Lexicon of geologic names of southern Arizona

Larry Mayer, 1978, pp. 143-156


This is one of many related papers that were included in the 1978 NMGS Fall Field Conference Guidebook.

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LEXICON OF GEOLOGIC NAMES OF SOUTHERN ARIZONA

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The entries in this lexicon are organized as follows:

Geologic Name Thickness Geologic Period

1. Type locality.
2. Initial and important published references.
3. Lithology.
4. Contact relations; if intrusive then isotopic age date if available.
5. Comments or isotopic ages for volcanics if available.

Geologic names include informal names as well as names accepted by the U.S. Geological Survey. Thickness refers to the type section. If a type section was not referred to in the source, then the maximum thickness was used. All localities are in southeastern Arizona unless otherwise indicated. The source of the isotopic age-dates are referenced only when they were not contained in the source noted in item 2. A 't' after a geologic name indicates the name is generally unused or obsolete.

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Abrigo Formation 235m Upper Cambrian
1. Bisbee.
2. Ransome 1904 (Abrigo Limestone); Stoyanow, 1936; Hayes and Landis, 1965; Hayes, 1975.
3. Limestone, cherty limestone to calcareous shale.
5. Stoyanow subdivided Abrigo into: Copper Queen Limestone, Abrigo formation (restricted), Southern Belle Quartzite, Santa Catalina Formation. Hayes and Landis subdivided Abrigo into: Copper Queen member, upper sandy member, middle member, lower member. Lithologies of latter members are as follows (maximum thickness): Lower member-(202 m) micaceous silty shale and thin-bedded limestone in Mule Mtns.; siltstone and fine-grained sandstone further north. Middle member-(393 m) distinctively ribbed limestone or dolomitized limestone in and west of Mule Mtns. Farther north, in Brandenburg Mtn. area, entirely sandstone. In transition between these facies, dolomite dominates. Upper sandy member-(155 m) sandstones that are well sorted and dolarenites, some glauconitic. Copper Queen member-(45 m) medium-gray to pinkish gray limestone and calcarenite, cross-laminated dolomitized sandstone.

Abrigo Formation (restricted) Upper Cambrian
1. Bisbee.
2. Stoyanow, 1936.
3. Restricted to that part of Abrigo which contains Crepicephalus-Arapahoa fauna.
4. Underlain by Southern Belle Quartzite. Overlain by Copper Queen Limestone.

American Flag Formation 633m Cretaceous(?)
1. American Flag Spring, Mammoth quadrangle.
3. Fine- to medium-grained graywackes; conglomerate.

Amole Arkose 610m Lower Cretaceous
1. Tucson Mtns.
3. Arkoses, siltstones.

Amole Granite Upper Cretaceous/lower Tertiary
1. Tucson Mtns.
4. Intrudes Cretaceous (Laramide?) sedimentary rocks. K-Ar age date 68.1 ± 2.7 m.y. (Damon and Bikerman, 1964).

Amole Latite Upper Cretaceous/lower Tertiary
1. Tucson Mtns.
3. Dense felsitic rock with phenocrysts of quartz and feldspar and abundant xenoliths of arkose.
4. Intrusive as sills into Cretaceous sedimentary rocks.

Amole Quartz Monzonite Upper Cretaceous/lower Tertiary
1. Tucson Mtns.
3. Quartz monzonite.
4. K-Ar age date, 72.9 ± 2.2 m.y. (Damon and others, 1963).

A Mountain Basaltic Andesite Oligocene/Miocene
1. Sentinel Peak (*A Mtn.*)
4. K-Ar age date, 27.0 ± 1.2 m.y.

Andrada Formation Pennsylvanian and Permian
1. Empire Mtns.
2. Wilson, 1951; Bryant, 1955.
3. Limestones; dolomites; red siltstones.
4. Equivalent of Earp, Colina and Epitaph Formations undifferentiated.

Angelica Arkose 1524m+ Lower Cretaceous
1. Sierrita Mtns.
3. Conglomerate; arkosic sandstone and siltstone; arkosic grit and pebble conglomerate.
5. The minimum age of the Angelica Arkose is fixed by the overlying Late Cretaceous Demetrie Volcanics. Cooper correlates the Angelica with Amole Arkose and Bisbee Group.

Ankla Formation Upper Cretaceous
1. Tucson Mtns.
3. Tuffaceous arkoses and siltstones.
4. Underlain by Cat Mountain Rhyolite.

Apache Canyon Formation 260m Lower Cretaceous
1. Whetstone Mtns.
3. Siltstone and mudstone, some fine-grained sandstone and arkose.
4. Underlain by Willow Canyon Formation. Overlain by Schellenburg* Canyon Formation.
5. Part of Bisbee Group.
Drewes uses the name Schellenburger

Apache Group 305m Upper Precambrian
2. Ransome, 1903, 1915; Darton, 1932.
3. Arkosic quartzite; siliceous mudstone; conglomerate; limestone. Numerous diabase intrusions.
5. Intruded by 1150-1200 m.y. old diabase. Widespread occurrence throughout central Arizona. Subdivided into Mescal Limestone; Dripping Spring Quartzite; Barnes Conglomerate Member; Pioneer Shale; Scanian Conglomerate Member.

Apsley Conglomerate Member 120m Tertiary
1. Apsley Camp, Brandenburg Mtn. quadrangle.
3. Cliff-forming thin-bedded, yellowish to light gray conglomerate and some conglomeratic tuff.
4. Underlain by Helis Half Acre Tuff Member. Overlain by andesite of Table Mountain in Holy Joe Peak quadrangle.
5. Member of Galiuro Volcanics.

Aravaipa Member 90m Miocene
1. Aravaipa Canyon, Brandenburg Mtn. quadrangle.
3. White, unwelded tuff; gray, slightly welded devitrified tuff; welded devitrified tuff.
4. Member of Galiuro Volcanics.
5. K-Ar age dates, 25.7 ± 0.8 m.y., 22.9 ± 0.7 m.y.

