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Lexicon of geologic names of southern Arizona

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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.
4. Underlain conformably by Bolsa Quartzite. Overlain disconformably by Devonian strata.
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 dolomitic 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.
2. Creasey, 1967.
3. Fine- to medium-grained graywackes; conglomerate.
4. Underlain unconformably by Escabrosa Limestone. Overlain unconformably by Gila Conglomerate.

Amole Arkose 610m Lower Cretaceous

1. Tucson Mtns.
2. Brown, 1939; Hayes and Drewes, 1968.
3. Arkoses, siltstones.
4. Underlain by Recreation Red Beds. Overlain disconformably by Tertiary rocks.

Amole Granite Upper Cretaceous/lower Tertiary

1. Tucson Mtns.
2. Brown, 1939.
3. Granitic.
4. Intrudes Cretaceous (Laramide?) sedimentary rocks. K-Ar age date 68.1 ± 2.7 m.y. (Damon and Bickerman, 1964).

Amole Latite Upper Cretaceous/lower Tertiary

1. Tucson Mtns.
2. Brown, 1939.
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.
2. Brown, 1939.
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.")
2. Damon and Bickerman, 1964.
3. Basaltic andesite.
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.
2. Cooper, 1971.
3. Conglomerate; arkosic sandstone and siltstone; arkosic grit and pebble conglomerate.
4. Underlain disconformably by Whitcomb Quartzite. Overlain conformably by Demetrie Volcanics.
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.

Anklam Formation Upper Cretaceous

1. Tucson Mtns.
2. Bickerman and Damon, 1966.
3. Tuffaceous arkoses and siltstones.
4. Underlain by Cat Mountain Rhyolite.

Apache Canyon Formation 260m Lower Cretaceous

1. Whetstone Mtns.
2. Tyrrell, 1964; Drewes, 1971.
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

1. Globe.
2. Ransome, 1903, 1915; Darton, 1932.
3. Arkosic quartzite; siliceous mudstone; conglomerate; limestone. Numerous diabase intrusions.
4. Underlain unconformably by Pinal Schist. Overlain unconformably by Troy Quartzite.

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; Scanlan Conglomerate Member.

Apsey Conglomerate Member 120m Tertiary

1. Aspey Camp, Brandenburg Mtn. quadrangle.
2. Krieger, 1968a.
3. Cliff-forming thin-bedded, yellowish to light gray conglomerate and some conglomeratic tuff.
4. Underlain by Hells 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.
2. Krieger, 1968a; Creasey and Krieger, 1978.
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.

Arkill Limestone 0.6m Lower Cretaceous

1. Bisbee area.
2. Stoyanow, 1949.
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.
2. Stoyanow, 1949.
3. Dark gray impure limestone grading laterally into white shale.
4. Part of Joserita Member of Lowell Formation.

Barnes Conglomerate Member 9m Upper Precambrian

1. Globe.
2. Ransome, 1903.
3. Well-rounded pebbles of white or pink quartzite with some red jasper in a matrix of arkosic grit.
4. Underlain by Pioneer Shale. Overlain by Dripping Spring Quartzite.
5. Part of Apache Group. Widespread marker bed in southeast and central Arizona.

Bathtub Formation 701 m Lower Cretaceous

1. Near Adobe Canyon, Santa Rita Mtns.
2. Drewes, 1968.
3. Conglomerate; volcanic sandstone; rhyolite tuff breccia; andesite flows, dacite breccia and rhyolite tuff and flows.
4. Underlain unconformably by Temporal Formation. Overlain unconformably by Bisbee Formation.

Beehive Rhyolite Tertiary

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

Big Dome Formation 600m(?) Late Miocene

1. Big Dome, Sonora, quadrangle.
2. Krieger and others, 1973.
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.
2. Gilluly 1956.
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; Glance Conglomerate. Tyrrell subdivided Bisbee Group as follows: Turney Ranch Formation; Schellenburg Canyon Formation; Apache Canyon Formation; Willow Canyon Formation (in Whetstone Mtns.).

