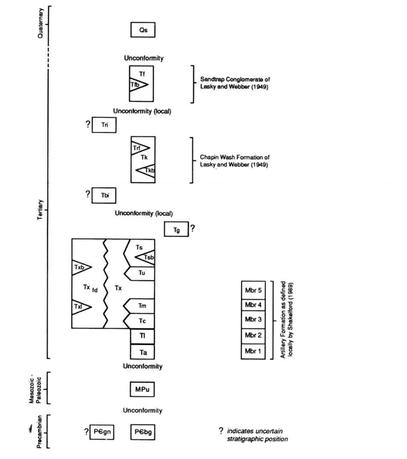
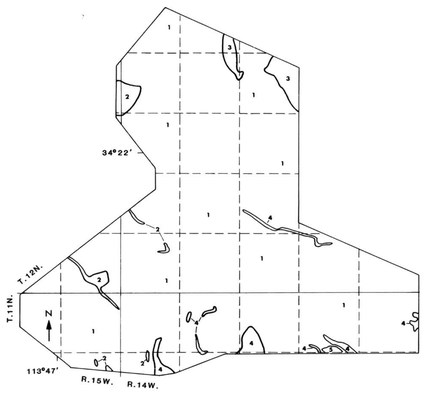
CORRELATION OF MAP UNITS



SOURCES OF DATA



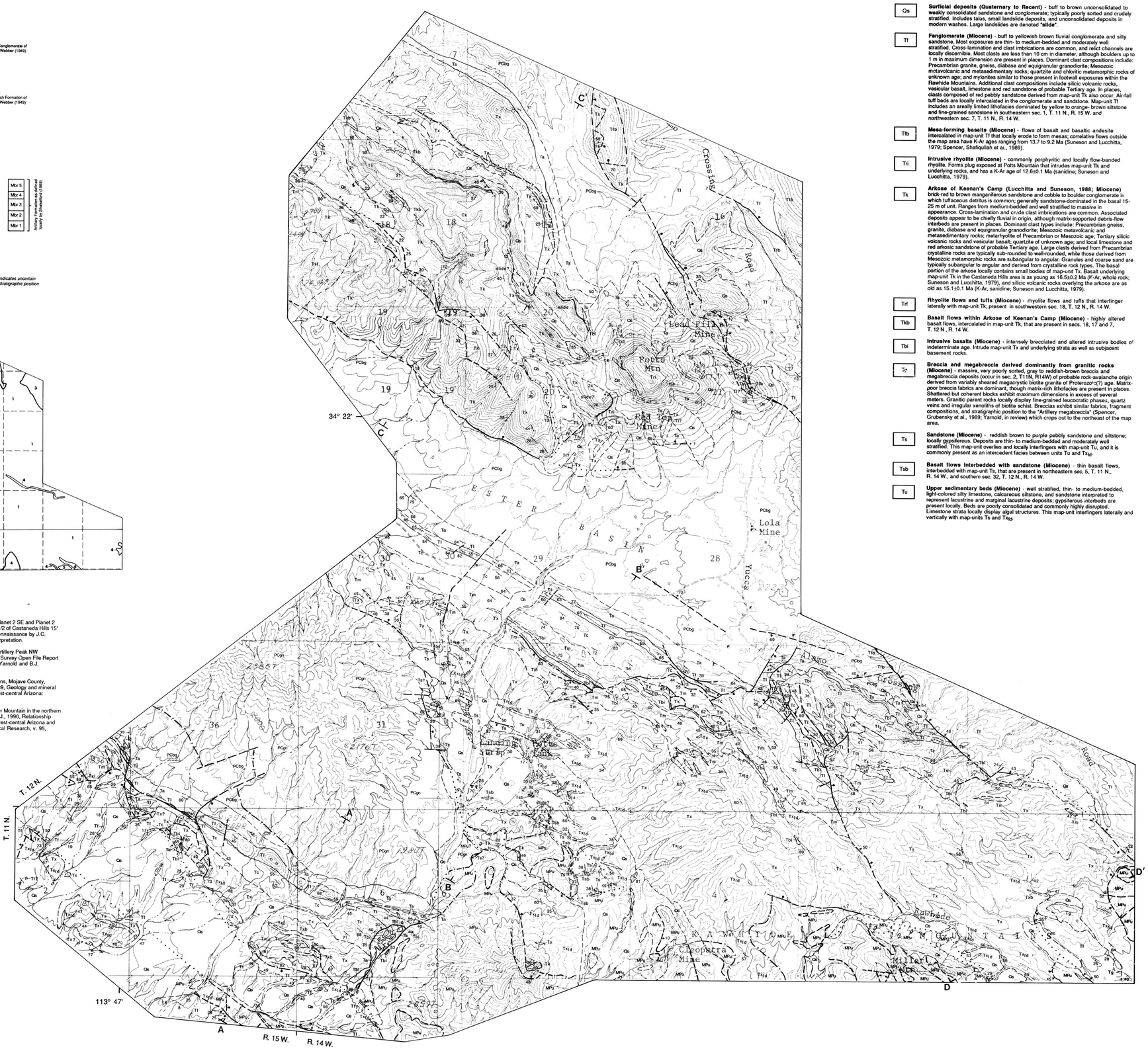
1 -- J.C. Yarnold and B.J. McDaniel - this report.