Arkell Limestone 0.6m Lower Cretaceous
1. Bisbee area.
3. Slabby, grayish-brown and buff arenaceous limestone.
4. Part of Saavedra Member of Lowell Formation.

Baga Shale and Limestone 2m Lower Cretaceous
1. Ninety One Hills, Bisbee area.
3. Dark gray impure limestone grading laterally into white shale.
4. Part of Joserita Member of Lowell Formation.

Barnes Conglomerate Member 9m Upper Precambrian
2. Ransome, 1903.
3. Well-rounded pebbles of white or pink quartzite with some red Jasper in a matrix of arkosic grit.

Bathtub Formation 701m Lower Cretaceous
1. Near Adobe Canyon, Santa Rita Mtns.
3. Conglomerate; volcanic sandstone; rhyolite tuff breccia; andesite flows, dacite breccia and rhyolite tuff and flows.
4. Underlain disconformably by temporal Formation. Overlain unconformably by Bisbee Formation.

Beehive Rhyolite Tertiary
1. Tucson Mtns.
2. Brown, 1939; Damon and Bikerman, 1964.
4. Equivalent to biotite rhyolite; K-Ar age date 60.5 ± 1.8 m.y.

Big Dome Formation 600m (?) Late Miocene
3. Poorly indurated, pebble to cobble conglomerate.
4. Underlain unconformably by San Manuel Formation. Overlain by Quiburis Formation.
5. K-Ar on interbedded tuff; 14 m.y., 17 m.y.

Bisbee Formation Lower Cretaceous
1. Southeastern Arizona.
3. Arkose sandstone, mudstone, conglomerate, some thin-bedded limestone.
4. Underlain unconformably by older rocks. Overlain unconformably by Tertiary rocks.
5. Equivalent to Morita-Cintura Formations generally north of Mule Mtns. where Mural Limestone is absent.

Bisbee Group 1402m Bisbee 2743m Whetstone Mtns. Lower Cretaceous
1. Southeastern Arizona.
2. Dumble, 1902; Ransome, 1904; Stoyanow, 1949; Tyrrell, 1964.
3. Coarse basal conglomerate, arkosic sandstones, mudstones and limestones.
4. Underlain unconformably by older rocks. Overlain unconformably by Cenozoic rocks.
5. Subdivided into: Cintura Formation; Mural Limestone; (Lowell Formation; Morita Formation; Galian Conglomerate.

Black Knob Dolomite 15m Lower Cretaceous
1. Ninety One Hills, Bisbee area.
3. Yellow or pinkish, sometimes silicified dolomite.
4. Underlain by Cienda Limestone. Overlain by Joserita Member.

Black Prince Limestone 50m Upper Mississippian/Lower Pennsylvanian
1. Central Cochise Co.
3. Limestone with basal pebbly mudstone.
4. Underlain disconformably by Escabrosa Limestone. Overlain disconformably by Horquilla Limestone.

Blacktail Formation Cenozoic (?) 1. Portal area.
3. Andesitic and dacitic lavas and tuffs.
4. May be equivalent to Nipper Formation.

Bliss Sandstone 61m Upper Cambrian-Lower Ordovician
1. Franklin Mountains, Texas.
2. Richardson, 1904.
3. Orthoquartzites, feldspathic sandstones, arkoses near base; some glauconite grains; cross-bedded.
5. Bliss becomes younger from west to east and Early Ordovician fossils have been found. Used in Swisshelm, Chiricahua and Dos Cabezas Mtns.

Boisa Quartzite 131m Middle Cambrian
1. Bisbee.
3. Coarse-grained quartzite, some basal conglomerate.
4. Underlain unconformably by older rocks. Overlain by Abrego Formation.
5. Widespread throughout southern Arizona.

Bonita Beds 244m Pliocene (?)
1. Eastern Safford Valley.
3. Massive conglomerate characterized by basaltic and rhyolitic fragments.

Bonita Park Formation Cenozoic
3. Red beds and tuff.

Bronco Volcanics 1829m Upper Cretaceous or lower Tertiary
1. Bronco Hill near Tombstone.
3. Andesite flow breccia; fine-grained quartz-latite tuff.
### Buford Canyon Formation
671 m Mesozoic and Cenozoic
- Buford Canyon, Kiondyke quadrangle.
- Poorly sorted, bedded conglomerate with fragments of Pinal Schist; fine-grained, sparsely porphyritic vesicular or amygdaloidal basalts and andesites.
- Underlain unconformably by Pinal Schist.

### Canelo Hills Volcanics
1829 m Triassic or Jurassic
- Canelo Hills and Huachuca Mtns.
- Volcanic sedimentary rock, interlayered rhyolitic tuff and lava; rhyolitic lava; welded tuff.
- Underlain unconformably by Paleozoic rocks. Overlain unconformably by younger strata.
- K-Ar date of 173 ± 7 m.y. on biotite of welded tuff.

### Canelo Red Beds
415 m Lower Cretaceous
- Canelo Hills.
- Red elastics with some thin beds of limestone.
- Underlain unconformably by Paleozoic rocks. Overlain unconformably by younger rocks.

### Cargadera Quartz Monzonite Miocene
- Santa Catalina Mtns.
- Quartz diorite to quartz monzonite.
- K-Ar age date, 24.8 ± 3 m.y.

### Catalina Granite
Post-Cretaceous
- Santa Catalina Mtns.
- Moore and others, 1941; Peirce, 1958; McCullough 1963; Hoelle, 1976.
- Hypidiomorphic biotite-hornblende-sphene-bearing quartz monzonite.