Black Knob Dolomite 1Sm Lower Cretaceous

1. Ninety One Hills, Bisbee area.
2. Stoyanow, 1949.
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.
2. Romslo, 1949; Gilluly and others, 1954.
3. Limestone with basal pebbly mudstone.
4. Underlain disconformably by Escabrosa Limestone. Overlain disconformably by Horquilla Limestone.

Blacktail Formation Cenozoic(?)

1. Portal area.
2. Enlows, 1955.
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.
4. Underlain unconformably by Precambrian rocks. Overlain with slight disconformity by El Paso Group.
5. Bliss becomes younger from west to east and Early Ordovician fossils have been found. Used in Swisshelm, Chiricahua and Dos Cabezas Mtns.

Bolsa Quartzite 131m Middle Cambrian

1. Bisbee.
2. Ransome, 1904; Krieger, 1968b.
3. Coarse-grained quartzite, some basal conglomerate.
4. Underlain unconformably by older rocks. Overlain by Abrigo Formation.
5. Widespread throughout southern Arizona.

Bonita Beds 244m Pliocene(?)

1. Eastern Safford Valley.
2. Wood, 1959.
3. Massive conglomerate characterized by basaltic and rhyolitic fragments.

Bonita Park Formation Cenozoic

1. Chiricahua National Monument.
2. Enlows, 1955.
3. Red beds and tuff.
4. Underlain by Bisbee Group. Overlain unconformably by Faraway Ranch Formation.

