GEOLOGIC MAP OF THE WESTERN EAGLETAIL MOUNTAINS LA PAZ COUNTY, ARIZONA

by

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INTRODUCTION

The area described in this study includes the western Eagletail Mountains, Yuma county, Arizona and includes much of the Eagletail Mountains Wilderness Area (Figure 1). Bedrock in this area consists largely of Miocene silicic volcanic rocks and subordinate mafic and intermediate volcanic units (Plate 1). Sources of data are shown in Figure 2, rock-unit correlations and relative ages are shown in Figure 3, and map symbols are shown in Table 1.

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Additional mapping, done in 1997 by J. Spencer and S. Richard, was intended to clarify the structure and stratigraphy of two areas, as follows: (1) an inaccessible area in the southwestern foothills of the Eagletail Mountains (southern part of map area) that had only been mapped previously by aerial photograph interpretation, and (2) a layered sequence of volcanic rocks intruded by dikes on the steep northeastern range front that had not been satisfactorily mapped. K-Ar radiometric dates are also located on the updated map.

PREVIOUS INVESTIGATIONS

Previous geologic studies of the area include reconnaissance studies incorporated into State geologic maps by Wilson and others (1969) and Reynolds (1988), and reconnaissance mapping by Miller and others (1989). The eastern Eagletail Mountains were mapped by Spencer and others (1992). The area to the south and southeast of the study area was mapped by Gilbert and others (1992) and Gilbert and Spencer (1992), the area directly to the west was mapped by Grubensky and Demsey (1991), and the Little Harquahala Mountains to the northwest were mapped by Spencer and others (1985). Mineral deposits in the eastern Eagletail Mountains were described by Lane (1986) and Miller and others (1989). The upper Cenozoic surficial deposits were mapped and described in reconnaissance by Demsey (1990). K-Ar dates are summarized by Spencer and others (1995).

GEOLOGIC SETTING

The study area is within the Basin and Range physiographic and tectonic province, much of which underwent severe Tertiary extension and magmatism (Spencer and Reynolds, 1989). The region around the study area is characterized by northwest-trending normal faults and fault blocks, and the northwest trend of the Eagletail Mountains is probably due to Tertiary normal faulting and southwestward tilting of the range. Pre-Tertiary rocks exposed along the northeastern flank of the range consist of Jurassic to Proterozoic granitoid rocks. Early to middle Miocene magmatism produced a thick sequence of flows, flow domes, and hypabyssal intrusions with local mafic. Dominantly felsic magmatism was followed by early to middle Miocene basaltic magmatism.

Cenozoic sedimentary and volcanic rocks

QTs **Surficial deposits (Quaternary and Pliocene)**--Unconsolidated alluvium and colluvium, including talus, sand and gravel in modern washes, and unconsolidated to poorly consolidated gravel, sandy gravel, and sand, locally with silt or boulders, that typically forms flat, locally incised surfaces up to 5 meters above modern drainages. Also includes older unconsolidated alluvium and colluvium that form rounded hills and gentle hill slopes.

QTbr **Basalt rubble (Quaternary to Tertiary)**--Slopes and hilltops mantled with boulders and cobbles of resistant basalt.

QTrr **Rhyolite rubble (Quaternary to Tertiary)**--Slopes and hilltops mantled with boulders and cobbles of resistant rhyolite.

QTc **Pedogenic carbonate (Quaternary to Tertiary)**--Buff crystalline carbonate with siliceous stringers and laminations parallel to bedding, and 1-4 cm diameter irregular siliceous clots. Outcrops as bed 1-2 m thick, with bedding broadly parallel to the hillslope, but warped into an open syncline. Lamination defining bedding within the unit is warped into minor monoclinal folds and cut by microfaults. Outcrop distribution suggests rock is pedogenic carbonate mantling topography, but folds and minor faults in the unit suggest that it is older and interbedded with basalt (map unit Tb).