2 -- Ivo Lucchitta and Neil Suneson - Geologic map of the Planet 2 SE and Planet 2 NE, Arizona, quadrangles (together comprise eastern 1/2 of Castaneda Hills 15' Quadrangle), unpublished (scale 1: 24,000). Also, reconnaissance by J.C. Yarnold and B.J. McDaniel and aerial photography interpretation.

3 -- Ivo Lucchitta and Neil Suneson - Geologic map of the Artillery Peak NW quadrangle, Mohave County, Arizona: U.S. Geological Survey Open File Report 85-277, scale 1:24,000. Also, reconnaissance by J.C. Yarnold and B.J. McDaniel.

4 -- T.J. Shakelford - Geologic map of the Rawhide Mountains, Mojave County, Arizona, *in* Spencer, J.E. and Reynolds, S.J., eds., 1989, Geology and mineral resources of the Buckskin and Rawhide Mountains, west-central Arizona: Arizona Geological Survey Bulletin 198, plate 1.

5 -- J.E. Spencer and S.J. Reynolds - Geologic map of Miller Mountain in the northern Rawhide Mountains, *in* Spencer, J.E. and Reynolds, S.J., 1990, Relationship between Mesozoic and Cenozoic tectonic features in west-central Arizona and adjacent southeastern California: Journal of Geophysical Research, v. 95, p. 539-555, fig. 5.



DESCRIPTION OF MAP UNITS

Qs **Surficial deposits (Quaternary to Recent)** - buff to brown unconsolidated to weakly consolidated sandstone and conglomerate; typically poorly sorted and crudely stratified. Includes talus, small landslide deposits, and unconsolidated deposits in modern washes. Large landslides are denoted "**slide**".

Tf **Fanglomerate (Miocene)** - buff to yellowish brown fluvial conglomerate and silty sandstone. Most exposures are thin- to medium-bedded and moderately well stratified. Cross-lamination and clast imbrications are common, and relict channels are locally discernible. Most clasts are less than 10 cm in diameter, although boulders up to 1 m in maximum dimension are present in places. Dominant clast compositions include: Precambrian granite, gneiss, diabase and equigranular granodiorite; Mesozoic metavolcanic and metasedimentary rocks; quartzite and chloritic metamorphic rocks of unknown age; and mylonites similar to those present in footwall exposures within the Rawhide Mountains. Additional clast compositions include silicic volcanic rocks, vesicular basalt, limestone and red sandstone of probable Tertiary age. In places, clasts composed of red pebbly sandstone derived from map-unit Tk also occur. Air-fall tuff beds are locally intercalated in the conglomerate and sandstone. Map-unit Tf includes an areally limited lithofacies dominated by yellow to orange- brown siltstone and fine-grained sandstone in southeastern sec. 1, T. 11 N., R. 15 W. and northwestern sec. 7, T. 11 N., R. 14 W.

Tfb **Mesa-forming basalts (Miocene)** - flows of basalt and basaltic andesite intercalated in map-unit Tf that locally erode to form mesas; correlative flows outside the map area have K-Ar ages ranging from 13.7 to 9.2 Ma (Suneson and Lucchitta, 1979; Spencer, Shafiqullah et al., 1989).

