UNITED STATES DEPARTMENT OF THE INTERIOR

GEOLOGICAL SURVEY

Geologic map of the Poachie Range, Yavapai and Mohave Counties, Arizona

by

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This map is preliminary and has not been reviewed for conformity with U.S. Geological Survey editorial standards and stratigraphic nomenclature.

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DESCRIPTION OF MAP UNITS

Qf **Alluvial and debris fans (Holocene)**--Bouldery gravel, sand and silt mantling surfaces where major drainage systems change gradient. Examples are along the sides of the Big Sandy River valley. One to several meters thick

Qal **Alluvium (Holocene)**--Gravel, sand, and silt in washes and on modern floodplains. Generally 1 to 3 m thick

Qpg **Pediment gravel (Holocene)**--Coarse grained gravel, sand, and silt mantling gently sloping surfaces. Generally 1 to 3 m thick

Ql **Landslide deposit (Holocene and Pleistocene)**--Boulders and blocks of basalt or granite in a matrix of sand and silt. Irregular hummocky surface. A meter to several meters thick

Qtc **Talus and colluvium (Holocene and Pleistocene)**--Angular fragments of rock in matrix containing various proportions of sand and silt. A meter to a few meters thick

Qof **Older alluvial and debris fans (Pleistocene)**--Coarse gravel, sand, and silt mantling dissected surfaces where drainage systems change gradient. Examples are along the sides of the Big Sandy River valley. One to several meters thick

Qoa **Older alluvium (Pleistocene)**--Gravel, sand, and silt capping terraces along major drainages. Contains stream rounded pebbles, cobbles, and locally, boulders. Best developed along the Big Sandy River valley where it is as much as 6 m thick

Qop **Older pediment gravel (Pleistocene)**--Coarse gravel, sand and silt mantling gently sloping, dissected surfaces. Generally 1 to 3 m thick

Tgy **Younger gravel (Pliocene or Miocene)**--Coarse gravel, sand, and silt deposits related to present drainage pattern but deeply dissected. As much as 10 m thick

Tbi **Basalt plugs (Miocene)**--Olivine and pyroxene basalt in plugs that probably served as feeders for some basalt flows

Tg **Gravel (Miocene)**--Gravel, sand, and silt. Locally contains boulders a meter or two in diameter. Interfingers with basalt flows and contains rare beds of tuff and tuffaceous sand and gravel in western part of map area. In northeastern part of area interfingers with and overlies Miocene rhyodacitic volcaniclastics (Tvc) and is overlain by basalt (Tby) and has some lahars in its lower part. Deposit north of wash northeast of U.S. Highway 93 may be younger. Maximum thickness about 120 m

Tby **Younger basalt (Miocene)**--Olivine and pyroxene basalt flows. One to five flows form mesa cap 5 to 45 m thick

Ta **Andesite (Miocene?)**--Olivine clinopyroxene andesite forming small plug at south margin of map area in sec. 17, T. 12 N., R. 11 W.

Tbl **Lower basalt (Miocene)**--Olivine and pyroxene basalt and andesite flows on south flank of Poachie Range, where flows and interbeds of gravel are locally about 150 m thick, and in tilted fault blocks in Big Sandy River valley. Unconformably overlain by Tby in Government Wash area

Tgb **Boulder gravel (Miocene)**--Boulders of granite as much as several meters in diameter in a matrix of sand and fine-grained conglomerate. Elongate body in secs. 10, 15, and 16, T. 13 N., R. 12 W. is at least 60 m thick and contains some clasts of welded tuff like that on Greyback Mountain southwest of Bagdad suggesting that it is older than uplift and tilting of the Poachie Range. Deposits in the Big Sandy drainage contain some blocks of Paleozoic limestone and, especially near their bases, fragments of Mesozoic(?) siliceous metavolcanic rock. Thin deposits of sedimentary breccia (Tbr) occur locally at the base but are not mapped. Maximum thickness about 100 m

Tbr **Breccia (Miocene)**--Sedimentary breccia composed of angular fragments of porphyritic siliceous volcanic rock metamorphosed at greenschist facies conditions. Interstices of fragments filled with muddy matrix. Occurs in the Big Sandy Valley. Locally at least 50 m thick

Tob **Olivine basalt (Miocene)**--Porphyritic olivine basalt containing olivine phenocrysts as much as 5 mm in diameter. Occurs in fault blocks and small exposures beneath gravels in the Big Sandy River valley area