Tc **Conglomerate (Tertiary)**-- Massive, unorganized boulder conglomerate with tan, very fine-grained sand matrix. Matrix is moderately indurated. Unit is exposed only in washes. Clasts are mostly basalt boulders up to about 1 m diameter, and include of a variety of types of basalt (vesicular, non-vesicular, different phenocryst assemblages). Clasts are subrounded to subangular. Other minor clast types include fine-grained equigranular biotite granite, very fine-grained pink quartzose sandstone (Supai Formation?), Bolsa Quartzite, sparse gray Paleozoic carbonate clasts, and metabasalt (greenstone). Source of Paleozoic clasts was unmetamorphosed. Unit is locally permeated by chalcedony-calcite veinlets.

Tb **Basalt (Tertiary)**--Dark reddish brown, vesicular and nonvesicular basalt and basaltic andesite(?). Contains 1 to 3%, 1 to 2 mm pyroxene. In the northwestern part of the map area, rocks of this unit are of uncertain stratigraphic relationship to rocks included with unit Tb elsewhere, and could be correlative with map units Tbau or Tblh.

Tbx **Basalt breccia (Tertiary)**--Angular to subangular basalt fragments in indurated basaltic rock matrix. Unit is generally massive and matrix poor. Locally includes red oxidized zones and highly vesiculated rock suggestive of autobreccia, but other outcrops have the appearance of rock avalanche deposits or tectonic breccia.

Tblh **Basalt of Little Horn Mountains (Tertiary)**--Blue-gray, variably resistant basalt and basaltic andesite lavas mapped by Grubensky and Demsey (1991) in the western part of the map area. Probably correlative with map units Tb or Tbau.

Tif **Intermediate to felsic, quartz-poor volcanic rocks (Tertiary)**--Tan flows(?) with up to 5 to 10%, 1 to 7 mm plagioclase, 1 to 3%, 1 to 2 mm biotite, and little or no quartz. Approximately one half mile north of the northeast corner of section 2, T. 1 N., R. 12 W., rocks of this unit are dark gray, slightly vitrophyric, with sparse fine-grained biotite and K-feldspar.

Tad **Crystal poor andesite-dacite (Tertiary)**--Medium to dark purplish grey andesite or dacite with 2-3 mm blocky plagioclase crystals, and 1-2 mm hornblende or biotite crystals typically replaced by chlorite. Plagioclase crystals are commonly poikilitic, enclosing hornblende and biotite crystals.

Tau **Andesite (Tertiary)**--In northwestern part of map area this unit consists of pyroxene andesite flows and medium brown to purplish tan, biotite-hornblende-feldspar (typically 1-3mm diameter) intermediate composition flows with sparse potassium(?) feldspar phenocrysts up to 7 mm diameter. Unit is resistant to weathering in this area and may form cliffs.

Tbau **Basalt and basaltic andesite, undivided (Tertiary)**--Basalt, basaltic andesite, and possible andesite lavas and flow breccias. Variably vesicular to non-vesicular, commonly dark reddish brown to dark gray to black. Locally interbedded with bedded pyroclastic rocks. Stratigraphic position relative to map units Tb and Tba, which are lithologically similar, is not clear.

Tbap **Pyroxene basaltic andesite (Tertiary)**--This unit is exposed only in one area in the northwestern part of map area directly west of the Clanton Well Road. This unit consists of slope forming, locally vesicular, crystal poor, medium to light gray flows that weather pale orange and contain 1 to 2%, 1 to 3 mm pyroxene (augite?), sparse albite twinned plagioclase phenocrysts, and abundant (40-50%) plagioclase microlites. Elongate pits, 5 to 30 mm, on weathered surfaces are probably vesicles and vesicles enlarged by weathering.

Tvs **Volcanic-lithic sandstone and bedded pyroclastic rocks (Tertiary)**--Includes bedded pyroclastic rocks, tuff, volcanic-lithic sandstone and conglomerate with sparse volcanic and granitoid clasts.