### Catalina Gneiss
Precambrian
- Santa Catalina Mtns.
- Banded augen gneiss, augen gneiss, gneissic granite.
- Banks (1976) suggests Catalina Gneiss is cataclastically deformed Samaniego and Oracle Granite, and sills.
- K-Ar age dates, 29.3 ± 1.0 m.y. (Livingstone and others, 1967). Now considered part of Santa Catalina Gneiss.

### Cat Mountain Rhyolite
244 m Upper Cretaceous
- Tucson Mtns.
- Brown, 1939.
- Rhyolite flows and mudflows.
- Underlain unconformably by Amole Arkose and Tucson Mountain Chaos. Overlain by Anklam Formation/Safford Tuff. K-Ar age date, 69.6 ± 2.8 m.y. (Bikerman and Damon, 1966).

### Cave Creek Formation
1372 m Cretaceous
- Cave Creek area.
- Enlows, 1955.
- Rhyolitic tuffs and welded tuffs.
- May be correlated with Rhyolite Canyon Formation (Marjaniemi, 1968).

### Chapparal Sandstone
7 m Lower Cretaceous
- Ninety One Hills, Bisbee area.
- Stoyanow, 1949.
- White saccharoidal sandstone with large fossil tree trunks.
- In Saavedra Member of Lowell Formation.

### Chiricahua Rhyolite
Tertiary (?)
- Pedregosa Mountains.
- Kottlowski, 1963. **Cholla Member I**- 21m Lower Cretaceous
- Ninety One Hills, Bisbee area.
Copper Belle Monzonite Porphyry  Triassic or Jurassic
1. Copper Belle Claim, Gleeson Ridge.
3. Light-gray to greenish-gray or pink porphyry.

Copper Creek Granodiorite  Upper (?) Cretaceous
1. Copper Creek, Klondyke quadrangle.
3. Medium-grained porphyritic and slightly cataclastic.

Copper Queen Limestone  25 m Upper Cambrian
1. Bisbee.
2. Stoyanow, 1936.
3. White to gray cliff-forming algal limestone.
5. Considered member of Abris by Hayes (1975).

Coronado Sandstone  60 m Middle to Upper Cambrian
1. Clifton-Morenci area.
3. Arkosic to orthoquartzitic sandstones with some siltstones, shales and sandy dolomites.

Corral de Piedras Welded Tuff Oligocene-Miocene
1. Tumacacori Mtns.
3. Tuffs.
4. K-Ar date, 26.5 ± 1.2 m.y.

Corta Sandstone  Illm  Lower Cretaceous
1. Ninety One Hills, Bisbee area.
3. Crossbedded sandstone.

Demetrie Volcanics  2440 m (? ) Cretaceous-Tertiary
1. Tascuela area, Sierrita Mtns.
3. Grayish-blue dacite to andesite tuff breccia.

Desert Museum Andesite Porphyry  Upper Jurassic (?)
3. Andesite porphyry.
4. Intrudes Recreation Red Beds. K-Ar, 150 ± 5 m.y.

Dripping Spring Quartzite  59 m Upper Precambrian
1. Globe area.
2. Ransome, 1903; Ransome, 1915; Cooper and Silver, 1964.
3. Quartzite; arkosic quartzite; intercalated shale.
4. Underlain by Barnes Conglomerate, overlain by Mescal Limestone.
5. Part of Apache Group.

Earp Formation  123 m Pennsylvanian (Virgilian)
1. Tombstone Hills.
3. Thin shaly limestones and reddish shales; massive limestone and dolomite that weather orange or reddish.
4. Underlain by Horquilla Limestone. Overlain by Colina Limestone.
5. The Earp Formation is believed to be wholly of marine origin, recording shallower conditions than prevailing during Horquilla deposition. The conglomerates in the lower third of the Earp appear to be intraformational. Part of Apache Group.

Elephant Head Quartz Monzonite  Upper Cretaceous
1. Santa Rita Mtns.
3. Fine- and coarse-grained quartz monzonite.
4. K-Ar age dates on biotite, 68.2 ± 4.5 m.y., 69.0 ± 2.1 m.y. Pb-alpha on zircon 188 m.y.
5. The Pb-alpha age may suggest that the Elephant Head is Jurassic Squaw Gulch Granite that was recrystallized in the Late Cretaceous.

El Paso Group  488 m Lower Ordovician
1. Franklin Mountains, Texas.
2. Richardson, 1904; Hayes, 1975.
3. Thin layered carbonates, quartzose at base; skeletal lime wackestones, thick bedded; sandy dolomites.
4. Underlain unconformably by Bliss Sandstone or Precambrian rocks. Overlain unconformably by Montoya Limestone.
5. El Paso is considered a group in "eastern area" which does not extend into Arizona. In Arizona, Hayes refers to El Paso as a formation. The formations composing the El Paso Group are: Hitt Canyon Formation, McKellingon Limestone, Padre Formation.

Epitaph Dolomite  239 m Permian (Leonardian)
1. Tombstone Hills.
3. Dolomite with knots of silica; dolomite, limestone, red shale and thin sandy layers.
4. Underlain by Colina Limestone. Overlain conformably (?) by Scherrera Quartzite or unconformably by Glance Conglomerate.
5. Part of Naco Group.

Escabrosa Limestone  213 m Lower Mississippian (Kinderhookian and Osagean)
1. Bisbee.
2. Ransome, 1904.
3. Limestone, light-gray, thick-bedded, coarse-grained with crinoid fragments.

Espinal Gritt  Illm  Lower Cretaceous
1. Ninety One Hills, Bisbee area.
3. Conglomeratic grit, subangular pebbles of limestone, quartzite, chert, arkose.
4. Overlain by Corta Sandstone.

Faraway Ranch Formation  240 m Cenozoic
3. Ignimbrites.
4. K-Ar age date, 27.6 ± 0.8 m.y. (Marjaniemi, 1968).