Ts **Limestone and arkose (Miocene)**--Thin-bedded lacustrine limestone and fine- to coarse-grained, locally pebbly arkose. Maximum thickness about 100 m

Trd **Rhyodacite (Miocene)**--Phenocrysts of quartz, plagioclase, hornblende, and biotite in a glassy to cryptocrystalline matrix. Forms dikes and plugs in the Big Sandy River area and dikes near the volcanic field in the eastern part of the map area

Tvf **Felsic flow rocks (Miocene)**--Rhyodacite containing phenocrysts of quartz, plagioclase, hornblende, and biotite as much as 5 mm long in a glassy matrix. Forms plugs, dikes, exogenous domes, and flows. Local vitrophyre at base of flows and exogenous domes. K-Ar age of biotite is 22.0$\pm$0.8 Ma (R.F. Marvin, written commun., 1985) and fission-track age of zircon is 23.5$\pm$2.7 Ma (C.W. Naeser, written commun., 1985)

Tvc **Felsic pyroclastic rocks (Miocene)**--Tuff, tuff breccia, and volcanic conglomerate. Forms carapace over domes and is interbedded with flows of Tvf. Grades from coarse vent-facies tuff breccia to distal facies tuff, lahar, ash flow, and conglomerate. Tuff breccia has angular fragments of rhyodacite as much as 1 m in diameter in a matrix of rhyodacite tuff. Lahars are massive layers of pebbles to boulders of rhyodacite and, locally, Precambrian rock in a mud matrix. Most tuffs are white; some are massive; others are bedded and probably were redeposited by fluvial processes

Twt **White tuff (Miocene)**--Crystal vitric tuff containing conglomerate beds and scattered pebbles and cobbles of Precambrian rock. Crossbedded. Thicker pebble beds lack internal bedding and were probably deposited as mudflows. To southeast unit is thinner and mapped with unit Tvc. Unit as mapped is as much as 40 m thick. Probably fills a paleovalley

Tpc **Basal conglomerate (Miocene)**--Cobbles and boulders mostly of Precambrian rocks in a sand matrix but locally contains Miocene volcanic clasts

Artillery Formation (Miocene and Oligocene?)--In southwest corner of map area

Tal **Limestone**--Thin-bedded light-gray and light-yellowish-gray limestone and algal limestone, medium-grained greenish-gray sandstone, siltstone, and shaly siltstone, and a few beds of light-pinkish-gray medium- to coarse-grained arkosic sandstone

Tab **Basal arkose**--Arkose and pebbly arkose

Kr **Rhyolite (Cretaceous)**--Altered white aphanitic rhyolite. Locally contains phenocrysts of quartz, plagioclase, and potassic feldspar as much as 1 mm diameter. Forms dikes and small plugs in the north central part of the area north of Olea Ranch. Fission-track age of zircon is 66.7±8.1 Ma (C.W. Naeser, written commun., 1985)

Krd **Rhyodacite (Cretaceous)**--Light-greenish-gray rhyodacite containing phenocrysts of hornblende, biotite, and plagioclase several millimeters long; hornblende phenocrysts are locally as much as 1 cm long. Forms dikes in the north-central and western parts of the map area and small plugs in the central part. Some plugs are medium-grained hornblende granodiorite; hypersthene occurs locally in chilled margin of one plug, and another plug is a potassic feldspar-bearing augite-hornblende-biotite diorite. Fission-track age of zircon from dike north of U.S. Highway 93 is 65.5±11 Ma (C.W. Naeser, written commun., 1985)

Yd **Diabase (Middle Proterozoic)**--Hornblende-plagioclase diabase containing a few thin plagioclase-rich veinlets. Forms dikes and sills ranging from 1 cm to a few tens of meters thick. Many sills parallel a gently dipping joint set. Age is based on petrographic similarity to dated diabase in eastern Arizona. Laths of andesine or labradorite in a matrix of hornblende, accessory biotite and quartz and, locally, monoclinic pyroxene altered in varying degrees to actinolite and (or) chlorite. Grain size 1-4 mm

Yg **Granite (Middle Proterozoic)**--Fine- to medium-grained and locally porphyritic biotite quartz monzonite, granite, and rarely, granodiorite. Locally contains muscovite. Porphyritic varieties have potassic feldspar phenocrysts as large as 1 cm. Locally grades to pegmatite. Intrudes metamorphic rocks and coarse-grained granite (Ycg) as dikes, plugs, and stocks. In Ycg south of U.S. Highway 93 some bodies are rich in clots of biotite as much as 1 cm long well aligned by flow. Contains inclusions of wallrock. Locally grades to Ycg