Tsl **Sandstone and limestone (Tertiary)**--Variably tuffaceous limestone and sandy limestone beds up to perhaps 1 m thick within a sequence of tuffaceous sandstone, siltstone, and sparse conglomerate.

Trv **Rhyolite vitrophyre (Tertiary)**--Massive, medium gray vitrophyre with 3 to 5% phenocrysts of 1 to 2mm biotite, hornblende, and feldspar.

Trb **Big crystal rhyolite (Tertiary)**--Pale tan to grayish tan rhyolite flows and flow breccias. Characterized by 2 to 5 mm sanidine crystals. Commonly contains varying amounts of 1 to 3 mm biotite, plagioclase, hornblende, and tiny (<1mm) pyroxene crystals. Quartz is present locally but in many areas is conspicuously absent. Vitrophyre common near contacts with other units; locally unit is vitric throughout. Devitrified, hydrated zones are reddish gray.

Trbq **Big crystal quartz rhyolite (Tertiary)**--Similar to Trb, but 1-2 mm quartz crystals are present.

Tr **Biotite rhyolite (Tertiary)**--Generally tan, pale gray, or reddish brown. Commonly crystal poor. Locally contains 1 to several percent, 1 to 3 mm aligned biotite, and minor fine grained (≈1mm) quartz, plagioclase, sanidine, and locally, hornblende(?). May contain hornblende and plagioclase. Locally flow banded or vitrophyric. Some rocks of this unit are very light weight because of microvesicles(?) or pumice fragments(?). In some areas rhyolite light violet-gray, crystal rich, and contains 5 to 10% 1mm crystals of quartz, feldspar (sanidine and plagioclase), and biotite and/or hornblende.

In thin section biotite is commonly altered to opaque iron oxides(?). Local brown hornblende is typically partially altered. Most samples contained abundant fresh albite-twinned plagioclase,

generally < 1mm. One sample was characterized by 1 to 3 mm thick bands of alternating gray, fresh to weakly altered rhyolite and red, weakly altered rhyolite. Locally bands are stringers or elongate, rounded blobs.

Trx **Rhyolite breccia (Tertiary)**--Monolithologic rhyolite breccias, both clast- and matrix-supported. Matrix is same composition as clasts. Clasts vary from dense to 30% vesicles. Deposits are interpreted as flow and carapace breccias, and as block-and-ash flow and small-volume pyroclastic flow deposits. In some localities near domes, pods of stratified, fine-grained vitric tuff, each with a different orientation, occur within this unit, and are interpreted to indicate disrupted bedded tuff deposits.

Ta **Andesite (Tertiary)**--This unit is exposed along base of range front in northeastern part of the map area. It consists of medium to dark brown, reddish gray, or pinkish brown andesite to dacite(?) lava flows and fragmental rocks with 1%, 1 to 2 mm hornblende, 3 to 8%, 2 to 6 mm K-feldspar, and 0 to 2%, 1 to 2 mm quartz.

Tba **Andesite and basaltic andesite (Tertiary)**--Basalt, basaltic andesite and andesite lavas. Dark grey lavas with tiny plagioclase, pyroxene and olivine crystals. Interbedded with all other rock units, but generally forms a subordinate part of the section. One thin section revealed embayed quartz.

Tbp **Bedded pyroclastic rocks (Tertiary)**--Bedded tuff, tuffaceous sediments and pyroclastic rocks. Distinguished by presence of bedding. Generally light yellowish tan, pale tan, or white. Commonly contains 1 to 3%, locally fresh biotite up to 2 mm and sparse quartz and feldspar up to 2 mm diameter. May be moderately friable. Pyroclastic deposits include moderately well-sorted beds of 0.5-1 cm diameter pumiceous clasts or ash, poorly sorted beds of pumice, ash, and lithic fragments, and well-sorted beds of fine-grained, laminated, wavy- or cross-bedded ash. Beds are typically 2-20 cm thick, although a few are massive and up to 5 m thick. Channel deposits are rare in the pyroclastic deposits. Waterlain deposits are volcanogenic sandstones and pebbly sandstones, with sub-angular to sub-rounded clasts. Beds are typically 2-20 cm thick and moderately well-sorted, although a few are massive and up to 5 m thick. Channel deposits are common. In cliff exposures, low angle unconformities are commonly visible, with angular discordance up to 20°. Interbedded with all other rock units, but most commonly found between rhyolite flows.

