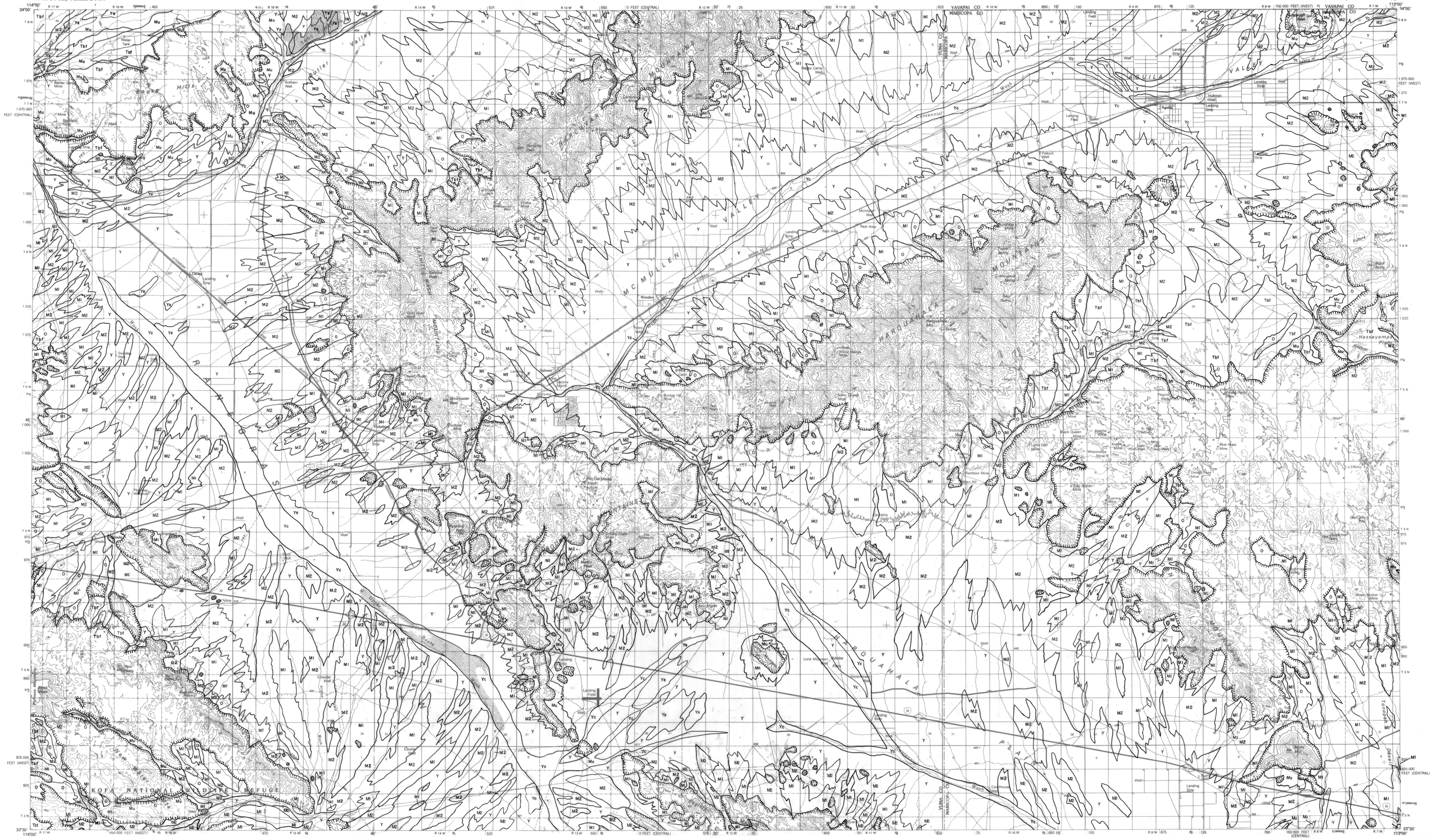

88-4

QUATERNARY GEOLOGIC MAP OF THE SALOME 30 x 60 MINUTE QUADRANGLE, WEST-CENTRAL ARIZONA

by

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Scale 1:100,000

1 0 1 5 10 miles

1 0 1 5 10 15 kilometers

1988

Introduction

The area within the Salome 30 x 60 minute quadrangle is part of the Sonoran Desert within the southern Basin and Range physiographic province. Landforms and geomorphic relationships in this area are products of several independent controlling variables, and as such, may serve as analogies for similar mountain/basin settings in adjacent areas of the southwestern U.S.