Bronco Volcanics 1829m Upper Cretaceous or lower Tertiary

1. Bronco Hill near Tombstone.
2. Gilluly, 1945, 1956.
3. Andesite flow breccia; fine-grained quartz-latite tuff.

4. Underlain unconformably by Bisbee Formation. Overlain unconformably by late Tertiary and Quaternary rocks.
- Buford Canyon Formation** 671 m Mesozoic and Cenozoic
1. Buford Canyon, Kiodyke quadrangle.
 2. Simons, 1964.
 3. Poorly sorted, bedded conglomerate with fragments of Pinal Schist; fine-grained, sparsely porphyritic vesicular or amygdaloidal basalts and andesites.
 4. Underlain unconformably by Pinal Schist.
- Canelo Hills Volcanics** 1829m Triassic or **Jurassic**
1. Canelo Hills and Huachuca Mtns.
 2. Hayes and others, 1965.
 3. Volcanic sedimentary rock, interlayered rhyolitic tuff and lava; rhyolitic lava; welded tuff.
 4. Underlain unconformably by Paleozoic rocks. Overlain unconformably by younger strata.
 5. K-Ar date of 173 ± 7 m.y. on biotite of welded tuff.
- Canelo Red Beds** 415m Lower Cretaceous
1. Canelo Hills.
 2. Feth, 1948.
 3. Red elastics with some thin beds of limestone.
 4. Underlain unconformably by Paleozoic rocks. Overlain unconformably by younger rocks.
- Cargadera Quartz Monzonite** Miocene
1. Santa Catalina Mtns.
 2. Damon and others, 1963.
 3. Quartz diorite to quartz monzonite.
 4. K-Ar age date, 24.8 ± 3 m.y.
- Catalina Granite** Post-Cretaceous
1. Santa Catalina Mtns.
 2. Moore and others, 1941; Peirce, 1958; McCullough 1963; Hoelle, 1976.
 3. Hypidiomorphic biotite-hornblende-sphene-bearing quartz monzonite.
- Catalina Gneiss** Precambrian
1. Santa Catalina Mtns.
 2. DuBois, 1959.
 3. Banded augen gneiss, augen gneiss, gneissic granite.
 4. Banks (1976) suggests Catalina Gneiss is cataclastically deformed Samaniego and Oracle Granite, and sills.
 5. K-Ar age dates, 29.3 ± 1.0 m.y. (Livingstone and others, 1967). Now considered part of Santa Catalina Group.
- Cat Mountain Rhyolite** 244m Upper Cretaceous
1. Tucson Mtns.
 2. Brown, 1939.
 3. Rhyolite flows and mudflows.
 4. 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** 1 372m Cenozoic(?)
1. Cave Creek area.
 2. Enlows, 1955.
 3. Rhyolitic tuffs and welded tuffs.
 4. May be correlated with Rhyolite Canyon Formation (Marjaniemi, 1968).
- Chapparal Sandstone** 7m Lower Cretaceous
1. Ninety One Hills, Bisbee area.
 2. Stoyanow, 1949.
 3. White saccharoidal sandstone with large fossil tree trunks.
 4. In Saavedra Member of Lowell Formation.
- Chiricahua Rhyolite** Tertiary(?)
1. Pedregosa Mountains.
 2. Kottlowski, 1963. **Cholla Member I-** 21m Lower Cretaceous
 1. Ninety One Hills, Bisbee area.
2. Stoyanow, 1949.
 3. Shaly sandstone; thin bedded shales; crossbedded sandstone; limestone; massive crossbedded sandstone.
 4. Part of Lowell Formation.
- Cintura Formation** 427m Lower Cretaceous
1. Cintura Hills, Bisbee.
 2. Ransome, 1904.
 3. Quartzite; red shale and sandstone; nodular shale and flaggy crossbedded sandstone.
 4. Underlain by Mural Limestone. Overlain unconformably by Quaternary strata.
 5. Part of Bisbee Group.
- Clafin Ranch Formation** Tertiary
1. Tucson Mtns.
 2. Richard and Courtright, 1960.
 3. Thick series of clastic beds.
 4. Resembles Tucson Mountain Chaos. Correlated with Salero (lower) by Hayes (1970).
- Cloudburst Formation** 1829m Upper Cretaceous or Tertiary
1. San Manuel area.
 2. Pelletier, 1957; Creasey, 1965.
 3. Conglomerate, quartz monzonite fragments, arkosic matrix; interbedded flows and flow breccias, tuff, conglomerate.
 4. Overlain unconformably by Gila Conglomerate.
- Cochise Formation** 95m Middle Cambrian
1. Whetstone Mtns.
 2. Stoyanow, 1936; Cedarstrom, 1946.
 3. Reddish sandstone; yellow to red shale; blue to brown mottled limestone alternating with shale.
 4. Underlain by Bolsa Quartzite. Overlain by Abrigo Formation (restricted).
- Cochise Peak Quartz Monzonite** Triassic or Jurassic
1. Cochise Peak.
 2. Gilluly, 1956.
 3. Light-greenish-gray quartz monzonite.
 4. Keith and Barrett (1976) place in Precambrian.
- Colina Limestone** 193m Permian
1. Colina Ridge, Tombstone Hills.
 2. Gilluly and others, 1954.
 3. Dense, black limestone with some minor beds of shale and sandstone.
 4. Underlain by Earp Formation. Overlain by Epitaph Dolomite.
 5. Part of Naco Group.
- Concha Formation** 39m Permian
1. Gunnison Hills.
 2. Gilluly and others, 1954; Bryant, 1955.
 3. Limestone, light gray, cherty with some sand layers at base.
 4. Underlain by Scherrer Formation. Overlain unconformably by Glance Conglomerate.
 5. Part of Naco Group.
- Continental Granodiorite** Precambrian
1. Box Canyon near Continental.
 2. Drewes, 1968.
 3. Ranges in composition from granodiorite to quartz monzonite.
 4. Rb-Sr, 800 ± 80 m.y.; Pb-alpha, 1360 ± 160 m.y. (**see Silver, this guidebook**).
- Contzen Pass Tuff** Mid-Tertiary
1. North Tucson Mtns.
 2. Bikerman and Damon, 1966; Mauger and others, 1965.
 3. Contains euhedral phenocrysts of oligoclase, biotite and hornblende
 4. K-Ar age date, 26.0 ± 1.2 m.y.

