A FIELD GUIDE TO THE NORTHWESTERN GRANITE WASH MOUNTAINS,

WEST-CENTRAL ARIZONA

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This report is preliminary and has not been edited or reviewed for conformity with Arizona Bureau of Geology and Mineral Technology standards.

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1983 AGS Fall Field Trip Route

Led by
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Arizona Bureau of Geology and Mineral Technology

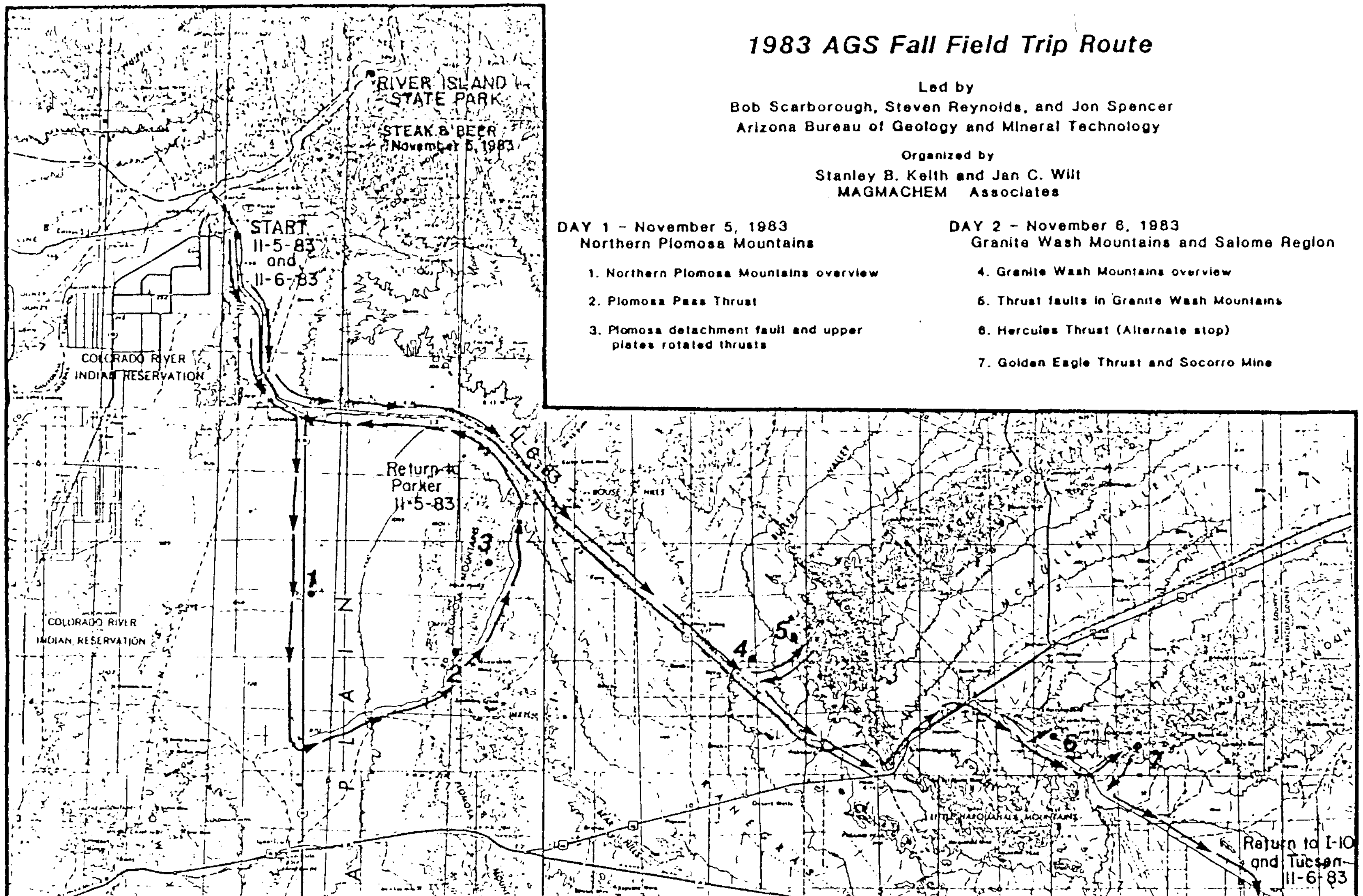
Organized by
Stanley B. Keith and Jan C. Wilt
MAGMACHEM Associates