For this report, the intermontane surficial deposits have been defined and mapped in an attempt to decipher the general late Cenozoic alluvial history of this region. The geomorphic surfaces and associated soils have been divided into the following map units according to relative age: a pre-Quaternary basin-fill unit (TDf); an earliest Quaternary unit (O); two categories of middle Quaternary alluvium (M1 -- older and M2 -- younger); and three latest Quaternary units (Y -- terraces and alluvial fans, Ye -- eolian sand, and Yc -- active alluvium in major channels). The estimated numerical ages of the surfaces are inferred largely from radiometric dates and geologic studies in southwestern Arizona (especially Bull (in press), and Morrison and Menges, 1982). The distribution of Quaternary units used here provides a basis for evaluating temporal and spatial patterns of deposition on both basinal and regional scales.

The mapping is based primarily on interpretation of U2 high-altitude aerial photos (scale 1:125,000), supplemented locally by natural-color aerial photos (1:24,000). For verification of the photo-interpretation, unit designations and surface characteristics were evaluated at several sites in the field. This project was supported by the Arizona Geological Survey and the U.S.G.S. Cooperative Geologic Mapping (COGEOMAP) Program.

Aerial photographs were provided by Raymond A. Brady of the U.S. Bureau of Land Management.

Explanation of map units

The distinguishing features of the map units are described below, and indicate the criteria on which the mapping is based; estimated age ranges are also given. Morphologic and pedologic similarities between the units used here and those defined and locally dated by investigators working in adjacent regions are the primary basis for ascribing correlative age estimates to surfaces on the Salome quadrangle. The correlations were most extensively drawn from the mapping of Quaternary alluvial surfaces along the lower Colorado River by W.B. Bull, reported in Bull (in press). No dates have been obtained directly for the surfaces in the Salome area, and therefore the age assignments are only approximate. However, the inferred time scale for the units represents a reasonable interpretation of available data.

Unit	Estimated age (years)
Yc	≤ 1000

Confined to active and recently active deposits of major axial drainages. Primarily sand and silt (hue 7.5 to 5 YR); no soil development has occurred on any of the deposits.

Y ~1,000 - ~13,000

Represents inferred latest Quaternary (Holocene and latest Pleistocene) alluvial surfaces. Primarily underlain by well-sorted sand and silt, with local occurrences of fine gravels. Surfaces are very slightly (≤ 0.5 m relief) but abundantly dissected by active gullies and washes. Typically fine grained and smooth in appearance; remnant bar-and-swale topography preserved locally. Incipient to light varnish on mafic clasts where a surface pavement occurs. Surfaces exhibit minimal soil development -- the most strongly developed profiles contain cambic horizons (hue 7.5 YR) over stage I to II calcic horizons (Machette, 1985). (Soil great groups typically Torriorthents, Calciorthids, or Camborthids)

Ye 0 - ~13,000

Limited to zones of concentrated occurrence of sand dunes. Eolian sands are deposited on TDf, M2, and Y surfaces.

M2 ~11,000 - 250,000

Represents inferred late to middle Pleistocene alluvial surfaces. Underlain by deposits of sand and silt to coarse gravels; generally well-sorted. Surfaces are slightly to moderately dissected (~1 to 4 m above active channels). Remnants have smooth and fine-grained surfaces or planar gravelly pavement. Pavements commonly have moderate to dark varnish on mafic clasts. Soils on the remnants exhibit slightly to moderately developed textural B horizons (hue 7.5 to 5 YR), typically above a stage II to III calcic horizon (Camborthids to Haplargids).