- Copper Belle Mon zonite Porphyry** Triassic or Jurassic
1. Copper Belle Claim, Gleeson Ridge.
 2. Gilluly 1956.
 3. Light-gray to greenish-gray or pink porphyry.
- Copper Creek Granodiorite** Upper(?) Cretaceous
1. Copper Creek, Klondyke quadrangle.
 2. Simons, 1964.
 3. Medium-grained porphyritic and slightly cataclastic.
 4. Intrudes Precambrian to Mesozoic rocks. Overlain unconformably by Galiuro Volcanics. K-Ar age date, 68 m.y. (Creasey and Kistler, 1962).
- Copper Queen Limestone 25m** Upper Cambrian
1. Bisbee.
 2. Stoyanow, 1936.
 3. White to gray cliff-forming algal limestone.
 4. Underlain by Abrigo Formation (restricted). Overlain disconformably by Martin Limestone.
 5. Considered member of Abrigo by Hayes (1975).
- Coronado Sandstone 60m** Middle to Upper Cambrian
1. Clifton-Morenci area.
 2. Lindgren, 1905; Hayes, 1972, 1975.
 3. Arkosic to orthoquartzitic sandstones with some siltstones, shales and sandy dolomites.
 4. Underlain unconformably by Precambrian rocks. Overlain by El Paso Limestone.
- Corral de Piedras Welded Tuff** Oligocene-Miocene
1. Tumacacori Mtns.
 2. Damon and Bikerman, 1964.
 3. Tuffs.
 4. K-Ar date, 26.5 ± 1.2 m.y.
- Corta Sandstone 11m** Lower Cretaceous
1. Ninety One Hills, Bisbee area.
 2. Stoyanow, 1949.
 3. Crossbedded sandstone.
 4. Underlain by Espinal Grit. Overlain by Quimbo Dolomite.
- Demetrie Volcanics 2440m(?)** Cretaceous-Tertiary
1. Tascuela area, Sierrita Mtns.
 2. Thorns, 1967; Cooper, 1971.
 3. Grayish-blue dacite to andesitic tuff breccia.
 4. Underlain unconformably by Late Cretaceous granite. Overlain unconformably by Red Boy Rhyolite.
- Desert Museum Andesite Porphyry** Upper Jurassic(?)
1. Desert Museum area, Tucson. Mtns.
 2. Damon and others, 1967.
 3. Andesite porphyry.
 4. Intrudes Recreation Red Beds. K-Ar, 150 ± 5 m.y.
- Dripping Spring Quartzite 59m** 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 123m** Pennsylvanian (Virgilian)
1. Tombstone Hills.
 2. Gilluly and others, 1954.
 3. Thin shaly limestones and reddish shales; massive limestone and dolomite that weathers 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 Naco Group.
- Elephant Head Quartz Monzonite** Upper Cretaceous
1. Santa Rita Mtns.
 2. Drewes, 1968.
 3. Fine- and coarse-grained quartz monzonite.
 4. K-Ar age dates on biotite, 68.2 ± 2.4 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 488m** 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, McKellington Limestone, Padre Formation.
- Epitaph Dolomite 239m** Permian (Leonardian)
1. Tombstone Hills.
 2. Gilluly and others, 1954.
 3. Dolomite with knots of silica; dolomite, limestone, red shale and thin sandy layers.
 4. Underlain by Colina Limestone. Overlain conformably(?) by Scherrer Quartzite or unconformably by Glance Conglomerate.
 5. Part of Naco Group.
- Escabrosa Limestone 213m** Lower Mississippian (Kinderhookian and Osagean)
1. Bisbee.
 2. Ransome, 1904.
 3. Limestone, light-gray, thick-bedded, coarse-grained with crinoid fragments.
 4. Underlain by Martin Limestone. Overlain disconformably(?) by Horquilla, Black Prince and Paradise Formations.
- Espinal Gritt 1m** Lower Cretaceous
1. Ninety One Hills, Bisbee area.
 2. Stoyanow, 1949.
 3. Conglomeratic grit, subangular pebbles of limestone, quartzite, chert, arkose.
 4. Overlain by Corta Sandstone.
- Faraway Ranch Formation 240m** Cenozoic
1. Chiricahua National Monument.
 2. Enlows, 1955.
 3. Ignimbrites.