In southeastern part of map area rocks of this unit locally contain abundant pumice fragments that weather to form elongate pits up to 3 cm long. Locally in this area rocks of this unit also include (1) volcanogenic conglomerate, (2) vesicular basalt fragments, 2 to 20 cm diameter (locally up to 50 cm diameter), in light tan, bedded, volcaniclastic matrix, and (3) breccias composed of rhyolite vitrophyre clasts in rhyolitic matrix.

Tu **Undivided sandstone, conglomerate, tuff, mafic lava and breccia (Tertiary)**--Lithologically diverse rocks at base of section.

Tsb **Sedimentary breccia (Tertiary)**--Massive angular-clast conglomerate with good evidence for mixing with epiclastic sandstone matrix; monolithologic to polymictic. Predominant clast types include: (1) medium grained, equigranular biotite granitoid, (2) porphyritic biotite monzogranite that is lithologically identical to granitoid in Black Rock Hills at southern end of the Little Harquahala Mountains, and (3) Jurassic quartz porphyry identical to unit Jqp on this map and to Black Rock volcanics of Little Harquahala Mountains (Spencer and others, 1985).

Tx **Debris avalanche deposits (Tertiary)**--Lenses of shattered and brecciated rock with little or no discernible epiclastic matrix. Protolith rocks consist primarily of medium-grained, equigranular to moderately porphyritic, biotite granitoid, and with less abundant Tertiary basalt, tuff, and Jurassic hypabyssal quartz (up to 10 mm) porphyry with K-feldspar phenocrysts up to 50 mm long and with white (plagioclase?) rims. In most areas this unit is a monolithologic granitoid breccia.

Cenozoic intrusive rocks

Intrusive rocks Intrusions distinguished by nature of well exposed contacts and geometry of rock bodies. Lithologically identical lavas are present for all intrusive rocks.

Tmd **Mafic dikes (Tertiary)**--Basaltic to andesitic intrusions. Locally vesicular, medium to dark gray, with abundant 1 mm plagioclase. Lithologically similar to map unit Tba.

Tifd **Intermediate to felsic, quartz-poor dikes (Tertiary)**--Characterized by plagioclase, biotite, and hornblende crystals, light to medium grey color, and absence of significant quartz.

In the northeastern part of the map area dikes of this unit dip gently to moderately northeastward along steep range front, and may form dip slopes. In this area dikes are light gray, with 10 to 20%, 1 to 3 mm white plagioclase, 1 to 3 %, 1 to 2 mm biotite, and < 1% 1mm hornblende. These dikes intrude along normal faults.

In the southern part of the map area a single dike of this unit consists of a light gray, aphanitic matrix, 2 to 4%, 1 to 3 mm feldspar, at least some of which is potassium feldspar, 1 to 3%, 1 to 3 mm biotite, up to 1% hornblende phenocrysts <4 mm long, and little or no quartz.

Tpp **Plagioclase porphyry**--Intermediate to felsic, massive, hypabyssal intrusive porphyry containing 10 to 15%, 2 to 8mm, white plagioclase, 1 to 3 %, 1 to 3 mm biotite. Two to 10 cm mafic inclusions are common. Forms massive, rounded outcrops with little or no hint of layering. Rocks of this unit are probably coarse-grained equivalent of nearby, quartz-poor, intermediate to felsic dikes (map unit Tifd).