M1 ~250,000 - 790,000

Interpreted to represent middle to early middle Pleistocene alluvial surfaces. Underlying materials include sand and fine gravels to large cobbles in general, moderately sorted. The surfaces are moderately dissected (~3 to 6 m above active channels). Surface remnants are generally rounded by erosion near edges, and have gravelly to cobbly capping pavements. The mafic clasts of the pavement are consistently darkly varnished, and the surface remnants typically appear among the darkest on the piedmont. Underlying soils are characterized by moderately to very strongly developed argillic horizons (hue 5 to 2.5 YR), commonly overlying a stage III to IV calcic horizon (Haplargids to Paleargids).

Mu ~11,000 - 790,000

Combination of M1 and M2 units (undifferentiated), primarily representing surface remnants in which the two units are mixed to a degree that precludes their differentiation or generalization at the present scale of mapping. In a few places, this broader designation is used because of uncertainty in estimating the age of a particular remnant.

O ~790,000 - 1,800,000

Inferred early Pleistocene alluvial surfaces. Underlain by coarse gravels and cobbles, with minor amounts of finer material; commonly occurs as a relatively thin veneer (1 to 5 m thick) unconformably overlying older basin fill or bedrock. The surfaces are relatively deeply dissected (~7 to 10 m above active channels). Surface remnants are comparatively small, occurring on generally well-rounded ridges between the entrenched channels. Pavement on the surfaces is not well preserved due to extensive erosion and (or) clast weathering. Remnants are typically covered with abundant fragments of pedogenic carbonate (many ≥5 mm thick), derived from brecciated laminar petrocalcic horizons and carbonate clast-coatings. The fragments and coated clasts commonly lend a lighter-colored appearance to these remnants. Soils are generally stripped by erosion, exposing remnants of stage V or VI petrocalcic horizons (Paleorthids).

TDf >~1,500,000

Upper Tertiary (Miocene-Pliocene) and perhaps locally earliest Pleistocene deposits of dominantly very coarse gravels to boulders. Deposits are highly dissected (>10 m relief) and original surfaces are not preserved; exposures commonly reveal a carbonate-indurated zone several meters thick near present surface. In places, especially near mountain fronts, deposits are unconformably overlain by veneers of younger alluvium.

Other map symbols

alluvial-unit contact

bedrock-alluvial contact

Depositional patterns, relationships, and controls

The mapped occurrence and distribution of Quaternary alluvial units in this area reflects the local late Cenozoic tectonic and climatic history and the lithologic setting. Basin and Range deformation waned here approximately 10 to 6 Ma, and significant faulting ceased completely by early in the Pliocene (Shafiqullah and others, 1980; Morrison and others, 1981). The pre-Quaternary basin-fill units represent the last major pulses of coarse-grained deposition in the region. The present-day landscape is consequently dominated by relatively low, highly embayed mountain ranges, and wide, gently sloping intermontane areas. Integration of previously closed basins into the exterior drainage systems of the Gila (for McMullen Valley and Harquahala Plain) and Colorado (for Ranegras Plain and Butler Valley) rivers was accomplished relatively soon after the end of Basin and Range deformation (Eberly and Stanley, 1978; Shafiqullah and others, 1980), and the existing relatively low-gradient washes and generally small depth of stream incision in this region do not indicate extensive downcutting during the Quaternary. A noteable exception is the extensive downcutting associated with the stream capture at the west end of the McMullen Valley by the drainage system in the Ranegras Plain. This incision reflects a higher original base level of the McMullen valley compared with the Ranegras Plain.

In this general setting of tectonic quiessence and base-level stability, the Quaternary erosional and depositional history has been primarily climatically controlled. With the onset of the Pleistocene, major, prolonged climatic oscillations induced periodic changes in the rates of weathering, erosion, and sedimentation; these fluctuations contributed to episodic abandonment of alluvial surfaces and shifts in the loci of deposition within the basins. The O map unit is interpreted to represent the first of these crossings of the threshold from deposition to erosion (Bull, 1979), near the beginning of the Pleistocene (Menges and McFadden, 1981; Morrison, 1985). Remnants of these oldest Quaternary surfaces are found almost exclusively immediately adjacent to the mountain fronts, where the relative coarseness of the deposits and entrenchment of the channels has favored their isolation and preservation above younger units.