 4. K-Ar age date, 27.6 ± 0.8 m.y. (Marjaniemi, 1968).
- Flattop Basaltic Andesite** Oligocene-Miocene
1. Greenlee County.
 2. Damon and others, 1967.
 3. Basaltic andesite.
 4. K-Ar age date, 27.5 ± 0.8 m.y.
- Fort Buchanan Formation 610m** Upper Cretaceous
1. Santa Rita Mtns.
 2. Stoyanow, 1937, 1949.
 3. Conglomerate, alternating shales and sandstones.
 4. Underlain by andesitic lavas. Overlain by Fort Crittenden Formation.
 5. Part of Sonoita Group, etc.
- Fort Crittenden Formation 1372m** Upper Cretaceous
1. Santa Rita Mtns.
 2. Stoyanow, 1937, 1949; Drewes, 1968.
 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 Crittenden redefined and divided into five members.
- Fort Lowell Formation 120m Pleistocene
1. Tucson basin.
 2. Davidson, 1973.
 3. Dominantly sand and gravel.
 4. Underlain unconformably by Tinaja Beds. On surface called Rillito surface (Pashley, 1966); upper surface is University Terrace.
 5. Locally faulted and tilted.
- Fresnal Quartz Monzonite Lower Tertiary
1. Tascuela area, Sierrita Mtns.
 2. Thoms, 1967.
- Galiuro Limestone Pennsylvanian
1. Galiuro Mtns.
 2. Stoyanow, 1936.
- Galiuro Volcanics 1090m Oligocene-Miocene
1. Galiuro Mtns.
 2. Blake, 1902; Cooper and Silver, 1964; Krieger, 1968a; Creasey and Krieger, 1978.
 3. Basaltic andesites, latites, conglomerates, rhyolites, tuffs.
 4. Underlain by Threelinks Conglomerate. Overlain unconformably by Tertiary and Quaternary alluvium.
 5. Krieger subdivided Galiuro Volcanics into the following for Holy Joe Peak and Brandenburg Mtn. quads: andesite of Table Mountain, Apsy Conglomerate Member, Hells Half Acre Member, Rhyolite-Obsidian Member, andesite and conglomerate of Virgus 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.
 2. Drewes, 1968.
 3. Red beds with intercalated conglomerate and volcanics.
 4. Underlain unconformably by Permian strata. Overlain unconformably by Canelo Hills 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.
 2. Gilbert, 1875; Heindl, 1954, 1958; Krieger and others, 1973.
 3. Conglomerate, sandstone, siltstone, local limestone, tuffs, basal 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. Glance 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. Gleeson area.
 2. Gilluly, 1956.
 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.
 2. Simons, 1964.
 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.
 2. Simons, 1964.
 3. Granitoid; equigranular granite, quartz monzonite, diorite, granodiorite.
 4. Intrudes Pinkard rocks.
- Gringo Gulch Volcanics 450m Paleocene(?)
1. Gringo Gulch near Patagonia.
 2. Drewes, 1968.
 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.
 2. Drewes, 1974.
 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
1. Grosvenor Hills.
 2. Drewes, 1968.
 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 Meramian)
1. Chiricahua Mtns.
 2. Armstrong, 1962.
 3. Crinoidal limestone.
 4. Underlain by Keating Formation. Overlain by Paradise Formation.
 5. In Escabrosa Group.
- Happy Valley Quartz Monzonite Jurassic
1. Lecheguilla Peak, east of Tucson.
 2. Miles, 1966.
 3. Light pink, medium- to coarse-grained quartz monzonite.
- Harris Ranch Monzonite Jurassic-Cretaceous
1. Tascuela area, Sierrita Mtns.
 2. Damon and others, 1965.
 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.
 2. Krieger, 1968a; Creasey and Krieger, 1978.
 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 Apsy Conglomerate member.
 5. Part of Galiuro Volcanics.

