKE, RIPON, AND SALIDA 7½' QUADRANGLES)

by

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and

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Open-file report 78-656

1978

This report is preliminary
and has not been edited or
reviewed for conformity with
Geological Survey standards
and nomenclature

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EXPLANATION TO ACCOMPANY OPEN-FILE MAP 78-656

by

Denis E. Marchand and Jennifer W. Harden

This map is designed to portray the distribution of late Pleistocene and Holocene alluvial fan and flood plain deposits of the lower Tuolumne, Stanislaus, and San Joaquin Rivers in a manner that will facilitate understanding of the depositional and tectonic history of the San Joaquin-Sacramento valley. Our efforts have concentrated on refining and further subidviding the stratigraphic units proposed by earlier workers (Arkley, 1954, 1962, 1964; Davis and Hall, 1959) to allow for more precise dating of specific depositional and tectonic events. As such, this map is part of a series of published and proposed U.S. Geological Survey maps showing the distribution of unconsolidated and moderately consolidated Cenozoic deposits throughout the entire Central Valley (Marchand, 1976 a,b,c,d,e,f). These particular quadrangles demonstrate the spatial relations between most of the younger stratigraphic units in the northeastern San Joaquin Valley. The interested reader should consult Marchand and Allwardt (1977) for a schematic cross section of an area just south of these quadrangles and for a more complete discussion of Quaternary stratigraphic relations and ages of the deposits.

The Quaternary deposits of the eastern San Joaquin valley occur near the Sierra Nevada foothills as a series of nested alluvial terraces (Janda and Croft, 1967; Marchand, 1977a). Both fill and strath terraces are present, but the major stratigraphic units appear to fill erosional valleys carved into Mesozoic, Tertiary, and older Quaternary units. The depositional surfaces of the terraces converge westward and open onto alluvial fans with successively younger fans burying older fans.

Geologic, pedologic, and physiographic evidence was used to separate the Quaternary deposits within the map area into four major ages of deposits--the Riverbank Formation, the lower member of the Modesto Formation, the upper member of the Modesto Formation, and the post-Modesto deposits. Useful criteria for making these relative age assignments are superposition, degree of soil profile development, degree of erosional modification, position within a sequence of geomorphic surfaces, and cross-cutting soil patterns. These same criteria were used to recognize four time-related depositional or erosional phrases associated with the upper member of the Modesto Formation [and four such phases associated with the upper member of the Modesto Formation] and four such phases associated with post-Modesto deposits (see Marchand and Allwardt, 1977, for discussion of these phases). We have purposely tried to make as fine an age subdivision as possible using soil profile characteristics; further study may indicate that some [of the]characteristics believed to be age diagnostic are actually related to subtle differences in soil drainage or in soil parent material due to contrasts in depositional environment. Different depositional phases within deposits of a given age were recognized by relating contrasts in texture, sedimentary structures, and soil profile characteristics (Arkley, 1964; unpublished U.S.G.S. data) to different flood plain environments through studies of existing maps, aerial photographs, topographic maps, available exposures, and auger borings. Physiographic evidence for the relative age of the deposits is generally definitive near the foothills. As the depositional surfaces converge westward, geomorphic evidence becomes more ambiguous and separate depositional units are recognized primarily on the basis of stratigraphic unconformities, contrasting degree of development of relict soil profiles, and buried paleosols.

In preparing the maps, boundaries between previously mapped soil units (Arkley, 1964) were transferred manually to standard 1:24,000 7½ minute topographic maps. Some soil units were combined, and others were subdivided to define geologic map units following field observation of soils exposed in auger holes, river bluffs, roadcuts, canal excavations, and other suitable exposures. The geologic contacts gleaned from this soil information were then modified by means of additional field reconnaissance, as well as interpretation of 1:20,000 U.S. Geological Survey aerial photographs (flown primarily in 1946 but with additional coverage in 1959, 1962, and 1963) and topographic maps having 5-foot contour intervals. Deposits thinner than about 2-3 feet are shown as the underlying map unit.

Mapping and correlation of Quaternary deposits in Stanislaus County has been greatly facilitated by consultation with many geologists and soil scientists, especially R. J. Arkley, J. A. Bartow, E. L. Begg, E. J. Helley, and G. L. Huntington. R. J. Janda offered constructive suggestions for improvement of the explanation.

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MAP EXPLANATION*

pm4	pmls	pmed	HOLOCENE
pm3	pm3m		
pm2	pm2m		
pml	pmlm		

Post-Modesto Deposits

pmls, modern swamp, lacustrine, or marsh deposits

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

pm4, modern alluvial sand, silt, and clay of channels and point bars (Riverwash)

pm3, historic arkosic alluvial sand and silt along Tuolumne and Stanislaus Rivers associated with natural levees, meanders, and meander scars less than 2 m above base flow levels (Grangeville, Foster, Tujunga)