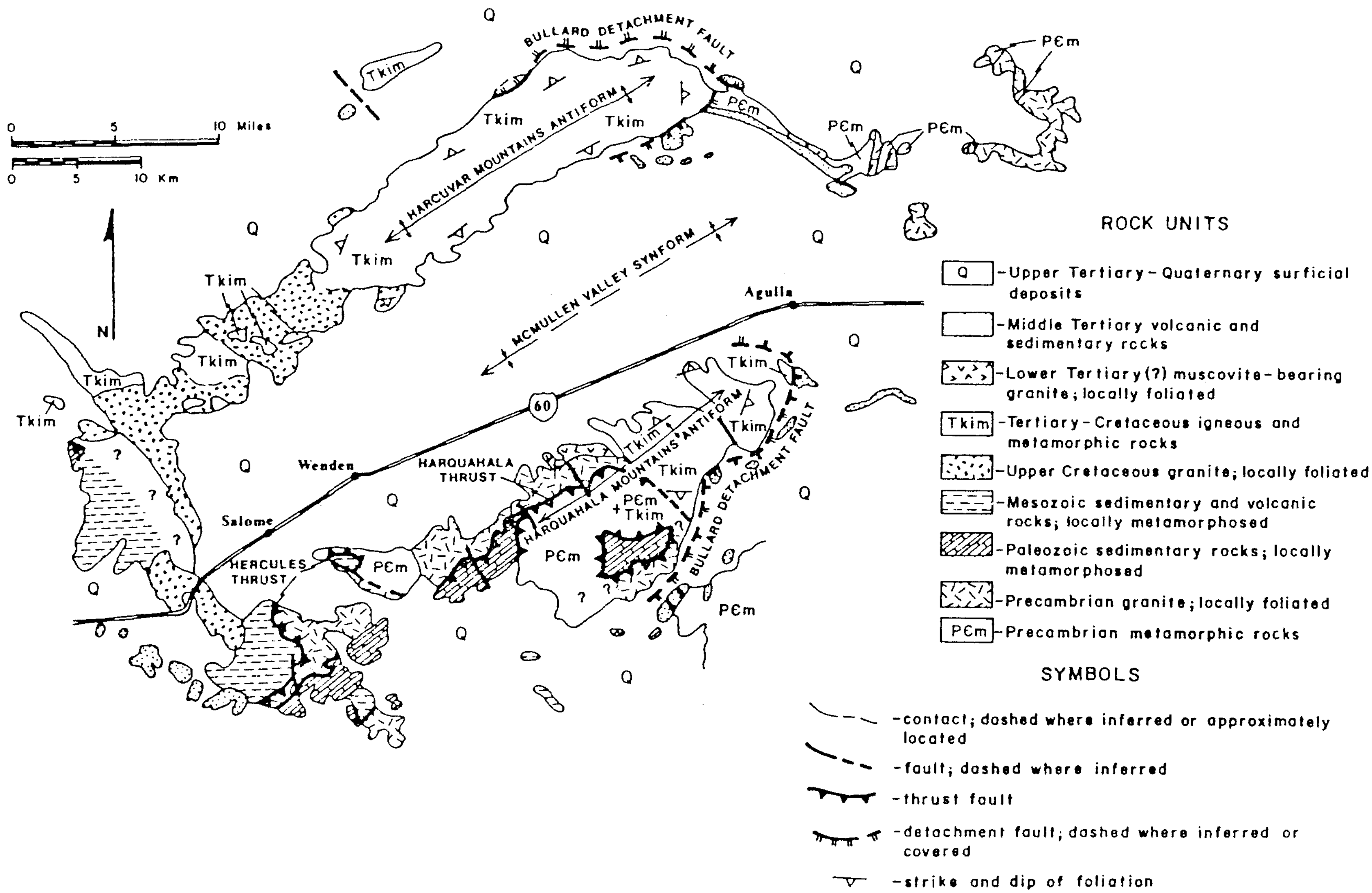
DAY 1 - November 5, 1983
Northern Plomosa Mountains