- Hilton Ranch Conglomerate 1278m Upper Cretaceous
1. Empire and Santa Rita Mtns.
 2. Schafroth, 1968.
 3. Cobble and boulder conglomerate.
 4. Underlain unconformably by Turney Ranch Formation of Schellenburger Canyon Formation.
- Holy Joe Member 90m Miocene
1. Holy Joe Peak, Holy Joe quadrangle.
 2. Krieger, 1968a; Creasey and Krieger, 1978.
 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 Pennsylvanian (Desmoinesian and Missourian)
1. Tombstone Hills.
 2. Gilluly and others, 1954.
 3. Thin bedded, blue-gray limestones alternating with thin beds of red shale and shaly limestone.
 4. Underlain disconformably 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.
 2. Simons, 1964.
 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.
 2. Hayes, 1967.
 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.
 2. Kinnison, 1959; Bikerman and Damon, 1966.
 3. Dark porphyritic andesite.
 4. Underlain by Anklam Formation. Overlain by Shorts Rana 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.
 2. Drewes, 1968.
 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.
- Joserita Member 36m Lower Cretaceous
1. Ninety One Hills, Bisbee area.
 2. Stoyanow, 1949.
 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.
 2. Gilluly, 1956.
 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.
 2. Hendle, 1963.
 3. Alluvial deposits characterized by boulders of gray quartz monzonite.
 4. Underlain by Cloudburst Formation. Overlain disconformably 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.
 2. Armstrong, 1961, 1962.
 3. Sequence of calcilutites and encrinites.
 4. Underlain by Upper Devonian strata. Overlain by Hachita Formation.
 5. In Escabrosa Group.
- Kino Formation Lower Tertiary
1. Mission Mine, near Tucson.
 2. Kinnison, 1966.
 3. Dominantly conglomerate.
- Lancha Limestone 4m Lower Cretaceous
1. Ninety One Hills, Bisbee area.
 2. Stoyanow, 1949.
 3. Limestone, arenaceous in places.
 4. Underlain by Morita Formation. Overlain by unnamed yellow dolomite.
- Laurel Canyon Granodiorite Precambrian
1. Laurel Canyon, Klondyke quadrangle.
 2. Simons, 1964.
 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.
 2. Peirce, 1958.
 3. Massive to gneissic.
- Lowell Formation Lower Cretaceous
1. Bisbee area.
 2. Stoyanow, 1949.
 3. Sandstones and limestones.
 4. Underlain by Morita Formation. Overlain by Mural Limestone.
 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 *Camerotoechia endlichii* and fish teeth.
 4. Underlain by Martin Limestone. Overlain by Escabrosa Limestone.
 5. Stoyanow believed this unit to be distinctly younger than typical Martin.
- Madera Canyon Granodiorite Upper Cretaceous
1. Madera Canyon, Santa Rita Mtns.
 2. Drewes, 1968.
 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 Dra-goon 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 disconform-ably by Troy Quartzite.
 5. Part of Apache Group.
- Mineta Formation Lower Miocene
1. Near Redington.
 2. Chew, 1952.
 3. Conglomerate, mudstone, siltstone and limestone.
- Molly Gibson Formation Lower Cretaceous
1. Patagonia Mtns.
 2. Stoyanow, 1937, 1949.
 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.
 2. Webb and Coryell, 1954.
 3. Rhyolitic lavas, breccias, tuffs.
- Morita Formation 440m Lower Cretaceous
1. Bisbee.
 2. Ransome, 1904.
 3. Shales, sandstones and limestones; red shale.
 4. Underlain by Glance Conglomerate. Overlain by Mural Lime-stone.
 5. Part of Bisbee Group.
- Mount Wrightson Formation 2550m Triassic or Jurassic
1. Santa Rita Mtns.
 2. Drewes, 1968.
 3. Dacitic to andesitic, some rhyolite and "turkey track" andesitic rocks; rhyolitic and latitic 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-bedded limestone, shale and sandstone; massive limestone; thin-bedded shale, sandstone, mudstone, limestone.
 4. Underlain by Morita Formation. Overlain by Cintura Formation.
 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 disconformably by Escabrosa Limestone. Overlain un-conformably by younger rocks.
 5. Raised to Group status by Gilluly and others (1954). Naco Group consists of: Concha Limestone, Scherrer Formation, Epi-taph Dolomite, Colina Limestone, Earp Formation, Horquilla Limestone. Bryant (1955) places Rainvalley Formation as upper-most Naco Group. Ross (1973) includes Black Prince in Naco Group.
- Nipper Formation Upper Cretaceous to Tertiary
1. Near Blue Mountain, Cochise Co.
 2. Sabins, 1957. Conglomerate, mafic volcanic cobbles and boulders; aphanitic andesite, flows.