Tri **Intrusive rhyolite (Miocene)** - commonly porphyritic and locally flow-banded rhyolite. Forms plug exposed at Potts Mountain that intrudes map-unit Tk and underlying rocks, and has a K-Ar age of 12.6±0.1 Ma (sanidine; Suneson and Lucchitta, 1979).

Tk **Arkose of Keenan's Camp (Lucchitta and Suneson, 1988; Miocene)** brick-red to brown manganiferous sandstone and cobble to boulder conglomerate in which tuffaceous detritus is common; generally sandstone-dominated in the basal 15-25 m of unit. Ranges from medium-bedded and well stratified to massive in appearance. Cross-lamination and crude clast imbrications are common. Associated deposits appear to be chiefly fluvial in origin, although matrix-supported debris-flow interbeds are present in places. Dominant clast types include: Precambrian gneiss, granite, diabase and equigranular granodiorite; Mesozoic metavolcanic and metasedimentary rocks; metarhyolite of Precambrian or Mesozoic age; Tertiary silicic volcanic rocks and vesicular basalt; quartzite of unknown age; and local limestone and red arkosic sandstone of probable Tertiary age. Large clasts derived from Precambrian crystalline rocks are typically sub-rounded to well-rounded, while those derived from Mesozoic metamorphic rocks are subangular to angular. Granules and coarse sand are typically subangular to angular and derived from crystalline rock types. The basal portion of the arkose locally contains small bodies of map-unit Tx. Basalt underlying map-unit Tk in the Castaneda Hills area is as young as 16.5±0.2 Ma (K-Ar, whole rock; Suneson and Lucchitta, 1979), and silicic volcanic rocks overlying the arkose are as old as 15.1±0.1 Ma (K-Ar, sanidine; Suneson and Lucchitta, 1979).

Trf **Rhyolite flows and tuffs (Miocene)** - rhyolite flows and tuffs that interfinger laterally with map-unit Tk; present in southwestern sec. 18, T. 12 N., R. 14 W.

Tkb **Basalt flows within Arkose of Keenan's Camp (Miocene)** - highly altered basalt flows, intercalated in map-unit Tk, that are present in secs. 18, 17 and 7, T. 12 N., R. 14 W.

Tbi **Intrusive basalts (Miocene)** - intensely brecciated and altered intrusive bodies of indeterminate age. Intrude map-unit Tx and underlying strata as well as subjacent basement rocks.

Trp **Breccia and megabreccia derived dominantly from granitic rocks (Miocene)** - massive, very poorly sorted, gray to reddish-brown breccia and megabreccia deposits (occur in sec. 2, T11N, R14W) of probable rock-avalanche origin derived from variably sheared megacrystic biotite granite of Proterozoic(?) age. Matrix-poor breccia fabrics are dominant, though matrix-rich lithofacies are present in places. Sheared but coherent blocks exhibit maximum dimensions in excess of several meters. Granitic parent rocks locally display fine-grained leucocratic phases, quartz veins and irregular xenoliths of biotite schist. Breccias exhibit similar fabrics, fragment compositions, and stratigraphic position to the "Artillery megabreccia" (Spencer, Grubensky et al., 1989; Yarnold, *in review*) which crops out to the northeast of the map area.

Ts **Sandstone (Miocene)** - reddish brown to purple pebbly sandstone and siltstone; locally gypsiferous. Deposits are thin- to medium-bedded and moderately well stratified. This map-unit overlies and locally interfingers with map-unit Tu, and it is commonly present as an intercedent facies between units Tu and Tx_{fd}.

Tsb **Basalt flows interbedded with sandstone (Miocene)** - thin basalt flows, interbedded with map-unit Ts, that are present in northeastern sec. 5, T. 11 N., R. 14 W., and southern sec. 32, T. 12 N., R. 14 W.

Tu **Upper sedimentary beds (Miocene)** - well stratified, thin- to medium-bedded, light-colored silty limestone, calcareous siltstone, and sandstone interpreted to represent lacustrine and marginal lacustrine deposits; gypsiferous interbeds are present locally. Beds are poorly consolidated and commonly highly disrupted. Limestone strata locally display algal structures. This map-unit interfingers laterally and vertically with map-units Ts and Tx_{ls}.

