GEOLOGIC CROSS-SECTIONS OF WESTERN ARIZONA BASIN AND RANGE WITH ACCOMPANYING GEOLOGIC MAPS AND OTHER INFORMATION

by

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These cross-sections and maps fulfill part of a project for the U.S. Geological Survey under cooperative agreement NO. 14-08-001-A-0092 (Geologic Characterization of the Basin and Range Province), as a means of characterizing the surface and subsurface geology of western Arizona, ultimately as an aid to better understand regional hydrology. The northeast-trending cross sections (AT-1 to AT-20) were constructed, with some modifications, along alternate cross-section lines drawn by Carl Richardson (Arizona Geological Society Digest, v. 10, p. 1-6), with a vertical exaggeration of 10x. The downvalley cross-sections (AL-1 to AL-15) were constructed to approximate valley-center conditions. The constructions utilized all available recent geological literature as shown on reference sheets 26-35. Comparison of Mr. Richardson's geologic interpretations with those of the present report are some indication of the data accumulated in the past decade since his were open-filed.

New geologic work in the region has disclosed the presence of two geologic events that have juxtaposed unlike terranes along low angle faults, Cretaceous

thrusting, and mid-Tertiary detachment. The geologic complexity, the lack of detailed work, and lack of subsurface information in the region all make many of the interpretations of fault positions presented rather speculative. In particular, the subsurface extent of the Cretaceous thrust terrane, and the overall geometry of the deformation associated with mid-Tertiary extensional tectonics are especially poorly known. In addition, there is much talk at this writing of basement arching having produced structural relief in the region, at least along the line of metamorphic core complexes. So arches have been incorporated in the diagrams where appropriate.

An accompanying 1:500,000 topographic base map in 2 sheets (sheets 2 and 3) shows the position of the cross-sections. The geology used in the cross-sections is depicted as geologic maps in sheets 18-21. Gravity anomalies and basin bounding fault positions that aided construction of basin geometries and depths are shown in sheets 22-25.

Acknowledgments: Susan Calder assisted tremendously in initial literature search, data compilation, map compilation, cross-section drawing and general organization of the project. Ryan Anthony meticulously hand drafted the cross-sections. Jon Spencer added some information from his and Steve Reynolds' field area in the western part of the Phoenix 2^{o} sheet.

Accompanying sheets of this report are numbered as follows:

Sheet # 1 Explanation, legend, and index to maps and cross-sections (reproduced in this summary).

Sheet # 2 and 3 - 1:500,000 topographic base map showing cross-section lines.

Sheets # 4-17 - Cross-sections, horizontal scale 1:250,000.

Sheet # 18 Las Vegas - Kingman - Williams Sheets geology.

Sheet # 19 Needles - Prescott Sheets geology.

Sheet # 20 Salton Sea - Phoenix Sheets geology.

Sheet # 21 El Centro - Lukeville Sheets geology.

Sheet # 22 Las Vegas - Kingman - Williams Sheets gravity and faults.

Sheet # 23 Needles - Prescott Sheets gravity and faults.

Sheet # 24 Salton Sea - Phoenix Sheets gravity and faults.

Sheet # 25 El Centro - Lukeville Sheets gravity and faults.

Sheet # 26 Index of published geologic maps in western Arizona (1:1,000,000 scale).

Sheet # 27 Location map of cross-sections, wells with stratigraphic information, and theses and dissertations on western Arizona geology (1:1,000,000 scale).

The following sheets, scale 1:250,000 indicate map areas covered by all published geological reports:

Sheet # 28 Phoenix Quad

Sheet # 29 Prescott Quad

Sheet # 30 Salton Sea Quad

Sheet # 31 Kingman Quad

Sheet # 32 Williams Quad

Sheet # 33 Needles Quad

Sheet # 34 El Centro Quad

Sheet # 35 Ajo Quad

Sheets 18-35 are 1:250,000 scale, corresponding to the horizontal scale of the cross-sections.