1. Northern Plomosa Mountains overview
2. Plomosa Pass Thrust
3. Plomosa detachment fault and upper plates rotated thrusts

DAY 2 - November 6, 1983
Granite Wash Mountains and Salome Region

4. Granite Wash Mountains overview
5. Thrust faults in Granite Wash Mountains
6. Hercules Thrust (Alternate stop)
7. Golden Eagle Thrust and Socorro Mine




BULLARD DETACHMENT FAULT
HARCUVAR MOUNTAINS ANTIFORM
MCMULLEN VALLEY SYNFORM
HARQUAHALA MOUNTAINS ANTIFORM
HARQUAHALA THRUST
HERCULES THRUST
Aguila
Wenden
Salome
60
Tkim
PЄm
Q
0 5 10 Miles
0 5 10 Km
N
ROCK UNITS
Q -Upper Tertiary-Quaternary surficial deposits
-Middle Tertiary volcanic and sedimentary rocks
-Lower Tertiary(?) muscovite-bearing granite; locally foliated
Tkim -Tertiary-Cretaceous igneous and metamorphic rocks
-Upper Cretaceous granite; locally foliated
-Mesozoic sedimentary and volcanic rocks; locally metamorphosed
-Paleozoic sedimentary rocks; locally metamorphosed
-Precambrian granite; locally foliated
PЄm -Precambrian metamorphic rocks
SYMBOLS
-contact; dashed where inferred or approximately located
-fault; dashed where inferred
-thrust fault
-detachment fault; dashed where inferred or covered
-strike and dip of foliation

INTRODUCTION

The Granite Wash Mountains are one of the most structurally complicated mountain ranges in Arizona. The northern part of the range is composed of an imbricate stack of structurally interleaved Mesozoic sedimentary and volcanic rocks, Paleozoic strata, and Precambrian crystalline rocks. As part of the 1983 AGS Fall field trip, we will briefly examine the lithologies, structures, and mineralization in the northern part of the range. The geology and mineral deposits of the Granite Wash Mountains are currently being studied as part of an Arizona Bureau of Geology and Mineral Technology geological mapping project in the Phoenix 1x2 degree sheet. Geologic research in the range is not yet finished, so all conclusions and opinions discussed in this field trip guide must be considered **PRELIMINARY.**

With the exception of a thesis by Ciancanelli(1965), previous geologic research in the area is limited to reconnaissance studies (Wilson, 1960; Marshak, 1979; Rehrig and Reynolds, 1980; Reynolds, 1980, 1982) and somewhat cursory examinations of gold mines of the area (see references in Keith, 1978).

REGIONAL GEOLOGIC SETTING

The Granite Wash Mountains are located in west-central Arizona, a geologically complex and poorly understood part of the southern Basin and Range Province. The region is situated northeast of the Mesozoic batholith belt and southwest of the relatively stable Colorado Plateau, and has geologic characteristics intermediate between those of the two flanking areas. Precambrian crystalline rocks are widely exposed in this medial belt, whereas they have been largely obliterated by plutonism in the batholith belt and are covered by flat-lying Paleozoic and Mesozoic strata in the Colorado Plateau. Consistent with this medial position, west-central Arizona was the site of scattered Mesozoic-Cenozoic plutonism and metamorphism. The region also experienced multiple episodes of post-Paleozoic thrusting and deformation. The Paleozoic stratigraphy of the region is thin and cratonic, and Precambrian crystalline rocks are clearly involved in thrusting.

West-central Arizona can be subdivided into three lithologically distinct tectonic terranes whose boundaries are zones of intense deformation (Harding and others,1983). The northernmost terrane, consisting of Precambrian crystalline rocks with an overlying cover of cratonic Paleozoic strata and Mesozoic volcanic and sedimentary rocks, represents the southwestern limit of unequivocal North American craton. In at least two mountain ranges, this terrane has been thrust southward over Mesozoic volcanic and sedimentary rocks of the McCoy terrane. On its southern margin, the McCoy terrane has been overthrust by the composite San Gabriel-Joshua Tree terrane along the north- to northeast-vergent Mule Mountains Thrust and related structures

(Tosdal,1982; Harding, 1982). The San Gabriel-Joshua Tree terrane is largely composed of Precambrian crystalline rocks of uncertain affinity to North America (Powell, 1981).

