UNITED STATES DEPARTMENT OF THE INTERIOR
GEOLOGICAL SURVEY

PRELIMINARY GEOLOGIC MAPS SHOWING CENOZOIC DEPOSITS OF THE SNELLING AND MERCED FALLS QUADRANGLES, MERCED AND STANISLAUS COUNTIES, CALIFORNIA

by

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Open-file report 81-107

1980

Introduction

This is one of a series of preliminary geologic maps depicting late Cenozoic deposits of the San Joaquin Valley in a manner that will facilitate understanding of the depositional and tectonic history of the valley (for example--Marchand, 1976, 1980; Marchand and Wagner, 1980). Our efforts have concentrated on refining and further subdividing the stratigraphic units proposed by earlier workers (Arkley, 1954, 1962, 1964; Davis and Hall, 1959) to allow for more precise dating of depositional and tectonic events. These particular quadrangles demonstrate the spatial relations between most of the Quaternary and late Tertiary stratigraphic units in the northeastern San Joaquin Valley. The interested reader should consult Marchand and Allwardt (1977) for a schematic north-south cross section through the Snelling area and for a more complete discussion of the Quaternary stratigraphy.

Quaternary deposits of the eastern San Joaquin Valley occur near the Sierra Nevada foothills as a series of nested alluvial terraces. Though locally found as straths, major terrace-forming units generally appear as fills in erosional valleys carved into Mesozoic, Tertiary, and older Quaternary units. The depositional surfaces of the terraces converge westward and open onto alluvial fans such that successively younger fans bury older fans toward the San Joaquin Valley axis.

Geologic, pedologic, and physiographic evidence was used to separate the Cenozoic deposits within the map area into stratigraphic units of thirteen different ages--the Ione, Valley Springs, Mehrten, Laguna, North Merced Gravel, Turlock Lake (two units), and Riverbank (three units) Formations, the lower and upper members of the Modesto Formation, and post-Modesto deposits. Useful criteria for making these relative age assignments are superposition, lithology, degree of consolidaton and soil profile development, degree of

erosional modification, position within a sequence of geomorphic surfaces, and cross-cutting soil patterns.

Mapping was carried out through the use of soil survey maps, old and modern topographic maps, available exposures, auger borings, and aerial photographs. 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. Emphasis in mapping was placed on the Quaternary units. Contacts of pre-Quaternary units were not field checked and are based primarily on soils and airphotos, augmented by a few roadcut exposures.

In preparing the maps, boundaries between previously mapped soil units (Arkley, 1964) were transferred manually to standard 1:24,000 7.5-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 obtained from this soil information were then modified by means of additional field reconnaissance and examination of the oldest available topographic maps, as well as interpretation of 1:20,000 U.S. Geological Survey aerial photographs. Faults were identified from reconstruction of the Turlock Lake and Riverbank depositional surfaces, from available field exposures, and in locations where linear geologic contacts coincide with photolineaments.

Mapping and correlation of Cenozoic deposits in Stanislaus County has been greatly facilitated by consultation with R. J. Arkley. J. A. Bartow provided information on Tertiary contacts in several areas. The author, however, is responsible for any inaccuracies in the mapping.

REFERENCES CITED

Arkley, R. J., 1954, Soils of eastern Merced County: University of California Agricultural Experiment Station, Soil Survey no. 11, 174 p.

_____ 1962, The geology, geomorphology, and soils of the San Joaquin Valley in the vicinity of the Merced River, California in California Division of Mines and Geology Bulletin 182, Geologic Guide to the Merced Canyon and Yosemite Valley, p. 25-31.

_____ 1964, Soil survey of the eastern Stanislaus area, California: U.S. Department of Agriculture, Soil Survey Series 1957, no. 20, 160 p.

Davis, S. N. and Hall, F. R., 1959, Water quality of eastern Stanislaus and northern Merced Counties, California: Stanford University Publication of Geological Sciences, v. 6, no. 1, 112 p.