Flattop Basaltic Andesite  Oligocene-Miocene
1. Greenlee County.
4. K-Ar age date, 27.5 ± 0.8 m.y.

Fort Buchanan Formation  610 m Upper Cretaceous
1. Santa Rita Mtns.
3. Conglomerate, alternating shales and sandstones.
4. Underlain by andesitic lavas. Overlain by Fort Crittenden Formation.
5. Part of Sonora Group, etc.

Fort Crittenden Formation  1372 m Upper Cretaceous
1. Santa Rita Mtns.
3. Conglomerate, sandstone and shale.
4. Underlain unconformably by Bisbee Formation. Overlain by Salero Formation.
5. Originally part of Sonoita Group. Sonoita dropped by Drewes (1968) and Fort Crittenend redefined and divided into five members.

Fort Lowell Formation  120m  Pleistocene
1. Tucson basin.
3. Dominantly sand and gravel.
4. Underlain unconformably by Tinaja Beds. On surface called Rillito surface (Passley, 1966); upper surface is University Terrace.
5. Locally faulted and tilted.

Fresnal Quartz Monzonite  Lower Tertiary
1. Tascuela area, Sierrita Mtns.

Galiuro Limestone  Pennsylvania
1. Galiuro Mtns.
2. Stoyanow, 1936.

Galiuro Volcanics  1090m  Oligocene-Miocene
1. Galiuro Mtns.
3. Basaltic andesites, latites, conglomerates, rhyolites, tuffs.
5. Krieger subdivided Galiuro Volcanics into the following for Holy Joe Peak and Brandenburg Mtn. quads: andesite of Table Mountain, Apsey Conglomerate Member, Hells Half Acre Member, Rhyolitic-Obssidan Member, andesite and conglomerate of Virgin Canyon, Aravaipa Member, tuff and conglomerate of Bear Springs Canyon, andesite and conglomerate of Depression Canyon, Holy Joe Member, andesite of Little Table Mountain. K-Ar date for tuff and conglomerate of Bear Springs Canyon, 23.8 ± 0.7 m.y.

Gardner Canyon Formation  300m  Triassic or Jurassic
1. Santa Rita Mtns.
3. Red beds with intercalated conglomerate and volcanics.
5. Pb-alpha on zircon, 180 ± 20 m.y. Pb-alpha age, 170 ± 34 m.y. (Marvin and others, 1973).

Gila Conglomerate  800m+  Pliocene
1. Southeastern Arizona and southwestern New Mexico.
3. Conglomerate, sandstone, siltstone, local limestone, tuffs, basalt flows, volcanic sediments.
4. Underlain unconformably by older rocks.
5. In San Manuel area Krieger and others (1973) divided the Gila Conglomerate into the Quiburis, Big Dome and San Manuel Formations. Cornwall and Krieger (1975) report thickness of Gila Conglomerate in the Kearny quad. that exceed 3.5 km.

Glance Conglomerate  Lower Cretaceous
1. Bisbee.
2. Ransome, 1904; Gilluly, 1956.
3. Poorly bedded conglomerate with fragments of Naco Group limestones; sandstone and purple to green shaly sandstones.
4. Underlain unconformably by older rocks. Overlain by Morita Formation.
5. Basal member of Bisbee Group. Group locally in the Huachuca Mountains contains abundant intermediate lava flows and overlies unconformably the Canelo Hills Volcanics. The Glance has a very variable thickness, often less than 30 m, attributed to irregularities in its predepositional surface. It is reported to be "several thousand feet" thick at Bisbee (Ransome 1904). (See Bilodeau, this guidebook.)

Gleeson Quartz Monzonite  Triassic or Jurassic
1. Gleson area.
3. Coarse-grained, light-gray to greenish-gray, quartz monzonite.
4. K-Ar age date, 181 ± 5.4 m.y. (Drewes, 1976).

Glory Hole Volcanics  457m  Mesozoic or Cenozoic
1. Glory Hole mine, northwest of Copper Creelc.
3. Tuffs, welded tuffs, breccias, lavas, flows, breccias; andesitic or dacitic composition.
4. Overlain by Galiuro Volcanics.

Goodwin Canyon Quartz Monzonite Tertiary
1. Goodwin Canyon, Klondyke quadrangle.
3. Granitoid; equigranular granite, quartz monzonite, diorite, granodiorite.
4. Intrudes Pinkard rocks.

Gringo Gulch Volcanics  450m  Paleocene(?)
3. Dacitic lava, dacitic sandstone, conglomerate, tuff; pale orange tuff.
4. Underlain unconformably with rocks as young as the Josephine Canyon Diorite. K-Ar age date, 60.4 ± 4.2 m.y. (Drewes, 1971).

Granodiorite of Happy Valley  Oligocene
1. Happy Valley.
3. Moderately coarse-grained, massive, biotite granodiorite.
4. K-Ar age dates, 27.3 ± 1.1 m.y., 26.3 ± 0.9 m.y.

Grosvenor Hills Volcanics  600m  Upper(? ) Oligocene
3. Basal gravel and silt; tuff, tuffaceous sandstone, lava flows; vitrophyre flows, tuff.
4. Underlain unconformably by Cretaceous or older rocks. Overlain unconformably by Nogales Formation.

Hachita Formation  120m  Mississippian (middle Osagean-upper Meramician)
1. Chiricahua Mtns.
3. Crinoidal limestone.
5. In Escabrosa Group.

Happy Valley Quartz Monzonite  Jurassic
1. Lechequilla Peak, east of Tucson.
3. Light pink, medium- to coarse-grained quartz monzonite.

Harris Ranch Monzonite  Jurassic-Cretaceous
1. Tascuela area, Sierrita Mtns.
3. Granodioritic to quartz monzonitic.
4. Isotopic age date, 154 ± 25 m.y. Rb-Sr age date, 130 ± 6 m.y. (Damon and others, 1966).