The Granite Wash Mountains lie near or on the tectonic boundary between cratonic North America and the McCoy terrane. Regionally, this boundary is marked by a gently to moderately dipping thrust fault that separates two fundamentally distinct lithologic assemblages. The pre-Cenozoic stratigraphic sequence of the North American block includes: 1) a basement of Precambrian metamorphic and granitic rocks; 2) a 1-1.5 km-thick sequence of cratonic Paleozoic strata; 3) up to 2 km of intermediate to felsic volcanics of probable Jurassic age; and 4) a clastic unit of Jurassic or Cretaceous age that is nowhere more than 3 km thick. In contrast, the McCoy terrane is composed entirely of Mesozoic rocks, consisting of a thick lower unit of volcanic rocks whose base is not exposed, and an upper clastic sequence that is locally in excess of 7 km thick. The upper clastic sequences of the McCoy and North American terranes, although in similar stratigraphic positions, are stratigraphically and petrographically distinct (Harding, 1982). The name McCoy Mountains Formation is applied to the thick clastic sequences in the McCoy terrane, whereas the thinner sequences of the North American block are referred to as Apache Wash Formation (Harding, 1982). Both terranes and their mutual tectonic boundary have been locally intruded by late Mesozoic granitoids and depositionally overlapped by mid-Cenozoic volcanic and sedimentary rocks.

