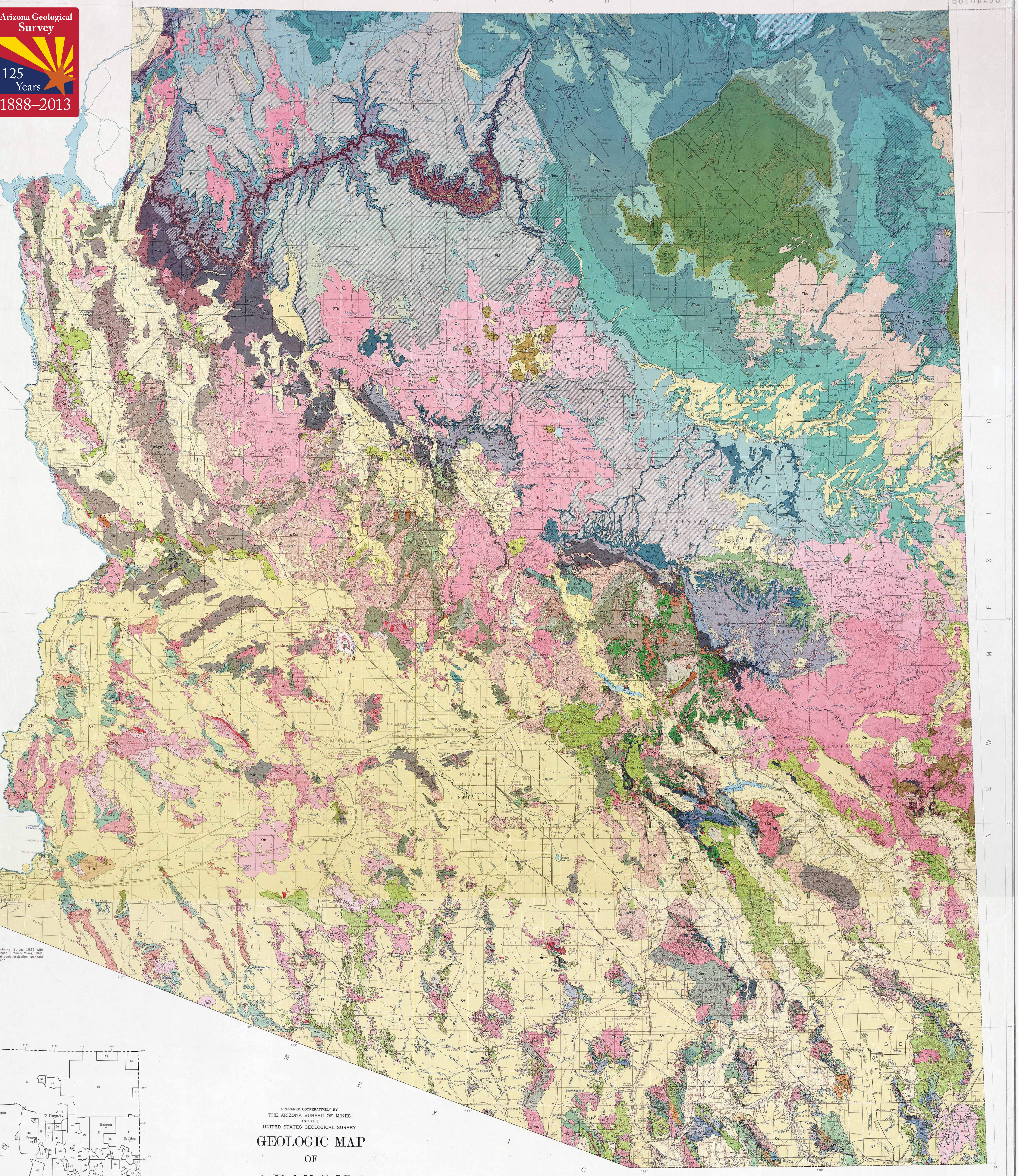
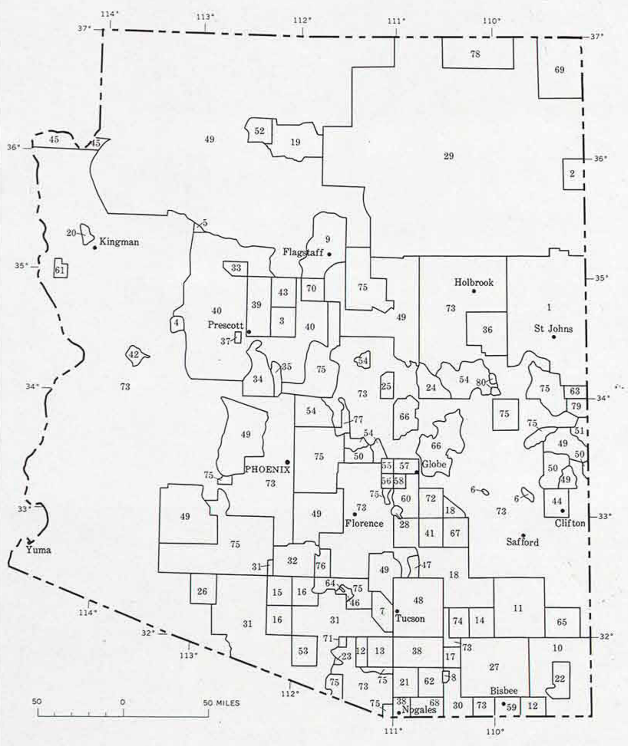
Arizona Geological Survey
125 Years
1888–2013