Hells Half Acre Tuff Member  150m  Miocene
1. Aravaipa Canyon, Brandenburg Mtn. quadrangle.
3. White, air-fall and partly reworked vitric, lithic and crystal tuff. Pumice lapilli and groundmass have been zeolitized.
4. K-Ar age dates, 24.6 ± 0.7 m.y., 22.5 ± 0.7 m.y. Overlain by Apsey Conglomerate member.
5. Part of Galiuro Volcanics.
Hilton Ranch Conglomerate 1278m Upper Cretaceous
1. Empire and Santa Rita Mtns.
3. Cobble and boulder conglomerate.
4. Underlain unconformably by Turney Ranch Formation of Schellenburger Canyon Formation.

Holy Joe Member 90m Miocene
3. Quartz-latite ash-flow tuff, slightly devitrified tuffs and vitrophyre.
4. Member of Galiuro Volcanics. K-Ar age dates, 26.5 ± 0.8 m.y. 26.7 ± 0.8 m.y.

Horquilla Limestone 300m Pennsylvaniaian (Desmoinesian and Missourian)
1. Tombstone Hills.
3. Thin banded, blue-gray limestones alternating with thin beds of red shale and shal't limestone.
4. Underlain unconformably by Escabrosa Limestone. Overlain by Earp Formation.
5. Part of Naco Group. Also called Horquilla Formation.

Horse Mountain Volcanics 900m Upper(? Cretaceous or Tertiary
1. Horse Mountain, near Aravaipa.
3. Andesitic to rhyolitic lava, tuff and agglomerate, some conglomerate.
4. Underlain unconformably by Horquilla or older rocks. Overlain unconformably by Hell Hole Conglomerate.

Huachuca Quartz Monzonite Jurassic(?)
1. Huachuca Mtns.
3. Medium- to coarse-grained equigranular quartz monzonite.
4. Most contacts are faults but Huachuca definitely intrude Permian strata and in some areas is overlain by Glance(?) Conglomerate. K-Ar age date, 164 ± 6 m.y. (Hayes, 1970).

Ivy May Andesite Tertiary
1. Saginaw area, Tucson Mtns.
3. Dark porphyritic andesite.

Johnny Lyon Granodiorite Precambrian
1. Johnny Lyon Hills, Dragoon quadrangle.
2. Damon, 1959; Cooper and Silver, 1964.
3. Medium- to coarse-grained, gray to gray-green, hornblende-biotite granodiorite.
4. U-Pb age date, 1660 ± 30 m.y.

Josephine Canyon Diorite Upper Cretaceous
1. Josephine Canyon, Santa Rita Mtns.
3. Dark-gray moderately coarse-grained subophitic diorite to quartz-diorite.
4. K-Ar age date, 67.1 m.y.; Pb-alpha age dates 60 ± 10 m.y., 60 ± 20 m.y.

Josertia Membert 36m Lower Cretaceous
1. Ninety One Hills, Bisbee area.
3. Soft sandstone and arenaceous shale, shaley limestone.
4. Underlain by Pacheta Member. Overlain by Saavedra Member.
5. Member of Lowell Formation.

Juniper Flat Granite Triassic or Jurassic
1. Bisbee quadrangle.
3. Granite porphyry to porphyritic granite. 4. Rb-Sr age date, 186 m.y.; K-Ar age date, 163 m.y. (Creasey and Kistler, 1962).

Kannally Member 1500m Middle(? Tertiary
1. Kannally Wash, Pinal Co.
3. Alluvial deposits characterized by boulders of gray quartz monzonite.
4. Underlain by Cloudburst Formation. Overlain unconformably by Tucson Wash Member.
5. Member of San Manuel Formation. Kannally dips 15°-20° NE, steepening to 45° near San Manuel fault.

Keating Formation 180m Mississippian (Osagean)
1. Blue Mtn., Cochise Co.
3. Sequence of calcilutites and encrinites.
5. In Escabrosa Group.

Kino Formation Lower Tertiary
3. Dominantly conglomerate.

Lancha Limestone 4m Lower Cretaceous
1. Ninety One Hills, Bisbee area.
3. Limestone, arenaceous in places.

Laurel Canyon Granodiorite Precambrian
1. Laurel Canyon, Klondyke quadrangle.
3. Coarse-grained, porphyritic, biotite-granodiorite.
4. Intrudes Pinal Schist and is intruded by diabase dikes.

Leatherwood Quartz Diorite Cretaceous-Tertiary
1. Santa Catalina Mtns.
3. Massive to gneissic.

Lowell Formation Lower Cretaceous
1. Bisbee area.
3. Sandstones and limestones.
5. Stoyanow restricted Mural to massive upper beds and named thinner bedded strata Lowell. Lowell consists of: Pachita, Jose- rita, Saavedra, Cholla, Quajote, Perilla and Pedregosa Members.

Lower Ouray Formation Upper Devonian
1. Santa Catalina Mtns.
2. Stoyanow, 1936.
3. Shale, sandstone and limestone containing Camerotoechial end-ichi and fish teeth.
5. Stoyanow believed this unit to be distinctly younger than typical Martin.

Madera Canyon Granodiorite Upper Cretaceous
1. Madera Canyon, Santa Rita Mtns.
3. Leucocratic and melanocratic granodiorite and porphyritic granodiorite.
4. K-Ar age date, 67.9 ± 2.1 m.y.

Martin Limestone 95m Middle and Upper Devonian
1. Mt. Martin, near Bisbee.
2. Ransome, 1904.
3. Dark-gray limestones and pink calcareous shales.
4. Underlain unconformably by Abrigo Formation. Overlain by Escabrosa Limestone.
5. Cooper and Silver (1964) used name Martin Formation in Dragoon Mountains due to presence of terrigenous clastics. Martin grades into an arenaceous facies in central Arizona (Stoyanow, 1936).