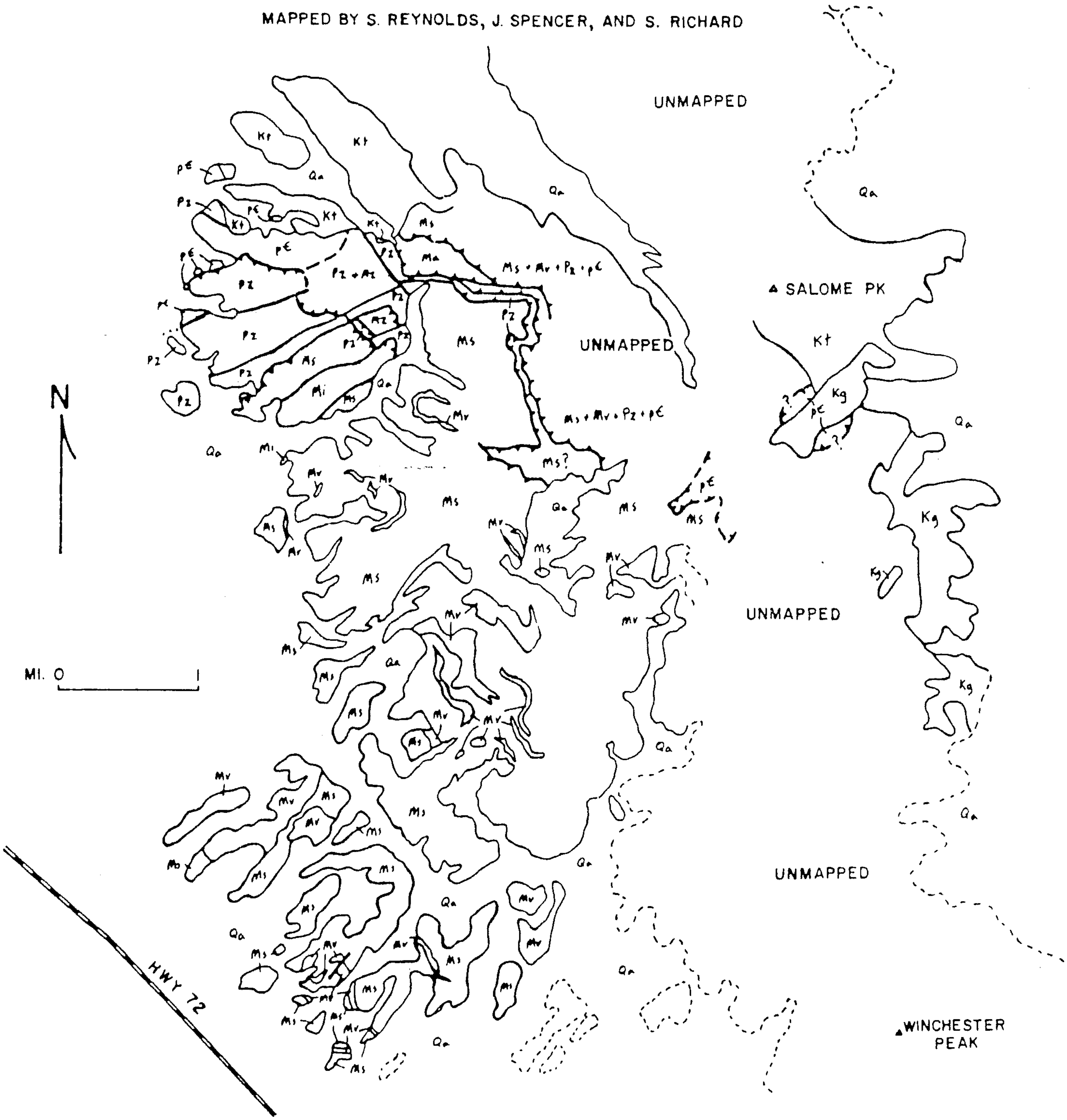
GEOLOGY OF THE GRANITE WASH MOUNTAINS

The Granite Wash Mountains are primarily composed of Mesozoic sedimentary, volcanic, and granitic rocks (Figures 1 and 2). The most widely exposed lithologic unit is an interlayered sequence of immature clastic rocks and intermediate to felsic volcanic rocks. The clastic lithologies include quartzofeldspathic and lithic sandstone, siltstone, and conglomerate. The volcanic rocks include andesitic flows and subvolcanic intrusions, quartz porphyry (ash-flow tuffs(?)), and bedded tuffs. The clastic and volcanic rocks are more highly metamorphosed in the eastern, structurally highest parts of the range. At present, it is unknown whether these Mesozoic rocks are correlative with 1) the McCoy Mountains Formation of the McCoy terrane, 2) the Apache Wash Formation of the North American block, or 3) some other Mesozoic unit.

The Mesozoic rocks described above are in tectonic contact with Paleozoic metasedimentary rocks and Precambrian(?) crystalline rocks. The Paleozoic metasedimentary rocks are correlative with lithologically similar middle and upper Paleozoic formations of the region, including (from bottom to top) Devonian Martin Formation, Mississippian Redwall Limestone, Pennsylvanian-Permian Supai(?) Formation, Permian Coconino Sandstone, and Permian Kaibab Formation. We emphasize that these correlations are based soley on lithology and stratigraphic succession, not on any paleontologic data. Precambrian crystalline rocks of the area include 1) high-grade,

SIMPLIFIED GEOLOGIC MAP OF THE GRANITE WASH MTNS.

MAPPED BY S. REYNOLDS, J. SPENCER, AND S. RICHARD



CORRELATION OF MAP UNITS

Qa				QUATERNARY	CENOZOIC
Kg				CRETACEOUS	MESOZOIC
Kt				CRETACEOUS	MESOZOIC
Ms	Mv	Mi	Ma		MESOZOIC
Pz					PALEOZOIC
pЄ					PRECAMBRIAN

DESCRIPTION OF MAP UNITS

Qa Quaternary alluvium

Kg Granite Wash Granodiorite - Medium-grained, equigranular, hornblende-biotite granodiorite with dioritic border phase. Dated at 65 and 69 m.y. (K-Ar biotite, Damon, 1968; Eberly and Stanley, 1978).

Kt Tank Pass Granite - Medium- to fine-grained, leucocratic, biotite granite. Dated at ≈ 85 m.y. (3-point Rb-Sr isochron, S. J. Reynolds, unpublished data).

Ms Mesozoic metasedimentary rocks - Primarily poorly- to very poorly-sorted litho-feldspathic sandstone and locally interbedded phyllite and conglomerate.