3. Underlain by Bisbee Group. Overlain by Faraway Formation.
- Nogales Formation 300m Pliocene and Miocene
1. Santa Rita Mtns.
 2. Drewes, 1972; Simons, 1974.
 3. Cobble to pebble gravel, grit and intercalated sand and silt.
 4. Underlain by Grosvenor Hills Volcanics. Overlain unconformably by basin-fill gravel.
 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.
 2. Lootens, 1965, 1966.
 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.
 2. Brennan, 1958.
 3. Conglomerates, sandstones, mudstones with intercalated vol-canics.
 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.
 2. Kinnison, 1966.
 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.
 4. Underlain disconformably by Escabrosa Limestone. Overlain by Naco Group.
- Patagonia Group 1740m+ Lower Cretaceous
1. Patagonia Mtns.
 2. Stoyanow, 1937, 1949.
 3. Shale, sandstone and volcanics.
 4. Baker (1962) subdivided the Patagonia Group into: Corral Can-yon Red Beds, Duquesne Volcanics, Bagby Ranch Formation, Molly Gibson Formation.
- Patagonia Tuff Oligocene-Miocene
1. Patagonia Water Gap.
 2. Damon and Bikerman, 1964.
 3. Tuffs.
 4. K-Ar age date, 25.3 ± 5.1 m.y.
- Peppersauce Canyon Sandstone 7m Upper Cambrian
1. Santa Catalina Mtns.
 2. Stoyanow, 1936; Krieger, 1968b.
 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.
 4. Underlain disconformably by El Paso Formation. Overlain by Escabrosa.
- Picacho de Calera Formation 25m Upper Devonian
1. Tucson area.
 2. Stoyanow, 1936.
 3. Sandstone and limestone.
 4. Underlain disconformably by Abrigo Formation.
- Pinal Schist 6000m Precambrian
1. Pinal Mtns.
 2. Ransome, 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; metarhyolite 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 microfaulting.
 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. Ransome, 1903; Gastil, 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.
 2. Drewes, 1968.
 3. Very coarse-grained, dark-gray monzonite.
 4. Pb-alpha age date, 180 ± 20 m.y.
- Portal Formation 102m Upper Devonian
1. Portal.
 2. Sabins, 1957.
 3. Alternating thin beds of calcareous shale and shaly limestone; hard fissile black shale; alternating beds of bioclastic limestone.
 4. Underlain disconformably by El Paso Formation. Overlain by Escabrosa Limestone.
- Quartz Monzonite of Tortolita Mountain Tertiary
1. Tortolita Mtns.
 2. Creasey and others, 1977.
 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.
 2. Heindl, 1963; Agenbroad, 1967; Krieger and others, 1973.
 3. Finely laminated mudstones, interbedded tuff; conglomerate with channel-type crossbedding, clasts of Pinal Schist, Apache Group and Ruin Granite.
 4. Underlain by Clodburst Formation. Overlain disconformably 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.
 2. Bryant, 1955.
 3. Limestones and dolomites, some sandstone.
 4. Underlain by Concha Formation. Overlain unconformably by younger rocks.
 5. Part of Naco Group.
- Recreation Red Beds 360m Upper Triassic or Jurassic
1. Tucson Mtns.
 2. Brown, 1939; Hayes and Drewes, 1968.
 3. Red, thick-bedded sandstone and mustone with some conglomerates and volcanic rocks.
 4. Underlain by volcanic rocks. Overlain by Amole Arkose. Intruded by 150 m.y. old Desert Museum Porphyry.
- Red Boy Rhyolite 300m Lower Tertiary
1. Tascuela area, Sierrita Mtns.
 2. Thoms, 1967; Cooper, 1971.
 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.
 2. Agenbroad, 1967.
 3. Fine grained facies of Quiburis Formation.
- Rhyolite Canyon Formation 877m Miocene
1. Chiricahua Mtns.
 2. Enlows, 1955; Marjaniemi, 1968.
 3. Ash flows.
 4. K-Ar age date 24.9 ± 0.6 m.y.
- Rillito Andesite Oligocene
1. North Tucson Mtns.
 2. Bikerman and Damon, 1966.
 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.
 4. Underlain by Abrigo Formation (restricted). Overlain disconformably by Picacho de Calera Formation.
- Rincon Valley Granodiorite Precambrian
1. Happy Valley area.
 2. Drewes, 1974, 1977.
 3. Massive medium-grained biotite-bearing and biotite-hornblende-bearing granodiorite.
 4. K-Ar age date, 1450 ± 60 m.y. May be correlative with Johnny Lyon Granodiorite (see Silver, this guidebook).
- Rodolfo Formation 720m Upper Traissic or Jurassic
1. Sierrita Mtns.
 2. Cooper, 1971.
 3. Coarse-grained sandstone, conglomerate; siltstone, sandstone, conglomerate; andesitic breccia, red beds, andesitic flows.
 4. Underlain unconformably by Rainvalley Formation. Overlain unconformably by Whitcomb Quartzite.
 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.