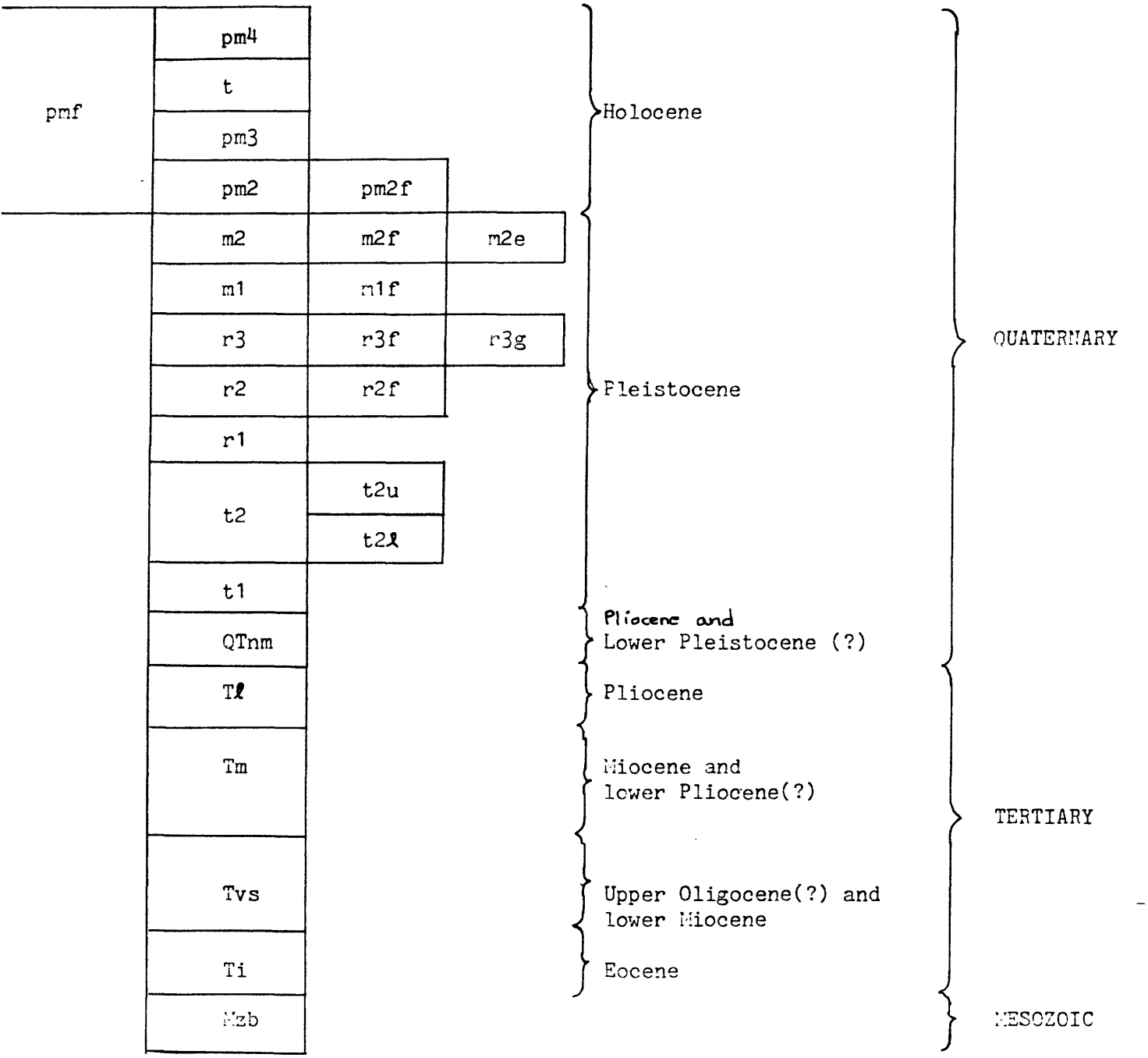
Marchand, D. E., 1976, Preliminary geologic maps showing Quaternary deposits of the northern Merced area, eastern San Joaquin Valley, Merced and Stanislaus Counties, California: U.S. Geological Survey Open-File Report 76-836, scale 1:24,000.

Marchand, D. E., 1980, Preliminary geologic maps showing late Cenozoic deposits of the Ceres, Denair, and Montpelier quadrangles, California: U.S. Geological Survey Open-File Report 80-607, scale 1:24,000.

Marchand, D. E. and Allwardt, Alan, 1977, Late Cenozoic stratigraphic units, northeastern San Joaquin Valley, California: U.S. Geological Survey Open File Report 77-748, 149 p. (in press as U.S. Geological Survey Bulletin 1470).

Marchand, D. E., and Wagner, Hugh, 1980, Preliminary geologic map showing late Cenozoic deposits of the Turlock Lake quadrangle, Merced and Stanislaus Counties, California: U.S. Geological Survey Open-File Report 80-913, 1:24,000.