Tri **Hypabyssal rhyolite (Tertiary)**--In thin section contains 2 to 3% green hornblende < 0.5 mm long, < 1% biotite, and sparse twinned plagioclase.

Tsi **Silicic intrusive rocks (Tertiary)**--Characterized by abundant quartz phenocrysts in some areas, in other areas consists of almost aphyric felsite with sparse 1mm quartz phenocrysts.

Pre-Cenozoic rocks

Jqp **Quartz porphyry (Jurassic)**--Highly fractured, greenish gray, massive quartz porphyry. Represents extrusive or hypabyssal intrusive rock that is probably correlative with virtually identical Jurassic volcanic and hypabyssal rocks in the Little Harquahala Mountains (Richard and others, 1987).

JXmg **Sore Fingers monzogranite (Jurassic to early Proterozoic)**--Medium- to coarse-grained monzogranite, with 20-50% K-feldspar in phenocrysts up to 7 cm in diameter, 20-25% quartz in anhedral grains up to 8 mm diameter, 30-35% plagioclase in 2-5 mm subhedral crystals, and 5-10% biotite generally greatly in excess of hornblende. Biotite is variably recrystallized to very fine-grained aggregates. K-feldspar phenocrysts are irregularly distributed in rock body; locally they occur packed together in cumulate zones which may consist of >50% phenocrysts. Sparse aplite dikes intrude the monzogranite. Correlated with the Sore Fingers Monzogranite (Spencer and others, 1985) of the southern Little Harquahala Mountains based on lithologic similarity. A sample of this rock in the southern Little Harquahala Mountains yielded a K-Ar minimum age of 140 Ma (Rehrig and Reynolds, 1980). U-Pb data from a probably correlative monzodiorite in the northern Little Harquahala Mountains indicates an age of near 160 Ma (S. M. Richard and N. R. Riggs, unpublished data).

JXlg **Fine-grained, equigranular, leucocratic granite (Jurassic to early Proterozoic)**--In some areas contains up to 2 to 3 percent biotite. Commonly contains pegmatite dikes.

JXg **Porphyritic granodiorite (Jurassic to early Proterozoic)**--Medium- to fine-grained biotite and hornblende-biotite granodiorite to monzogranite with gray potassium feldspar phenocrysts up to 4 cm long. Large K-feldspar phenocrysts may be rounded with long axes subparallel to local tectonic lineation. Local foliation and lineation are not obviously mylonitic, and are crosscut by younger quartz veins up to 5 cm thick. Locally includes medium- to fine-grained hornblende diorite(?) with up to 40% mafic minerals in bodies ranging from enclaves with diameters <1 m to pendants up to several 10's of m long. In more highly deformed zones near the margins of the body, the large K-feldspar phenocrysts are commonly recrystallized to rounded quartz-feldspar aggregates, which appear granitic; hornblende is typically moderately to completely replaced by biotite in these zones as well. Contacts on both the northwest and southeast are gneissic shear zones (shown as unit JXgn).

JXgn **Undivided gneiss (Jurassic to early Proterozoic)**--Typically fine-grained feldspar-quartz-biotite (±hornblende) gneiss, but also includes leucocratic quartzofeldspathic gneiss and sparse hornblende-plagioclase gneiss. Thin to very thin compositional banding defined by variations in mineralogy; banding mostly planar to curviplanar; ranges from well defined to subtle. Unit includes irregular small intrusions of medium- to fine-grained equigranular leucogranite, granodiorite, and diorite. These range from cross cutting to concordant. This unit is interpreted to mostly consist of orthogneiss formed along the margins of adjacent granitoids.