PREPARED COOPERATIVELY BY
THE ARIZONA BUREAU OF MINES
AND THE
UNITED STATES GEOLOGICAL SURVEY

GEOLOGIC MAP OF ARIZONA

By
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SCALE 1:500 000
1 INCH EQUALS APPROXIMATELY 8 MILES
10 0 10 20 30 40 50 MILES
10 0 10 20 30 40 50 KILOMETERS
CONTOUR INTERVAL 500 FEET
DATUM IS MEAN SEA LEVEL
1969

SOURCES OF DATA

Sources cited have been locally modified or adjusted by the authors or by collaborating members of the staff of the United States Geological Survey.
* indicates unpublished.
† indicates unpublished map made for use in compiling county map or maps published by the Arizona Bureau of Mines, 1957–60.

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EXPLANATION

QUATERNARY

Pleistocene and Holocene

Qs — Sedimentary deposits
Mainly alluvial gravel, sand, and silt in flood plains, terraces, fans, and pediment cappings but locally includes dune sand, lake deposits, and landslide masses. Shown only in areas where they are of appreciable thickness or extent

Qb, Qr — Volcanic rocks
Qb, basaltic flows, agglomerate, tuffs, and cinders distinguished from older basalts by recognizable cinder cones, calderas, and other geomorphic evidence of youth
Qr, rhyolitic flows and tuff resting disconformably on Qs. Recognized only in Yuma County

Qi — Dikes and plugs
Mainly basaltic in composition

TERTIARY AND QUATERNARY

Pliocene and Pleistocene

QTs — Sedimentary deposits
Includes Gila Conglomerate and other stream and lake deposits mainly in intermontane areas. Consists of loosely to firmly consolidated gravel, sand, and silt, local clay, gypsum, marl, limestone, diatomite, and some intercalated basalt flows and felsic tuff beds

QTv, QTb, QTr — Volcanic rocks
Includes units interfingering with QTs and some possibly older units whose debris is in QTs
QTv, undivided rhyolitic to andesitic flows and pyroclastic rocks; includes some plugs and dikes
QTb, basaltic flows, agglomerate, tuff, and cinders
QTr, rhyolite flows and pyroclastic rocks

QTi — Dikes and plugs
Mainly andesitic to basaltic in composition but includes some rhyolitic intrusives in central Yuma County

TERTIARY

Pliocene(?) and Pliocene

Tbs, Tc, Tps — Sedimentary deposits
Tbs, sedimentary part of the Bidahochi Formation (Pliocene) in northeastern Arizona consisting of sandstone, siltstone, and locally bentonitic clay
Tc, Chuska Sandstone (Pliocene?) in Apache County
Tps, includes: fossiliferous alluvial and lacustrine deposits of middle or early Pliocene age within valleys of the present drainage system and correlative conglomerate, sand, silt, and clay; Daniels Conglomerate of western Pima County and other unfossiliferous alluvial conglomerates that locally contain lava flows, tuffs, and breccias and interfinger with Tertiary volcanic rocks known to be younger than Tms; and terrestrial deposits tentatively correlated with the Chuska Sandstone or Bidahochi Formation

Miocene(?) and Miocene

Tms — Sedimentary rocks
Terrestrial conglomerate, sandstone, siltstone, limestone, tuffaceous beds, and andesitic flows and breccias, including Locomotive Fanglomerate, Helmet Fanglomerate, Pantano Formation, and Whitetail Conglomerate; and fossiliferous beds in Pima and Yuma Counties known to be no older than late Oligocene or younger than middle Miocene

Ts — Sedimentary rocks
Mainly conglomerate, sandstone, siltstone, limestone, and tuffaceous beds but locally includes volcanic units ranging from rhyolitic to andesitic in composition

Tv, Tvs, Tvi, Tvm — Volcanic rocks
Flows, tuffs, breccias, and agglomerates interfingering in part with Tertiary sedimentary rocks. Includes some plugs and dikes
Tv, rhyolitic to basaltic rocks
Tvs, silicic volcanic rocks
Tvi, intermediate volcanic rocks
Tvm, mafic volcanic rocks

Ti — Dikes, sills, and plugs
Rhyolitic to basaltic in composition

CRETACEOUS AND TERTIARY

Upper Cretaceous and pre-Miocene(?)