Ygp **Porphyritic granite (Middle Proterozoic)**--Porphyritic biotite quartz monzonite and granite containing potassic feldspars as much as 1.5 cm in diameter in a fine- to medium-grained matrix. Some medium- to coarse-grained equigranular phases. Sample from north-central part of sec. 5, T. 12 N., R. 11 W. has whole-rock Pb isotopes indicating that it is Middle Proterozoic (J.L. Wooden, oral commun., 1987)

Ys **Signal Granite (Middle Proterozoic)**--Coarse-grained quartz monzonite and granodiorite containing potassic feldspar as much as 6 cm in diameter, plagioclase, and quartz as much as 1 cm in diameter, and biotite and hornblende as much as 0.5 cm long in aggregates as much as 1 cm long. Some of the granodiorite is porphyritic. Aligned potassic feldspar crystals form flow foliation. Metamorphosed to augen gneiss and mylonite along east contact. Contains widely scattered inclusions of Ysm, Ygd, hornblende-biotite gneiss, and gabbro. Contains a few thin quartz-microcline pegmatites and dikes of medium-grained biotite granite

Ysl **Leucocratic facies**--Coarse- to fine-grained orangish-pink-weathering leucocratic granite containing sparse biotite. Potassic feldspar as much as 5 cm long and quartz as much as 1 cm in diameter in coarse-grained varieties. Finer-grained type locally contains potassic feldspar phenocrysts. Grades to and cuts Ys

Ysm **Mafic facies**--Medium-grained biotite-hornblende quartz diorite to quartz monzonite locally containing scattered potassic feldspar phenocrysts as much as 2 cm in diameter. Is intruded by and grades to Ys

Ygd **Mafic granodiorite (Middle Proterozoic)**--Fine- to medium-grained, locally porphyritic hornblende-biotite and augite-hornblende-biotite granodiorite and diorite. Has distinctive granophyric texture in matrix. Contains small hornblende-plagioclase pegmatites and large microcline quartz pegmatites as much as 10 m thick. Contains inclusions of Ys and cut by dikes of Ys. Locally foliated parallel to dikes of Ys and pegmatite. These relations suggest Ys and Ygd were emplaced at nearly the same time. No dikes of Ygd were found cutting Ys suggesting that at the level exposed Ys is slightly younger. U-Pb age of zircon from 2 samples of Ys and one sample of Ygd define a chord with an upper intercept at 1409.6$\pm$2.5 Ma (J.L. Wooden, written commun., 1987)

Ycg **Coarse-grained granite (Middle Proterozoic)**--Biotite quartz monzonite, granite, and granodiorite containing potassic feldspar as much as 6 cm long. Ranges from equigranular to porphyritic. Cut by dikes of pegmatite and granite (Yg), which are especially numerous in the southeasternmost mapped bodies of this unit. Contains scattered inclusions of biotite-quartz-feldspar gneiss, biotite hornblende gneiss, biotite schist, amphibolite, and migmatite which are most common in SW1/4 sec. 20, T. 13 N., R. 10 W.

Ycf **Mixed coarse-grained and fine-grained granite (Middle Proterozoic)**--Intrusions of fine-grained granite in coarse-grained granite so numerous that they comprise about half the rock

Ypm **Porphyritic quartz monzonite (Middle Proterozoic)**--Biotite quartz monzonite, granite, and granodiorite containing generally well aligned tabular potassic feldspar phenocrysts as much as 6 cm long that define a flow foliation. Overprint denotes area where rock is fractured and stained with iron oxide. U-Pb ages of zircon from one sample of Ycg and one sample of Ypm define a chord with an upper intercept at 1416.2+2.4 Ma (J.L. Wooden, written commun., 1987)

YXg **Granite (Middle and Early Proterozoic)**--Fine- to medium-grained biotite granite, quartz monzonite, and rarely, granodiorite. Cuts Early Proterozoic rocks and contains inclusions of metamorphic rocks and Xcg

YXmg **Plutonic and metamorphic rocks (Middle and Early Proterozoic)**--Biotite-quartz feldspar gneiss, mica schist and gneiss, and amphibolite cut by numerous intrusions of coarse-grained quartz monzonite and fine-grained quartz monzonite. Southeastern outcrops of unit have the Dick Rhyolite (Xdr) as the only metamorphic rock component. Mapped in secs. 16 and 17, T. 13 N., R. 10 W.