Tx **Breccia and megabreccia derived dominantly from Mesozoic metamorphic rocks (Miocene); locally exhibits fluvial- and debris-flow-dominated lithofacies (Tx_{fd}) and limestone-dominated lithofacies (Txl)** - poorly stratified, greenish-gray to red breccia and megabreccia deposits of debris-flow and rock-avalanche origin interleaved with subordinate beds of fluvial sandstone and conglomerate as well as fine-grained lacustrine rocks. Breccia deposits are composed of angular to subrounded fragmented debris, and exhibit maximum clast sizes ranging from a few meters to tens of meters. Conglomerates typically exhibit subrounded clasts that locally are well imbricated. Predominant clast types are Mesozoic greenschist-grade metavolcanic and metasedimentary rocks and quartzite of unknown age; other minor clast types include metamorphosed carbonate rocks of Paleozoic age and Precambrian granitic rocks. The upper portion of this unit contains debris derived from gneissic rocks with pronounced feldspar augen (~1-2 cm in long dimension) in sec. 17, T. 12 N., R.14 W. Map-unit Tx occurs both as a thick, laterally extensive wedge that interfingers laterally with map-units Tm,Tu and Ts, and as thin lenses isolated within separate map units. Tx_{fd} indicates general areas where fluvial and debris-flow facies are dominant. **Txl** indicates localities (in southwest part of map area) where abundant limestone and siltstone interbeds of lacustrine origin occur.

Txb **Basalt flows interbedded with breccia (Miocene)** - thin basalt flows, interbedded with map-unit Tx, that are present in the southeastern corner of sec. 1, T. 11 N., R. 15 W.

Tm **Middle sedimentary beds (Miocene)** - well stratified, thin- to medium-bedded, calcareous siltstone, silty limestone, and sandstone interpreted to represent marginal lacustrine deposits. Limestone strata commonly display algal features and irregular chert bands and nodules. Lower portion of unit is reddish brown and gradational with map-unit Tc. Middle and upper portions of unit range from yellow to gray to pink, and fissile and platey textures are common. This map-unit interfingers laterally and vertically with map-unit Tx_{fd}.

Tc **Conglomeratic sandstone (Miocene or Oligocene)** - moderately to well stratified, reddish-brown to green, pebbly arkosic sandstone and rounded pebble conglomerate with well-imbricated ellipsoidal clasts. Cross-lamination is common and relict channels are locally discernible. Tuffaceous detritus is abundant, particularly in upper portion of unit. Dominant clast types include: Mesozoic metavolcanic and metasedimentary rocks; chert and white quartzite of unknown age; and metarhyolite of Precambrian or Mesozoic age. Large clasts composed of limestone of probable Tertiary age also occur in the southeast part of the map area.

Tl **Lower sedimentary beds (Miocene or Oligocene)** - a well-stratified sequence of sandstone, siltstone and lacustrine limestone in which tuffaceous detritus is common. The unit is typically dominated by reddish brown sandstone and yellow siltstone near the base, but contains an increasing amount of gray, indurated limestone toward the top. Limestone beds locally contain silicified rootlets, chert nodules and sandy turbidite lithofacies. Pebbly interbeds display mainly Precambrian crystalline clast types, except near the top of the unit where significant amounts of Mesozoic metavolcanic detritus are locally present. In the Artillery Peak area, sedimentary rocks inferred to be correlative with this map-unit (Yarnold, in press) contain a silicic tuff with K-Ar (biotite) ages ranging from 23.0 Ma to 26.57± 0.15 Ma (see Yarnold, in press, for references).

Ta **Basal sandstone and conglomerate (Miocene or Oligocene)** - reddish-orange to brown granular sandstone and conglomerate derived predominantly from Precambrian crystalline rocks. Contains white to light green, lenticular reduction spots and thin, heavy-mineral-rich horizons. Granules and small pebbles are typically subangular to angular, while larger clasts are commonly subrounded. Beds are moderately to well stratified, and cross-lamination is common. Deposits are dominantly fluvial in origin with rare debris-flow interbeds. Cobble to boulder conglomerate facies locally crop out near the basal contact and contain clasts of Precambrian granite and gneiss, metarhyolite of Precambrian or Mesozoic age, and white to red quartzite; clasts derived from Mesozoic metamorphic rocks are also present locally and increase in relative abundance toward southeast part of map area. This map unit fines and grades upward into overlying sedimentary beds.