Mv Mesozoic volcanic and hypabyssal rocks - Primarily massive flows 1-30 m thick of dark aphanitic metavolcanic rocks and associated fine-grained hornblende diorite(?) hypabyssal intrusives.

Mi Mesozoic igneous rocks - Porphyritic, hypabyssal(?) intrusive with abundant .3 to 3 cm K-spar phenocrysts in dark, microcrystalline groundmass.

Ma Mesozoic alaskite - Fine-grained, leucocratic, altered, granitic intrusives.

Pz Paleozoic metasedimentary rocks - Recognized formations include Martin, Redwall, Coconino, Supai, Kaibab, and evaporites at the top of the Kaibab.

pЄ Precambrian granite-gneiss - Includes medium- and fine-grained, equigranular and porphyritic, biotitic granitic and gneissic rocks.

compositionally layered, quartzofeldspathic gneiss; 2) locally porphyritic, medium- to coarse-grained granitic gneiss; and 3) equigranular, medium-grained, foliated granitoid rocks. We have not, as yet, recognized any depositional contacts between Precambrian, Paleozoic, and Mesozoic rocks.

The structure of the Granite Wash Moutains is very complex. The Mesozoic rocks are multiply deformed and weakly to strongly metamorphosed. The dominant structural fabrics are a steep, northwest-striking fracture cleavage and a well-developed subhorizontal cleavage or schistosity that contains a northeast-trending lineation. Refolded folds are locally common. Lithologic units in the Mesozoic section are commonly lenticular and erratic in distribution, possibly due to isoclinal folding. In addition, the Paleozoic section is locally attenuated and interfolded on a fine scale within the Mesozoic units. Many Paleozoic-Mesozoic contacts are faults and ductile shear zones, probably with significant amounts of tectonic transport. Other contacts may represent attenuated limbs of large-scale isoclinal folds and nappes. Isolated fault slivers and tectonic "fish" of Precambrian(?) crystalline rocks occur along some Paleozoic-Mesozoic contacts. In addition, preliminary mapping suggests the presence of a major thrust that places Precambrian crystalline rocks over **all** Mesozoic and Paleozoic rocks in the range.

The youngest pre-Cenozoic rocks in the range are two Upper Cretaceous plutons, the Tank Pass Granite and Granite Wash Granodiorite (Rehrig and Reynolds, 1980). Both plutons appear to intrude discordantly across all structures in the range, including the suggested major thrust. The ages of the Tank Pass Granite and Granite Wash Granodiorite are both constrained to 85-70 m.y.B.P. by published and unpublished K-Ar and Rb-Sr dates (Reynolds, 1982).

Cenozoic rocks in the range are limited to 1) numerous, northwest-trending dikes; 2) gently dipping, intermediate to mafic flows and pyroclastic deposits exposed on the western flank of the range; and 3) various generations of gravels.

Mineralization in the range consists mostly of (Keith, 1978):

1) Scheelite in quartz veins and pockets in metamorphosed Paleozoic and Mesozoic rocks adjacent to the Tank Pass Granite and Granite Wash Granodiorite; and

2) gold- and copper-bearing veins (locally accompanied by lead and silver) in Mesozoic, Paleozoic, and Precambrian rocks, commonly near intermediate to felsic dikes.

FIELD TRIP STOPS

The main emphasis of the Granite Wash segment of the field trip is to present a broad overview of the rock units, structure, and mineralization of the range. We will examine the lithology and structure of the Mesozoic sedimentary and volcanic rocks in both weakly and moderately metamorphosed conditions. Depending on the difficulty of access (due to the great flood of 83), we will also examine the tectonic interleaving of Paleozoic and Precambrian rocks within the Mesozoic section. If roads permit, we will do the latter at the Yuma Mine, a site of copper-silver-gold mineralization. The mineralization, including copper oxides and carbonates, is localized in strongly deformed Paleozoic carbonates that occur as tectonic lenses completely enclosed by Mesozoic metasedimentary rocks. Crystalline rocks, such as augen gneiss, locally occur along the Paleozoic-Mesozoic contact.

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