Symbol On Cross Sections	
Tpb	Pliocene Bouse Formation (basal marlstones, upper interbedded sands and clays; marginal calcareous tufa). (Labeled Plb on 1:250,000 geologic maps)
Mmf	Miocene-Pliocene(?) Muddy Creek Formation (QTs unit named in Lake Mead region). (shown as Mmf on geologic maps)
QTs	Quaternary-Tertiary (undivided) sedimentary rocks that fill Basin and Range grabens or half-grabens, mostly post-12 m.y. in age; consist of piedmont gravelly facies and valley center fluvial, lacustrine, and playa facies. Evaporites (halite, gypsum, anhydrite) are locally common.
Mie	Miocene dikes, plugs.
Mib	Miocene basaltic rocks. 15-2 m.y. old.
Tb	Tertiary basalts, 23-17 m.y. old.
Tv	Tertiary volcanics (andesites to rhyolites, flows and ash-flow tuffs, domes; with minor intercalated volcanoclastic sediments and basalts).
Ti	Tertiary intrusive plugs, domes sills.

Ti	Tertiary intrusive plugs, domes sills.
Ts	Tertiary sediments, undifferented; contained in, or under, Tv.
Ki	Laramide silicic plutons (granites, few diorites), 85-45 m.y. ages.
KTm	Cretaceous-Tertiary mylonitic gneisses (* see description below).
Mzs	Mesozoic sediments (sandstones, conglomerates, volcanoclastic sediments, minor evaporites-gypsum.
Mv	Mesozoic volcanics (rhyolites-rhyodacites, containing flows and ash-flow tuffs).
Mg	Mesozoic (Jurassic ?) granites.
Mm	Mesozoic sedimentary protoliths metamorphosed to quartzofeldspathic schist, etc.
PM	Complex tectonically interleaved Paleozoic and Mesozoic sedimentary rocks.
Pz	Paleozoic sedimentary rocks (sandstone, calcareous sandstone, limestone, shales), now metamorphosed for the most part to equivalent metamorphic rocks.
pCg	Precambrian granites-quartz monzonites (~ 1400-1700 m.y. ages).

pCm Precambrian metamorphic rocks (gneisses, schist).

pCv Precambrian volcanics, now metamorphosed.

Notes on rock units:

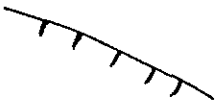
Small plugs, etc. enclosed with Tv or Tb terrains that are labeled "Ki" are all "Ti". True "Ki" is found in Ajo and El Centro Sheets (Southern Arizona batholith) and in Williams-Kingman sheets as moderate-sized granite plutons.

* KTm - Zone of ductile shear immediately below extensive detachment fault zone(s), perceived to have been produced in Laramide (?)- middle Tertiary time by either compressional or extensional tectonics; produced "gneisses" from protolith rocks including Mg, pCg, pCm, Pz, and PM. KTm rocks now warped into northeast-trending anticlinal arches and exposed in certain ranges (Buckskins, Rawhides, Harcuvars, Harquahulas, South Mountain, Santa Catalina-Rincon-Tortolitas). The Arching-uplift event took place before high angle Basin and Range faulting, probably ~ 25-13 m.y. ago.

Note on depth of Qts "basin fill": Depth ranges of QTs (numbers given in parentheses within QTs areas on cross-sections) are best guesses based on (1) depth to bedrock map of Oppenheimer and Sumner, (AGS Digest v. 13, p. 111-), (2) drill hole data, and (3) basement outcrop patterns. Gravity data points are relatively scarce in parts of western Arizona (as seen in Oppenheimer and Sumner) and so corresponding basin details are lacking. True depths of QTs are usually (not always) rather more shallow than gravity maps indicate, probably due to buried thicknesses of light Tv and Tvs units, above crystalline "basement".

on 1:250,000 maps

low or moderate-angle fault, teeth on upper plate. "Thrust fault". Cretaceous, and Miocene age for various faults in this category.



location of basal detachment fault that floors detached terrain, usually consisting of Tv, Tb, Ts units that are depositional or older crystalline rocks. Hatched lines on upper plate (detached terrane) side.