Two discrete middle Quaternary units (M1 and M2) consistently occur on the broad piedmont areas, suggesting that the units may be generally time-correlative, respectively, across the region. Together, these two units dominate the piedmonts, but their respective relative abundance varies from basin to basin. Lithology may be an important factor influencing the dominant surface age of the piedmonts; where the mountain-range lithologies are more resistant, yielding generally coarser debris, the piedmonts tend to be characterized by a greater proportion of M1 surfaces, relative to younger Quaternary units. Conversely, where the supply of debris is generally finer, the older remnants may be more easily eroded and not as commonly preserved with distance from the mountain front. For example, the basaltic gravel mantles on M1 remnants along the northeastern sides of the Plomosa and New Water mountains may in part account for the preservation of these remnants near the basinward ends of the fan complexes; in contrast, the piedmonts along the Granite Wash and Harcuvar mountains, where the alluvial material has weathered to grussy sand, are characterized by a significantly greater proportion of M2 and Y surfaces.

The latest Quaternary surfaces (Y) generally dominate the distal ends of the piedmonts and the central portions of the basins. They are primarily underlain by sand and silt, presumably derived from long-term weathering of the mountains during a period of somewhat more effective moisture (i.e., cooler and/or wetter climate) in the late Pleistocene. The material was supplied to the piedmont with the onset of relatively more arid conditions during the Holocene, resulting in an episode of aggradation (Bull, 1979). The exclusively fine-grained alluvium presently being transported in major active channels is apparently largely reworked from older deposits, and reflects the modern conditions of reduced sediment supply and stream transport capacity.

References

Bull, W.B., 1979, Threshold of critical power in streams: Geol. Soc. Am. Bull., v. 90, p. 453-464.

-----, in press, Geomorphic Responses to Climatic Change: New York, Oxford University Press.

Eberly, L.D., and Stanley, T.B., 1978, Cenozoic stratigraphy and geologic history of southwestern Arizona: Geol. Soc. Am. Bull., v. 89, p. 921-940.

Machette, M.N., 1985, Calcic soils of the southwestern United States in Weide, D.L., ed., Quaternary Soils and Geomorphology of the American Southwest: Geol. Soc. Am. Special Paper 203, p. 1-21.

Menges, C.M., and McFadden, L.D., 1981, Evidence for a latest Miocene to Pliocene transition from Basin-Range tectonic to post-tectonic landscape evolution in southeastern Arizona: Arizona Geol. Soc. Digest, v. 13, p. 151-160.

Morrison, R.B., 1985, Pliocene/Quaternary geology, geomorphology, and tectonics of Arizona, in Soils and Quaternary Geology of the Southwestern United States: Geol. Soc. Am. Special Paper 203, p. 123-146.

Morrison, R.B., and Menges, C.M., 1982, Maps of Quaternary geology of Arizona (1:1,000,000-scale quadrangles): on file at U.S. Geological Survey, Denver, Colorado, and at Arizona Bureau of Geology and Mineral Technology, Tucson, Arizona.

Morrison, R.B., Menges, C.M., and Lepley, L.K., 1981, Neotectonic maps of Arizona, in Stone, C., ed.: Ariz. Geol. Soc. Digest, v. 13, p. 179-183.

Shafiqullah, M., Damon, P.E., Lynch, D.J., Reynolds, S.J., Rehrig, W.A., and Raymond, R.H., 1980, K-Ar geochronology and geologic history of southwestern Arizona and adjacent areas, in Jenny, J.P., and Stone, C., eds., Studies in western Arizona: Ariz. Geol. Soc. Digest, v. 12, p. 201-260.

Revised August, 1990

PREPARED IN COOPERATION WITH THE U.S. GEOLOGICAL SURVEY COOPERATIVE GEOLOGIC MAPPING (COGEOMAP) PROGRAM #14-08-001-A0378

ABGMT OFR 88-4