Xg **Granite (Early Proterozoic)**--Fine- to medium-grained biotite granite and quartz monzonite. Locally contains muscovite. Contains inclusions of Xcg. Sample from sec. 36, T. 13 N., R. 11 W. has whole rock lead isotopes indicative of an Early Proterozoic age (J.L. Wooden, written commun., 1967)

Xqm **Quartz monzonite (Early Proterozoic)**--Muscovite-biotite quartz monzonite and granodiorite. Moderately coarse-grained containing potassic feldspars locally as much as 1 cm in diameter, biotite 0.5-2 mm partly in aggregates, quartz and plagioclase 2-5 mm. Locally contains accessory garnet. Contains inclusions of mica schist and gneiss and amphibolite and is cut by sparse dikes of pegmatite and aplite. Foliation poorly developed locally. U-Pb data on zircon define a chord with an upper intercept of 1688±14 Ma (J.L. Wooden, written commun., 1987)

Xcg **Coarse-grained granitic rock (Early Proterozoic)**--Hornblende-biotite and biotite-quartz monzonite, granodiorite, monzonite, and granite. Equigranular to porphyritic. Potassic feldspar commonly 1-2 cm in diameter but locally as much as 4 cm in diameter. Contains small bodies of diorite and gabbro. Foliation well developed to absent. Scattered inclusions of metamorphic rock, migmatite, and more mafic phases of the plutonic complex. Inclusions numerous near contacts with metamorphic rocks. Locally migmatitic. Cut by pegmatite, aplite, and fine-grained granite. Rock types in many places grade into one another and not separable at the scale of this study. Granodiorite dominant rock type except in southern part of map unit where quartz monzonite and granite dominate. Pattern in areas where distinctive porphyritic granodiorite containing chunky feldspar phenocrysts is common rock type. U-Pb data on zircon from a gneissose granodiorite from this unit define a chord with an upper intercept at 1706±2.8 Ma (J.L. Wooden, written commun., 1987)

Xga **Gabbro (Early Proterozoic)**--Coarse- to medium-grained hornblende gabbro cut by pegmatite, aplite, and granitic rock. Locally metamorphosed to hornblende gneiss and amphibolite, especially at margin of bodies. Locally contains inclusions of metamorphic rock. Contains andesine or labradorite, hornblende, and locally, biotite. Occurs as small bodies throughout area of Early Proterozoic rocks; many are too small to show on map

Xlg **Leucogranodioritic gneiss (Early Proterozoic)**--Fine-grained leucogranodioritic and quartz dioritic gneiss. Occurs in sec. 2, T. 13 N., R. 10 W. as small projection of body covering large area north of the map area. May correlate with alaskite porphyry unit of Bagdad area (Anderson and others, 1955)

Xgg **Gneissic granodiorite (Early Proterozoic)**--Light-gray biotite granodiorite ranging to quartz monzonite and quartz diorite. Grain size 5 mm. Many xenoliths of Xmg near contacts. Quartz, feldspar, and biotite grains are bent, broken, and partly recrystallized and form a partly healed cataclastic texture

Xdgm **Plutonic and metamorphic rock (Early Proterozoic)**--Mixed, variously metamorphosed gabbro, diorite, granodiorite, and porphyritic granodiorite containing numerous septa and inclusions of biotite schist and gneiss and intrusions of leucogranite and pegmatite. Mapped in secs. 17, 18, and 19, T. 13 N., R. 11 W.

Xsg **Mica schist and gneiss (Early Proterozoic)**--Plagioclase-quartz schist and gneiss containing variable proportions of biotite and muscovite; locally contains sillimanite ranging from fibrolite to aggregates of needles as much as 8 cm long. Locally contains garnet as much as 3 mm in diameter. Muscovite forms porphyroblasts as much as 1 cm in diameter. Muscovite and sillimanite appear to be in equilibrium. Contains some thin layers of biotite-quartz-plagioclase gneiss, quartzite, amphibolite, and biotite-hornblende gneiss. Contains pegmatite stringers, lenses, and dikes and is intruded by various granitic rocks. Mapped in eastern part of area

Xgs **Migmatitic gneiss and schist (Early Proterozoic)**--Biotite-plagioclase schist and gneiss, biotite-quartz-plagioclase schist, amphibolite, biotite-hornblende-plagioclase gneiss, plagioclase porphyroblast gneiss, and less common muscovite-garnet-biotite schist and gneiss locally containing sillimanite. Contains pods of diorite and gabbro partly metamorphosed to amphibolite. Contains pegmatite lenses, stringers, and pods. Some of the feldspar porphyroblast gneiss resembles porphyritic granodiorite gneiss, which intrudes the migmatitic gneiss and schist. More mafic schist and gneiss in north part of outcrop area. Complex gradational contact with Xcg; sharp contact with Ys. Mapped along east side of Signal batholith