TKs — Sedimentary rocks
Includes Cloudburst Formation in Pinal County and unnamed shale, sandstone, conglomerate, and limestone units in southern and western parts of the State; locally contains volcanic rocks

TKv, TKa, TKr — Volcanic rocks
Includes flows, pyroclastic rocks, and associated conglomerates consisting largely of volcanic debris. Where in contact with penecontemporaneous intrusive rocks (TKg, TKdi, TKi), the intrusive rocks generally cut the volcanic rocks
TKv, andesitic to rhyolitic in composition
TKa, predominantly andesitic in composition
TKr, predominantly rhyolitic in composition

TKg, TKdi, TKi — Intrusive rocks
TKg, granite, quartz monzonite, granodiorite, quartz diorite, and some porphyry equivalents of these rocks
TKdi, diorite; includes laccoliths of diorite porphyry in Carrizo Mountains
TKi, granitic, dioritic, rhyolitic, and andesitic dikes, sills, and plugs

TKsc, TKgn — Metamorphic rocks
TKsc, schist and phyllite
TKgn, gneiss derived mainly from intrusive rocks of early Tertiary and Late Cretaceous age but locally includes phases derived from sedimentary and igneous rocks ranging in age from Precambrian through Cretaceous in eastern Pima County

EXPLANATION (Continued)

CRETACEOUS

Upper Cretaceous

Kmv — Mesaverde Group
In Black Mesa area includes Yale Point Sandstone, Wepo Formation, and Toreva Formation

Km — Mancos Shale

Lower(?) and Upper Cretaceous

Kd — Dakota Sandstone

Lower Cretaceous

Kus — Sedimentary rocks
Includes Pinkard Formation in Greenlee County and probably equivalent beds in Graham and Pinal Counties. Upper Cretaceous beds in the Santa Rita Mountains are included with the undivided Cretaceous rocks (Ks)

Kls — Sedimentary rocks
Includes Bisbee Group in the southeastern part of the State; in northern Cochise County also includes underlying Jurassic(?) or Triassic(?) volcanic rocks

Ks, Kv, Kr, Ka, Kvs — Sedimentary and volcanic rocks
Ks, includes Amole Arkose and Recreation Red Beds of Brown (1939) and other units of known or supposed Cretaceous age
Kv, rhyolitic to andesitic flows and tuffs
Kr, predominantly rhyolitic flows and tuffs
Ka, predominantly andesitic flows and tuffs
Kvs, intercalated sedimentary and rhyolitic to andesitic volcanic rocks

JURASSIC

Upper Jurassic

Jm — Morrison Formation
Mapped with San Rafael Group south of latitude 35°50′ north

Middle and Upper Jurassic

Jsr — San Rafael Group
Includes Bluff and Cow Springs Sandstones, Summerville Formation, Todilto Limestone, and Entrada Sandstone of Late Jurassic age, and Carmel Formation of Late and Middle Jurassic age

TRIASSIC AND JURASSIC

JŦgc — Glen Canyon Group
Includes Navajo Sandstone (Jurassic and Triassic?), Kayenta Formation (Upper Triassic?), Moenave Formation (Upper Triassic?), and Wingate Sandstone (Upper Triassic)

JŦg — Granite, quartz monzonite, alaskite, and granitic to monzonitic porphyries

TRIASSIC

Upper Triassic

Ŧc, Ŧcs — Chinle Formation
Ŧcs, Shinarump Member mapped separately north of latitude 35°10′ north

Lower and Middle(?) Triassic

Ŧm — Moenkopi Formation
Includes Hoskinnini Member of Triassic(?) age in Monument Valley area

Order does not reflect age

Mzsc, Mzgn — Mesozoic metamorphic rocks
Mzsc, schist and phyllite derived from Mesozoic sedimentary rocks
Mzgn, gneiss