CORRELATION OF MAP UNITS



DESCRIPTION OF MAP UNITS[1/]

POST-MODESTO DEPOSITS

pm4 modern alluvial sand, gravel, and silt of channels and point bars along the Merced River and Dry Creek (Riverwash)

t Dredge tailings; gravelly debris from placer mining since deposition of pm3

pm3 historic alluvial gravel, sand, and overbank silt along the Merced River associated with natural levees, meanders, meander scars, and low benches about 2 m above base flow levels (Grangeville, Foster, and Tujunga soils)

pm2 late Holocene arkosic alluvial gravel, sand, and overbank silt along the Merced River forming a prominent low terrace about 0.5-1.5 m above pm3 levels (Grangeville, Hanford, Foster, and Tujunga soils)

pm2f late Holocene alluvial sand, gravel, and silt along Dry Creek derived from foothill andesitic and metamorphic sources; grades into and interfingers with pm2 terrace alluvium of the Merced River west of this area (Honcut soils)

pmf undifferentiated Holocene alluvium from foothill sources (Honcut soils)

MODESTO FORMATION

Upper member includes:

m2 arkosic alluvial sand and underlying silt along the Merced River, not differentiated as to terrace level; represents glacial outwash from the core of the Sierra Nevada (Hanford, Oakdale, and Greenfield soils)

m2f locally (foothill) derived alluvial silt, sand, and gravel forming low terraces along Dry Creek and smaller drainages tributary to the Merced and Tuolumne Rivers; contains abundant volcanic and metamorphic detritus (Wyman, Marguerite, and some Honcut soils)

m2e arkosic eolian sand, moderately well sorted (Delhi soils)

lower member includes:

m1 arkosic alluvial sand associated with terraces at or slightly above the highest m2 level along the Tuolumne and Merced Rivers; represents glacial outwash from the core of the Sierra Nevada (Greenfield soils)

m1f locally (foothill) derived alluvial silt, sand, and gravel forming terraces along Dry Creek slightly above the m2f surfaces; contains abundant volcanic and metamorphic detritus (Ryer soils)

RIVERBANK FORMATION

upper unit includes:

r3 arkosic glacial outwash sand forming terraces at or slightly above and m1 and highest m2 levels along the Tuolumne and Merced Rivers (Snelling, Madera, and San Joaquin soils)

r3f locally (foothill) derived alluvial silt and sand forming terraces along Dry Creek and other small streams tributary to the Merced and Tuolumne Rivers slightly above m1f surfaces; contains abundant volcanic detritus derived from the Mehrten Formation (Yokohl, Snelling, Madera soils)

r3g locally derived gravelly alluvium graded to r3 and r3f levels (Redding, Keyes soils)

middle unit includes:

r2 arkosic glacial outwash sand forming terraces about 3-5 m above r3 levels along the Tuolumne and Merced Rivers (Snelling, San Joaquin soils)

r2f locally (foothill) derived alluvial silt, sand, and gravel forming terraces along streams tributary to the Merced and Tuolumne Rivers; terraces stand slightly above Modesto surfaces; contains abundant volcanic and metamorphic detritus (Yokohl, Snelling, San Joaquin soils)

lower unit includes:

r1 arkosic glacial outwash sand forming terrace remnants about 3-6 m above r2 levels along the Merced River (Snelling, San Joaquin soils)

TURLOCK LAKE FORMATION

upper unit includes:

t2 undifferentiated arkosic glacial outwash underlying rolling, hilly topography (Rocklin, Whitney soils)

t2u arkosic coarse sand and gravel forming upper part of the upper unit; underlies a hilly, rolling topography; represents coarse glacial outwash (Montpelier soils)

t2l arkosic fine sand, silt, and clay forming lower part of the upper unit; crops out on lower hillslopes below t2u; represents fine glacial outwash and rock flour from the core of the Sierra Nevada (Whitney, Rocklin soils)

lower unit includes:

t1 arkosic glacial outwash sand, silt, and pebble gravel; exposed only in valleys or on lower hillslopes where it underlies the upper unit (Montpelier, Rocklin, and Whitney soils)

NORTH MERCED GRAVEL

QTnm Thin, locally derived gravel veneer overlying a pediment surface cut across Tertiary and Mesozoic rocks in this area; stands slightly above the reconstructed Turlock Lake depositional surface (Redding soils)

LAGUNA FORMATION

Tl Thick gravel with subordinate sand and silt (beneath the gravel cap); derived from mixed metamorphic, volcanic, and granitic sources from the Tuolumne and Merced drainages (Redding and Corning, and Hopeton soils).

MEHRTEN FORMATION

Tm Mudstone, siltstone, sandstone, conglomerate, and lahars derived from andesitic volcanic centers near the crest of the Sierra Nevada (Raynor, Pentz, Peters, and Keyes soils)

VALLEY SPRINGS FORMATION

Tvs claystone, tuffaceous claystone, claystone, clayey sandstone, and vitric tuff

IONE FORMATION

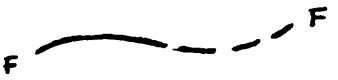
Ti varicolored anauxite-bearing sandstone, conglomerate, and kaolinitic claystone

UNDIFFERENTIATED BASEMENT ROCKS

Mzb slate and schist (Mariposa Group)

1/ The most characteristic soil series as mapped by Arkley (1954, 1964) are given in parenthesis after each unit description

DESCRIPTION OF MAP SYMBOLS



Fault

Topographic or Photolineament

Dashed where approximately located