Mescal Limestone 75m Upper Precambrian
1. Globe area.
2. Ransome, 1915.
3. Cherty limestone.
4. Underlain by Dripping Spring Quartzite. Overlain unconformably by Troy Quartzite.
5. Part of Apache Group.

Mineta Formation Lower Miocene
1. Near Redington.
3. Conglomerate, mudstone, siltstone and limestone.

Moly Gibson Formation Lower Cretaceous
1. Patagonia Mtns.
3. Shale, limestone and siliceous shales.
4. Underlain by lower section of Patagonia Group. Overlain by hornstones and siliceous or argillaceous shales of upper Patagonia Group.
5. Part of Patagonia Group.

Montana Peak Formation 240m Cenozoic(?)
1. Montana Peak, Ruby quadrangle.
3. Rhyolitic lavas, breccias, tuffs.

Morita Formation 440m Lower Cretaceous
1. Bisbee.
2. Ransome, 1904.
3. Shales, sandstones and limestones; red shale.
5. Part of Patagonia Group.

Mount Wrightson Formation 2550m Triassic or Jurassic
1. Santa Rita Mtns.
3. Dacitic to andesitic, some rhyolite and "turkey track" andesitic rocks; rhyolitic and latictic volcanics with lenses of sandstone, tuff; pillow lavas, sandstone.
4. Pb-alpha age date, 220 ± 30 m.y.

Mural Limestone 200m Lower Cretaceous
1. Bisbee.
2. Ransome, 1904; Gilluly, 1956.
3. Thin-beded limestone, shale and sandstone; massive limestone; thin-beded shale, sandstone, mudstone, limestone.
5. Part of Bisbee Group.

Naco Limestone 600m Upper Pennsylvanian and Permian
1. Bisbee.
2. Ransome, 1904.
3. Limestone and some dolomites and shales.
4. Underlain unconformably by Escabrosa Limestone. Overlain unconformably by younger rocks.

Nipper Formation Upper Cretaceous to Tertiary
1. Near Blue Mountain, Cochise Co.
2. Sabins, 1957. Conglomerate, mafic volcanic cobbles and boulders; aphanitic andesite, flows.

Nogales Formation 300m Cenozoic and Miocene
1. Santa Rita Mtns.
3. Cobble to pebble gravel, grit and intercalated sand and silt.
5. K-Ar age date, 12.6 ± 0.8 m.y.

Oracle Granite Precambrian
1. Mammoth area.
2. Peterson, 1938.
3. Coarse-grained porphyritic quartz monzonite.
4. K-Ar age date, 1420 m.y. (Damon and others, 1962).

Oro Blanco Conglomerate Mesozoic
1. Oro Blanco mining district.
2. Fowler, 1938.
3. Conglomerate-breccia.

Ox Frame Volcanics 1950m Mesozoic
1. Sierrita Mtns., Ox Frame Canyon.
3. Andesitic and rhyolitic volcanics, flow breccias, tuffs and welded tuffs.
4. Hayes and Drewes (1968) placed the Ox Frame Volcanics in the Triassic/Jurassic and correlated with the Canelo Hills Volcanics and Mount Wrightson Volcanics. Lootens placed it in the Lower(?). Cretaceous.

Pantano Formation 3900m Oligocene-Miocene
1. Tucson area.
3. Conglomerates, sandstones, mudstones with intercalated volcanics.
4. K-Ar age date, on tuff, 38.9 ± 1.5 m.y. (Marvin and others, 1973).

Papago Formation Lower Tertiary
1. Mission mine, near Tucson.
3. Dominantly argillite.

Paradise Formation 31m Upper Mississippian (Chesterian)
1. Chiricahua Mtns.
2. Stoyanow, 1936.
3. Black and gray crystalline limestone with sandstone and shale.

Patagonia Group 1740m+ Lower Cretaceous
1. Patagonia Mtns.
3. Shale, sandstone and volcanics.

Patagonia Tuff Oligocene-Miocene
1. Patagonia Water Gap.
3. Tuffs.
4. K-Ar age date, 25.3 ± 5.1 m.y.

Peppersauce Canyon Sandstone 7m Upper Cambrian
1. Santa Catalina Mtns.
3. Siliceous sandstone, quartzite.
4. Correlated with Copper Queen Limestone of Abrigo Formation.
Percha Shale 60m Middle and Upper Devonian
1. Sierra Co., New Mexico.
2. Gordon, 1907; Schumacher and others, 1976.
3. Calcareous black shales.

Picacho de Calera Formation 25m Upper Devonian
1. Tucson area.
2. Stoyanow, 1936.
3. Sandstone and limestone.
4. Underlain unconformably by Abrigo Formation.

Pinal Schist 6000m Precambrian
1. Pinal Mtns.
2. Ransom, 1903, 1904; Cooper and Silver, 1964.
3. Strongly foliated sericite schist interbedded with quartzose grits of sedimentary origin; some amphibolite schist possibly representing basalt flows; metaterrylite flows. The coarsest clastics are pebble and granule conglomerates grading into sandstones in short distances. The pebbles range from volcanic quartzite to slate and phyllite. In the sandstones, dynamic metamorphism is more apparent than thermal, including elongation of grains, internal granulation and microfolding.
4. Overlain unconformably by Apache Group or younger rocks.
5. The great thickness, cyclic graywacke-slate lithology and other evidence prompted Cooper and Silver to suggest that the Pinal was deposited in a eugeosyncline. Further the Pinal is correlated with the Yavapai Schist and Vishnu Schist. This may imply that paleo-oceanic crust is basement to the Pinal; this base is nowhere exposed.