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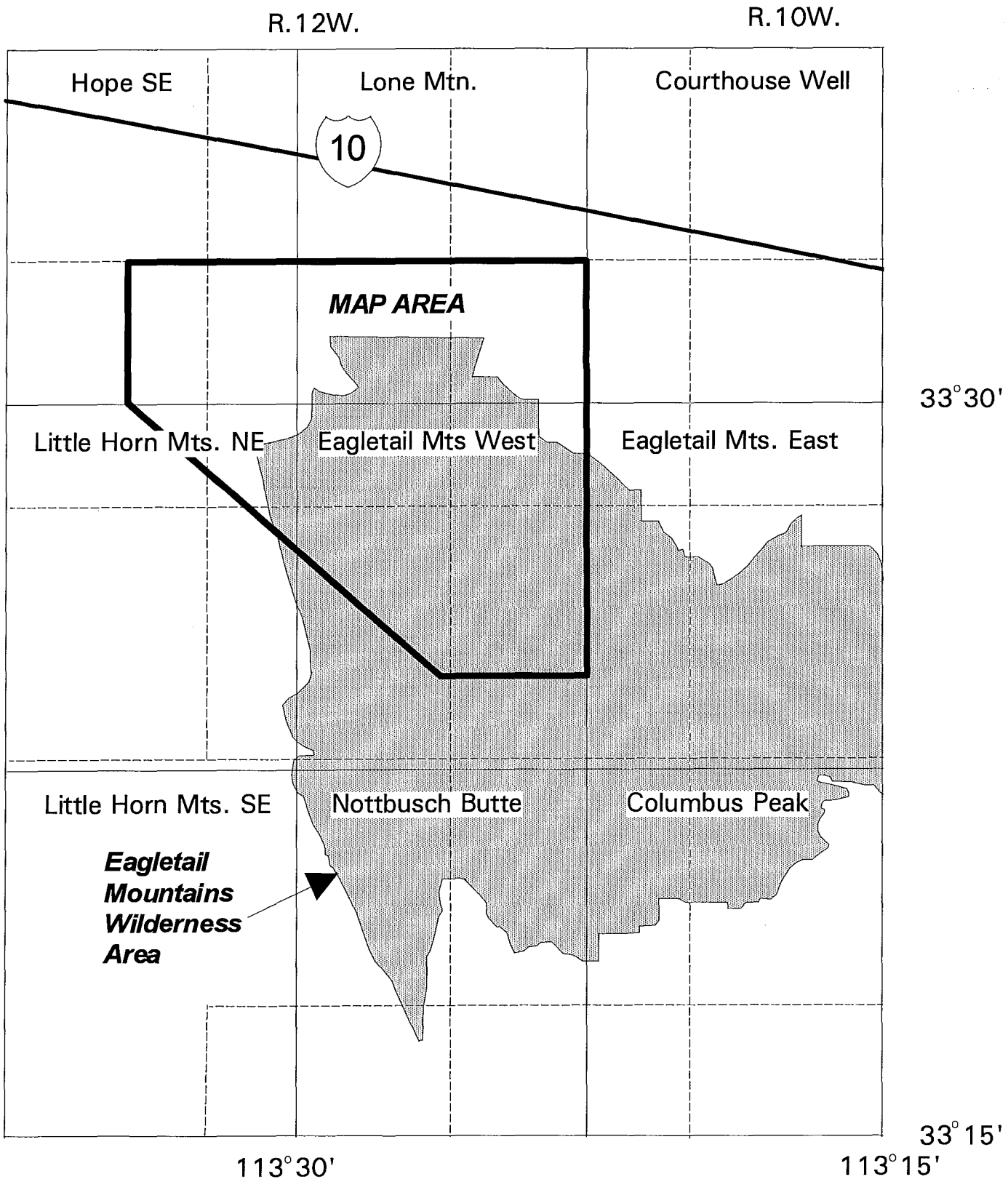
R.12W.
R.10W.
Hope SE
Lone Mtn.
Courthouse Well
10
MAP AREA
33°30'
Little Horn Mts. NE
Eagletail Mts West
Eagletail Mts. East
Little Horn Mts. SE
Nottbusch Butte
Columbus Peak
Eagletail Mountains Wilderness Area
33°15'
113°30'
113°15'