Mzgr — Mesozoic granite to quartz diorite

Mzv — Mesozoic volcanic rocks
Rhyolitic to andesitic flows and pyroclastic rocks; locally includes interfingering shale, sandstone, and conglomerate. Includes units known to predate Lower Cretaceous rocks in the Huachuca and Patagonia Mountains

Mzs — Mesozoic sedimentary rocks
Includes limestone, shale, sandstone, and conglomerate; locally metamorphosed

MzPzs — Mesozoic and Paleozoic sedimentary rocks undivided

PERMIAN

Pkt — Kaibab Limestone and Toroweap Formation

Pc — Coconino Sandstone

Pdc — De Chelly Sandstone

Pct — Cutler Formation
Includes De Chelly Sandstone Member, Organ Rock Tongue, Cedar Mesa Sandstone Member, and Halgaito Tongue in the Monument Valley area

Ph — Hermit Shale

Pnu — Upper formations
Includes Rainvalley Formation, Concha Limestone, and Scherrer Formation

PENNSYLVANIAN AND PERMIAN

PIPs — Supai Formation

PIPc — Pakoon Limestone (Permian) and Callville Limestone (Pennsylvanian) of McNair (1951) undivided

PIPn — Naco Group undivided

PIPnl — Lower formations
Includes Epitaph Dolomite (Permian), Colina Limestone (Permian), Earp Formation (Permian and Upper Pennsylvanian), and Horquilla Limestone (Pennsylvanian). Also includes the Naco Formation as used in central Arizona

Pzs — Paleozoic sedimentary rocks undivided

EXPLANATION (Continued)

DEVONIAN AND MISSISSIPPIAN

MDs — Sedimentary rocks
Includes Upper Mississippian Paradise Formation of Stoyanow (1926) and Hernon (1935) in extreme southeastern Arizona; Escabrosa Limestone (Upper and Lower Mississippian) and Martin Formation (Devonian) in much of southern and central Arizona; Redwall Limestone (Mississippian) and Temple Butte Limestone (Upper? Devonian) in northern Arizona; Modoc Limestone (Lower Mississippian) and Morenci Shale (Upper Devonian) in western Greenlee County; and locally Pennsylvanian limestone

CAMBRIAN AND ORDOVICIAN

OCs — Sedimentary rocks
Includes Longfellow Limestone (Lower Ordovician and Upper Cambrian) and Coronado Quartzite (Upper Cambrian) in Greenlee County; El Paso Limestone (Lower Ordovician), Abrigo Formation (Upper and Middle Cambrian), and Bolsa Quartzite (Middle Cambrian) in eastern Cochise County; Abrigo Formation and Bolsa Quartzite in western Cochise, Graham, Pima, Santa Cruz, Pinal, Gila, and Maricopa Counties; Tonto Group (Middle and Lower Cambrian) in northern and central Arizona; and Ordovician(?) and Cambrian limestone and dolomite in northwestern Mohave County

PRECAMBRIAN

Younger Precambrian

pCdb — Diabase
Locally includes post-Precambrian diabase

pCt — Troy Quartzite
Locally may contain Cambrian sandstone and quartzite

pCg — Grand Canyon Series
Includes Chuar and Unkar Groups

pCa — Apache Group
Includes Mescal Limestone and associated basalt flows, Dripping Spring Quartzite, and Pioneer Shale

Older Precambrian

pCgr, pCdi, pCpy — Intrusive rocks
pCgr, granite, quartz monzonite, granodiorite, and quartz diorite. Locally includes areas of granitic rocks, and other igneous rocks of post-Paleozoic age
pCdi, diorite, diorite porphyry, and gabbro
pCpy, pyroxenite

pCm — Mazatzal Quartzite
Locally includes Deadman Quartzite and Maverick Shale of Wilson (1939)

pCry — Rhyolite
Mainly flows and intrusive material but includes minor amounts of agglomerate and breccia

pCsc, pCgs, pCgn — Metamorphosed sedimentary and volcanic rocks
Mainly phyllite, slate, mica schist, chlorite schist, and amphibolite derived from interbedded shale, sandstone, and rhyolitic to basaltic flows and tuffs but locally includes intrusive rhyolite, diorite, gabbro, and pyroxenite
pCsc, includes Vishnu Schist in Grand Canyon area, Yavapai Series in central Arizona, Pinal Schist in southeastern Arizona, and unnamed schistose units
pCgs, mainly nonfoliated greenstone units derived from metamorphism of mafic flows and intrusive rocks
pCgn, gneiss; includes some areas of undivided schist and granite

STRUCTURAL SYMBOLS

Diatreme — Cinder cone — Caldera — Thrust fault
Normal fault (D, U) — Anticline — Syncline — Monocline

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