Pinkard Formation 150m Upper Cretaceous (Coloradoan)
1. Morenci area.
2. Lindgren, 1905.
3. Shales, sandstones and some conglomerate.

Pioneer Shale 81m Upper Precambrian
1. Globe area.
2. Ransom, 1903; Grist, 1954; Peterson, 1962.
3. Grayish-red arenaceous shale, some thin beds of siltstone; tuffaceous siltstone in places.
4. Underlain by Scanlan Conglomerate Member. Overlain by Barnes Conglomerate Member.
5. Part of Apache Group.

Piper Gulch Monzonite Triassic or Jurassic
1. Santa Rita Mtns.
3. Very coarse-grained, dark-gray monzonite.
4. Pb-alpha age date, 180 ± 20 m.y.

Portal Formation 102m Upper Devonian
1. Portal.
3. Alternating thin beds of calcareous shale and shaly limestone; hard fissile black shale; alternating beds of bioclastic limestone.

Quartz Monzonite of Tortolita Mountain Tertiary
1. Tortolita Mtns.
3. Fine-grained, granular quartz monzonite.
4. Fission track age date 16.5 ± 2.1 m.y.

Quiburis Formation 510m Pliocene and Pleistocene
1. San Pedro Valley.
3. Finely laminated mudstones, interbedded tuff; conglomerate with channel-type crossbedding, clasts of Pinal Schist, Apache Group and Ruin Granite.
4. Underlain by Cloudburst Formation. Overlain unconformably by Sacaton Formation and younger deposits.
5. In Gila Group. Krieger and others (1973) redefined the Gila Group excluding the Pleistocene sediments above the Quiburis. A number of diatom species in the fine-grained lakebed facies are characteristic of hot springs. Agenbroad subdivided Quiburis into Tres Alamos Member and Redington Member. K-Ar age date, 5.21 ± 0.17 m.y. (Scarborough, 1975).

Rainvalley Formation 120m Permian (Guadalupian)
1. Mustang Mtns.
3. Thick-bedded sandstone and mustone with some conglomerates and volcanic rocks.

Red Boy Rhyolite 300m Lower Tertiary
1. Tascuela area, Sierrita Mtns.
3. Massive, well indurated rhyolitic tuff intercalated with rhyolitic flows.
4. Underlain unconformably by Demetrie Volcanics. Overlain unconformably by Tertiary or Holocene alluvium.

Redington Member Pliocene
1. Redington-San Manuel area.
3. Fine grained facies of Quiburis Formation.

Rhyolite Canyon Formation 877m Miocene
1. Chiricahua Mtns.
3. Ash flows.
4. K-Ar age date 24.9 ± 0.6 m.y.

Rillito Andesite Oligocene
1. North Tucson Mtns.
3. Contains large feldspar and biotite phenocrysts.
4. K-Ar age date, 38.5 ± 1.3 m.y.

Rincon Limestone Upper Cambrian
1. Rincon and Whetstone Mtns.
2. Stoyanow, 1936.
3. Thick-bedded massive coarse-grained pink limestone with trilobite fragments.

Rincon Valley Granodiorite Precambrian
1. Happy Valley area.
4. K-Ar age date, 1450 ± 60 m.y. May be correlatable with Johnny Lyon Granodiorite (see Silver, this guidebook).

Rodolfo Formation 720m Upper Triassic or Jurassic
1. Sierrita Mtns.
3. Coarse-grained sandstone, conglomerate; siltstone, sandstone, conglomerate; andesitic breccia, red beds, andesitic flows.
5. Oldest intrusive cutting Rodolfo in Ash Creek, is Harris Ranch Monzonite, Pb-alpha age date 190 ± 20 m.y. Damon and others (1965) report a 154 m.y. age.
Scanlan Conglomerate Member 9m Upper Precambrian
2. Ransome, 1903.
3. Coarse-grained porphyritic quartz monzonite.

Sacaton Formation 7m Pleistocene
1. Sacaton Ranch, near Mammoth.
3. Alluvial deposits, predominantly poorly consolidated sand and gravel.
4. Underlain disconformably by Quiburis.

Safford Tuff Miocene
1. Tucson Mtns.
2. Brown, 1939; Damon and others, 1963; Bikerman and Damon, 1966.
3. Tuff and conglomerate.
4. K-Ar age date, 25.2 ± 1.7 m.y.

Sedimentary Rocks of southeastern Arizona not recognized as re
2. 1.
5. Part of Abrigo Formation. 4.
3. Granodiorite
1. 5. K-Ar age date, 72.2 m.y. (Creasey and Kistler, 1962).

San Manuel Formation 600m+ Middle(? Tertiary
1. San Manuel area.
3. Conglomerate, pebble to boulder. Krieger (Kearney quad.) de
scribed three members: older granitic alluvial deposits of poorly con
solidated granitic clasts; non-granitic alluvial deposits cons
isting of conglomerate and sandstone composed of clasts from Paleozoic limestones, Late Cretaceous or younger volcanic rocks and some Pinal Schist; younger granitic alluvial deposits with mostly granitic clasts.
4. Underlain unconformably (?) by Cloudburst Formation. Overlain by Big Dome or Quiburis Formation.
5. Part of Gila Group. Krieger reports 3000 m at Kearny quad.

Santa Catalina Formation Middle Cambrian
1. Santa Catalina Mtns.
3. Thin-bedded mudstone and shale.
5. Part of Abrigo Formation.

Santa Catalina Group Precambrian
1. Santa Catalina Mtns.
2. Blake, 1908; Drewes, 1977.
3. Gneissic rocks of southeastern Arizona not recognized as re-mobilized Phanerzoic.

Santa Teresa Granite Tertiary (?)
1. Santa Teresa Mtns.
3. Very pale red, medium-grained granite.
4. Pb-alpha age date, 60 ± 10 m.y.