Fig. 1

Fig 1

FILE: MSOURCE.DRW

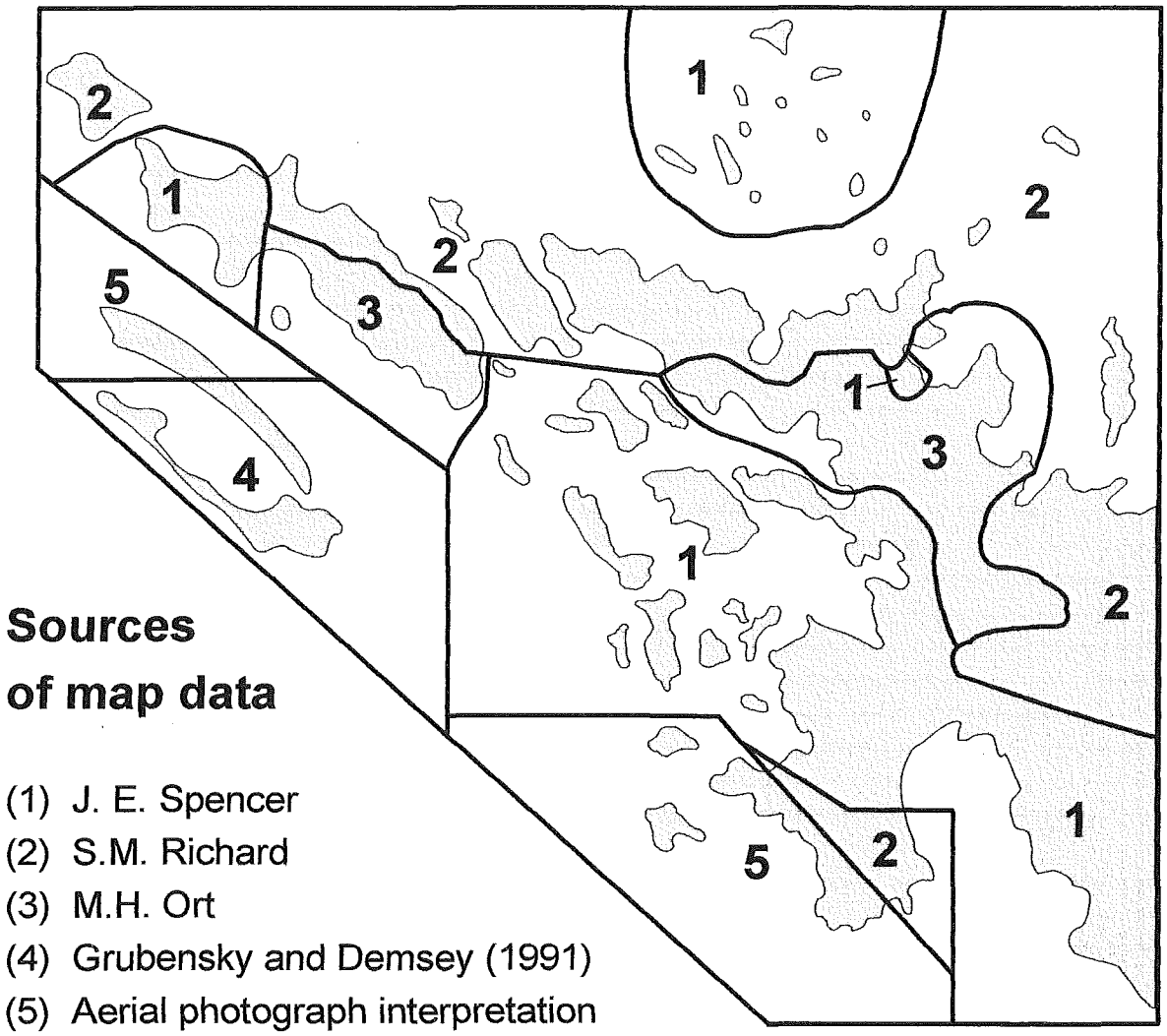

Fig. 2

Correlation of Map Units

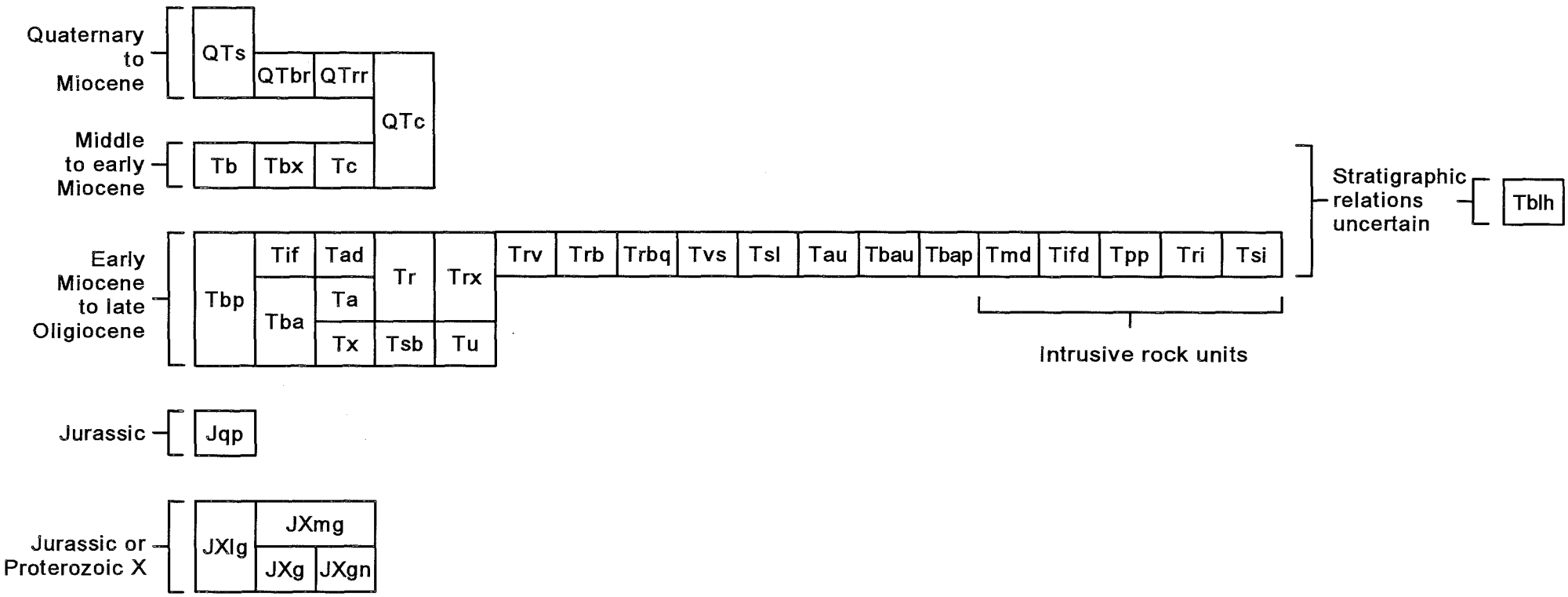

Fig. 3

Map Symbols

bedding

flow foliation

inclined vertical approximate

curviplanar bedding

Protomylonite; S-tectonite

Joint

Compositional Banding

quartz vein

66

Fault, showing dip; dashed where approximate, dotted where concealed.

Low-angle normal fault

Detachment fault; chloritic breccia present in footwall

39

Depositional or intrusive contact, showing dip; dashed where approximate, dotted where concealed.

massive volcanogenic breccia zones

v v v v v v vitrophyre zone

mafic dike

alteration zone; rock silicified, bleached or hematite stained

TABLE 1