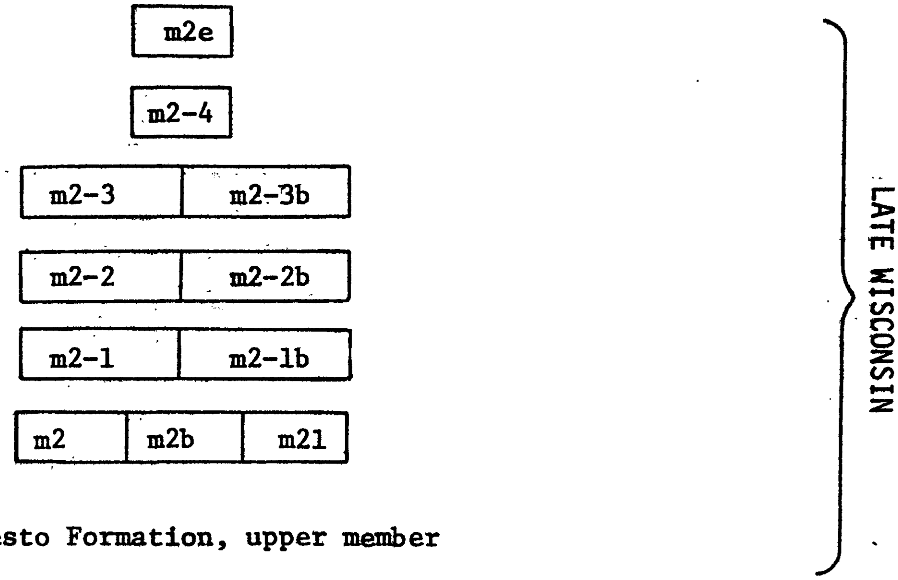
pm3m, historic alluvial sand, silt, and clay along lower San Joaquin River associated with natural levees, meanders, and meander scars less than 2 m above base flow levels; mixed Coast Range and Sierra Nevada provenance (Columbia)

pm2, late Holocene arkosic alluvial sand, silt, and gravel along Tuolumne and Stanislaus Rivers about 0.5-1.5 m above pm3 levels (Grangeville, Hanford, Foster, Tujunga)

pm2m, late Holocene alluvial sand, silt and clay along lower San Joaquin River about 0.5-1.5 m above pm3 levels; mixed Coast Range and Sierra Nevada provenance (Columbia)

pml, early Holocene (?) alluvial sand, silt, and gravel along Tuolumne and Stanislaus Rivers about 1-2 m above pm2 levels and below m2-4 levels (Hanford, Grangeville, Tujunga)

pmlm, early Holocene (?) alluvial silt and clay along lower San Joaquin River about 1-2 m above pm2 levels; mixed Coast Range and Sierra Nevada provenance (Temple)



Modesto Formation, upper member

m2e, arkosic eolian sand associated with subdued, stabilized dunes, (Delhi, Hilmar, Dello)

m2-4, arkosic alluvial sand, gravel, and overbank silt associated with phase 4 (lowest) terraces along Tuloumne and Stanislaus Rivers (Hanford, Oakdale, Tujunga)

m2-3, arkosic alluvial sand, gravel, and overbank silt associated with phase 3 terraces along Tuolumne and Stanislaus Rivers, about 3-4 m above m 2-4 levels (Hanford, Oakdale, Tujunga)

m2-3b, arkosic alluvial fine sand and silt of phase 3 fan interdistributary areas and floodbasins; commonly stratified (Dinuba)

m2-2, arkosic alluvial sand, gravel, and silt associated with phase 2 terraces and upper fans along Tuolumne and Stanislaus Rivers, about 3-4 m above m 2-3 levels (Hanford, Oakdale, Tujunga)

m2-2b, arkosic alluvial fine sand and silt of phase 2 fan interdistributary areas and floodbasins; commonly stratified (Dinuba)

m2-1, arkosic alluvial sand, gravel, and silt associated with phase 1 (highest) terraces and upper fans along Tuolumne and Stanislaus Rivers, about 3-4 m above m 2-1 levels (Hanford, Oakdale, Tujunga)

m2-1b, arkosic fine sand and silt of phase 1, (highest) fan interdistributary areas and floodbasins; commonly stratified (Dinuba)

m2, arkosic alluvial sand, silt and gravel of fan distributaries, not differentiated as to phase (Hanford, Oakdale, Tujunga)

m2b, arkosic alluvial fine sand and silt of fan interdistributary areas and floodbasins; commonly stratified; frequently underlain at shallow depth by m1b floodbasin deposits (Dinuba)

m21, arkosic local lacustrine, swamp and marsh, silt and clay (Meikle)

ml	mlb

Modesto Formation, lower member

ml, arkosic alluvial sand, silt and gravel of fan distributaries (Greenfield, Chualar)

mlb, arkosic alluvial fine sand and silt of fan interdistributaries and floodbasins; commonly stratified (Fresno, Waukena, Modesto, Rossi, Traver, Dinuba)

EARLY WISCONSIN

r3

Riverbank Formation, upper unit
arkosic alluvial sand (Snelling)

ILLINOIAN

* U.S. Soil Conservation Service soil series most typical of each unit are given in parentheses. These soils are described by Arkley (1964). A time sequence of similar soils along the Merced River, south and east of this area, is discussed by Harden and Marchand (1977).