Schellenburg/Schellenburger Canyon Formation 760m Lower Creta
taceous
1. Whetstone Mtns.
3. Quartzose and arkosic sandstone, thin-bedded to laminated silt
stone and shale.
4. Underlain by Apache Canyon Formation. Overlain by Turney Ranch Formation.
5. Drewes uses Schellenburger, probably preferred nomenclature.

Scherrer Formation 200m Permian (Leonardian)
3. Red siltstone; dolomitic limestone; massive sandstone.

Schleffel Granodiorite Tertiary
1. Tombstone area.
2. Butler and others, 1938; Gilluly, 1956.
3. Granodiorite to quartz monzonite.

Shore Ranch Andesite 120m Tertiary
1. Tucson Mtns.
5. K-Ar age date, 56.8 ± 1.7 m.y. (Bikerman and Damon, 1966).

Soinel Formation Upper Upper Cretaceous
1. Soinola area.
3. Conglomerates, sandstone, shale.
4. Soinola Group dropped by Drewes.

Southern Belle Quartzite 9m Middle Cambrian
1. Santa Catalina Mtns.
5. Part of Abrigo Formation.

SO Volcanics 1800m Tertiary
1. SO ranch and Hay Mountain.
3. Interbedded quartz latite tuffs and hornblende andesite flows.
4. Underlain by Bisbee(?) Formation. Overlain by Quaternary allu
vium.
5. K-Ar age date, 47 ± 2 m.y. (Marvin and others, 1973).

Squaw Gulch Granite Jurassic
1. Santa Rita Mtns.
3. Coarse-grained, pink, myrmekitic granite.
4. Pb-alpha age dates, 160 ± 20 m.y., 161 ± 20 m.y.

St. David Formation 180m Upper Pliocene to Pleistocene
1. Near St. David and Benson.
3. Silts and clays, fresh-water laid pyroclastics and paleosols.
4. Overlain by “granite wash.”
5. Age is based on vertebrate fossils.

Stevens Mountain Rhyolite 600m Cretaceous(?)
1. Tascuela area, Sierrita Mtns.
3. Conglomerates, sodic extrusives.
4. Underlain by Ox Frame Volcanics. Overlain unconformably by Demetrie Formation.
5. Hayes and Drewes (1968) correlate Stevens Mountains with Canelo Hills Volcanics.

Stronghold Granite  Tertiary
1. Cochise Stronghold, Dragoon Mtns.
3. Light-gray to light pink biotite granite with porphyritic border facies.
4. K-Ar age date, 22 ± 3.1 m.y. (Damon and Bikerman, 1964).

Sugarloaf Quartz Latite 450m  Upper Cretaceous or Lower Tertiary
1. Gleeson area.
3. Light pinkish-gray, phenocrysts of biotite, quartz and feldspar in aphanitic groundmass; andesitic flows.
4. Underlain unconformably by Bisbee Formation.

Sunshine Formation 210m  Cretaceous(?)
1. Tascuela area, Sierrita Mtns.
3. Interbedded pyroclastic and clastic rocks.
4. Underlain unconformably by Paleozoics. Overlain by Ox Frame Volcanics.

Swisshelm Formation 190m  Upper Devonian
1. Swisshelm.
2. Epis and others, 1957.
3. Sandstone, siltstone, shale, impure limestone.

Tascuela Red Beds 600m  Triassic or Jurassic
1. Tascuela area, Sierrita Mtns.
3. Conglomerate, shale and argillite with sandstone.
4. Underlain unconformably by Ox Frame Volcanics. Overlain by Stevens Mountain Rhyolite. 5. Thorns felt Tascuela was Cretaceous.

Temporal Formation 600m  Lower Cretaceous
1. Santa Rita Mtns.
3. Rhyolitic to andesitic tuff, arkosic fanglomerate; conglomerate, latite flows; rhyodacite breccia, conglomerate.

Texas Canyon Quartz Monzonite  Cretaceous or Tertiary
1. Little Dragoon Mtns.
2. Cooper and Silver, 1964.

Three Links Conglomerate 600m(?)  Tertiary
1. Steele Hills, Dragoon quadrangle.
2. Cooper and Silver, 1964.
3. Conglomerate intercalated with sandstone, siltstone, basalt flows and pyroclastic rocks.
4. Underlain unconformably by Morita and Cintura Formations (?). Overlain by Galiuro Volcanics.
5. May be correlated with Whitetail Conglomerate.

Tinaja Beds 1500m(?)  Tertiary
1. Tucson Basin.
3. Sandy gravel grading into gypsiferous clay and mudstone.
4. Underlain unconformably by Pancato Formation. Overlain unconformably by Fort Lowell Formation.
5. Correlated with Nogales Formation. Tres Alamos Member Pliocene
Whitcomb Quartzite  180m  Lower (?) Cretaceous
1. Sierrita Mtns.
3. Medium-grained orthoquartzite with lenses of rhythmic tuff in upper part.

Whitetail Conglomerate  300m  Tertiary
1. Globe area.
2. Ransome, 1903.
3. Alluvial conglomerate.
4. Underlain unconformably by older rocks. Overlain by dacite flow.

Williamson Canyon Volcanics  900m  Upper Cretaceous or Tertiary
1. Williamson Canyon, Klondyke quadrangle.
3. Agglomerates, tuffs, lavas, flow breccias.
4. Underlain disconformably by Pin kard Formation. Overlain unconformably by Arizona Mtns.

Wrong Mountain Quartz Monzonite  Precambrian (?)
1. Happy Valley area.
3. Foliated fine- to medium-grained biotite-muscovite-quartz monzonite.
4. K-Ar age dates, 24.5 ± 0.9 m.y., 24.8 ± 0.9 m.y. Dates may record thermal resetting of mica-clock (see Silver, this guidebook).

REFERENCES


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