Xm **Metamorphic rocks (Early Proterozoic)**--Plagioclase-quartz-biotite gneiss, plagioclase-biotite-microcline-quartz gneiss, biotite-microcline-plagioclase-quartz gneiss locally containing garnet, amphibolite, and hornblende-pyroxene-plagioclase granofels. Contains small bodies of metagabbro. Injected by dikes of Ys. Mapped in and adjacent to Ys outcrops in western part of area

Xa **Amphibolite (Early Proterozoic)**---Contains some layers of muscovite-biotite schist and gneiss. Mapped in eastern part of area

Xmag **Mafic gneiss (Early Proterozoic)**--Dark-greenish-gray to black fine-grained biotite-hornblende-plagioclase schist and gneiss and plagioclase porphyroblast gneiss. Contains numerous intrusions of porphyritic quartz diorite, granodiorite, and quartz monzonite, (Xcg) containing feldspar phenocrysts as much as 2 cm in diameter, and of fine- to medium-grained quartz monzonite and granite (YXg), and of variously metamorphosed gabbro (Xga). Contacts with adjacent units gradational

Xmg **Mica gneiss (Early Proterozoic)**--Biotite-muscovite gneiss, garnet-muscovite-biotite gneiss, muscovite-quartz schist, and sillimanite and (or) andalusite-muscovite-biotite and biotite-muscovite schist. Contains tourmaline-bearing pegmatites and some tourmaline-bearing layers. Muscovite as much as 2 mm in diameter. Ranges from finely laminated to unlayered in outcrops a meter or two across

Xmv **Mixed metavolcanic rocks (Early Proterozoic)**--Fine-grained biotite-quartz-feldspar gneiss, amphibolite, hornblende gneiss, quartz-plagioclase-hornblende gneiss and some layers of muscovite-biotite schist and gneiss which locally contain andalusite and (or) sillimanite. Contains some phyllitic schist and white, very fine-grained, banded siliceous layers

Xdr **Dick Rhyolite (Early Proterozoic)**--Fine-grained biotite-quartz-feldspar gneiss locally containing quartz grains as much as 1 mm diameter, lenses of mosaic-textured quartz as much as 2 mm long, and feldspar grains as much as 0.5 mm in diameter in a matrix having a grain size of about 0.2 mm. Contains some layers of muscovite-biotite, sillimanite-muscovite, and andalusite-muscovite-biotite schist, and a few thin amphibolite layers. Rare layers of calc-silicate rock. A few quartz-microcline-tourmaline pegmatites as much as 0.2 m thick. Southwest of U.S. Highway 93 unit contains many intrusions of Yg and Ycg. A marker layer of amphibolite 20-40 m thick separates the Dick Rhyolite from the unit of mixed metavolcanic rocks

Xma **Amphibolite, hornblende gneiss, and quartz-plagioclase-biotite gneiss (Early Proterozoic)**--Small areas in sec. 2, T. 13 N., R. 110 W.

Some of the age relations of the Tertiary units are inferred from unpublished mapping by Ivo Luchitta west of this area and along the Big Sandy River in this map area and from Otton (1982).

The stratigraphic sequence of the layered metamorphic rocks in the northeastern corner of the area is extrapolated from the studies of Anderson and others (1955) at Bagdad (about 10 km northeast of the northeast corner of the map area), and Conway and others (1986) south of Bagdad. The only named stratigraphic unit extended into this map area is the Dick Rhyolite. Other units change lithology southwestward, as does the Dick Rhyolite south of U.S. Highway 93. The supracrustal rocks also become more recrystallized and injected by granitic material southward so that the units are not recognizable with certainty south of U.S. Highway 93. North of that highway the rocks have fewer relict primary structures and textures than in the Bagdad area.

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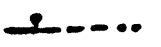

Fault--Dashed where inferred; dotted where concealed. Bar and ball on downthrown side

Shear zone

Strike and dip of bedding

Inclined

Strike and dip of flow foliation

Inclined

Vertical

Strike and dip of foliation and compositional layering

Inclined

Vertical

Strike and dip of foliation

Inclined

Vertical

Bearing and plunge of mineral lineation--May be combined with foliation or foliation and layering

Inclined

Area of fractured rock

CORRELATION OF MAP UNITS