MPu **Metamorphic and igneous rocks, undifferentiated (Mesozoic and Paleozoic)** - dominant rock types include: white, gray and brown, variably cherty, metamorphosed limestone and dolomite interbedded with white to greenish-gray quartzite and green to purple phyllite (Paleozoic); green to brown quartz-mica-feldspar schist (Mesozoic) with small (1-2 mm) quartz and feldspar phenocrysts, interpreted to represent metamorphosed volcanic and sedimentary rocks; and green to reddish-brown, coarse-grained alkali grnite (Mesozoic?).

PCgn **Gneiss (Precambrian?)** - green to pink or gray, highly sheared and weathered granitic gneiss. Weakly to well foliated; locally displays a streaky mineral lineation. Locally intruded by diabase dikes. Although these gneissic rocks somewhat resemble Tertiary mylonitic rocks present in footwall exposures in the Rawhide Mountains (interpreted to be equivalent by Suneson, 1980), the authors agree with Shakelford (1989) in his interpretation that the rock types are distinct, and that their associated deformational events are probably unrelated. Quartz "blebs" within map-unit PCgn appear less continuous than in the lower-plate mylonites. In addition, fabric data from map-unit PCgn provided by Shakelford (1989) and Suneson (1980) indicate dominantly SE-NW orientated lineations; this contrasts with the SW-NE trend typically exhibited by footwall mylonites. Shakelford (1989) suggested that deformation associated with map-unit PCgn was probably Precambrian or Mesozoic. The contact between this unit and map-unit PCbg in sec. 36 (T. 12 N., R. 15 W.) and sec. 1 (T. 11 N., R. 15 W.) is ambiguous in nature and is interpreted here as a fault (querried), though it was interpreted by Shakelford to be an intrusive contact.

PCbg **Biotite granite (Precambrian)** - reddish brown to gray, medium- to coarse-grained, weakly to non-foliated, porphyritic biotite granite. Commonly highly weathered and brecciated. Locally intruded by pegmatite, aplite, quartz and dark green to gray dissabe of probable Proterozoic age.

MAP SYMBOLS

CONTACT: Depositional or intrusive; dashed where approximately located or gradational, dotted where concealed.

FAULT: Dashed where approximately located or inferred, dotted where concealed, querried where conjectural. Arrow indicates direction and amount of dip.

NORMAL FAULT: Dashed where approximately located or inferred, dotted where concealed, querried where conjectural. Arrow indicates direction and amount of dip. Bar and ball on hanging-wall block.

STRIKE AND DIP OF BEDDING: Where leader present, dot shows location of measurement.

ANTICLINE: Shows crestline and direction and amount of plunge.

LEADER CONNECTING AREAS OF SAME ROCK UNIT

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PRELIMINARY GEOLOGIC MAP OF TERTIARY SEDIMENTARY ROCKS IN THE NORTHERN RAWHIDE MOUNTAINS, MOHAVE COUNTY, ARIZONA

by

John C. Yarnold and Brett J. McDaniel

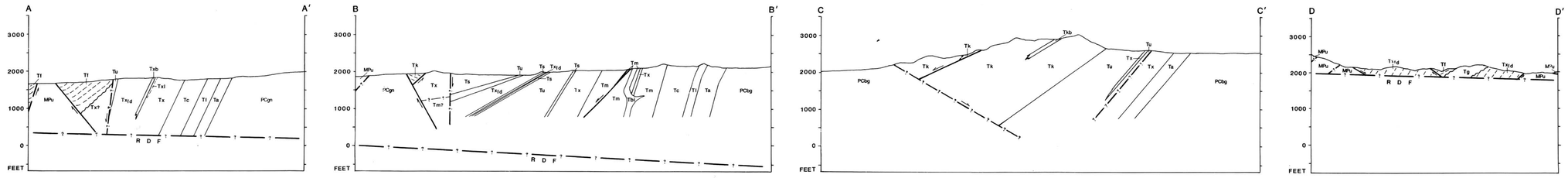
1992

TRUE NORTH

SCALE: 1:18,000

0 1 mi.

0 1 km



Quaternary units omitted

Elevation of Rawhide detachment fault (RDF) extrapolated from Shakelford's (1989) contour map of detachment surface

Arizona Geological Survey Contributed Map CM-92-B