- Ruin Granite Precambrian
1. Globe quadrangle.
 2. Ransome, 1903.
 3. Coarse-grained porphyritic quartz monzonite.
- Sacaton Formation 7m Pleistocene
1. Sacaton Ranch, near Mammoth.
 2. Heindl, 1963.
 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.
- Salero Formation 1550m Upper Cretaceous
1. Santa Rita Mtns.
 2. Drewes, 1968.
 3. Dacite flows; dacitic flow breccia with exotic blocks (up to 300 m) of Jurassic and older rocks; welded tuff; arkosic fanglomerate, sandstone, tuff.
 4. Underlain by Fort Crittenden Formation (locally) and unconformably by Squaw Gulch Granite.
 5. K-Ar age date, 72.5 ± 3.3 m.y. (Drewes, 1971).
- Samaniego Granite Cretaceous-Tertiary
1. Santa Catalina Mtns.
 2. DuBois, 1959; Creasey and others, 1977.
 3. Granodiorite-quartz monzonite.
- San Manuel Formation 600m+ Middle(?) Tertiary
1. San Manuel area.
 2. Heindl, 1963; Krieger and others, 1973; Krieger, 1974.
 3. Conglomerate, pebble to boulder. Krieger (Kearney quad.) described three members: older granitic alluvial deposits of poorly consolidated granitic clasts; non-granitic alluvial deposits consisting 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.
 2. Stoyanow, 1936; Krieger, 1968b.
 3. Thin-bedded mudstone and shale.
 4. Underlain by Troy Quartzite. Overlain by Southern Belle Quartzite.
 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 remobilized Phanerozoics.
- Santa Teresa Granite Tertiary(?)
1. Santa Teresa Mtns.
 2. Simons, 1964.
 3. Very pale red, medium-grained granite.
 4. Pb-alpha age date, 60 ± 10 m.y.
- Scanlan Conglomerate Member 9m Upper Precambrian
1. Globe area.
 2. Ransome, 1903; Cooper and Silver, 1964; Shride, 1967. 3. Conglomerate with sub-angular fragments in a sandy matrix, interbeds of sandstone and quartzite.
 4. Underlain unconformably by Pinal Schist. Overlain by Pioneer Shale.
5. Basal Member of Pioneer Formation.
- Schellenburg/Schellenburger Canyon Formation 760m Lower Cretaceous
1. Whetstone Mtns.
 2. Tyrrell, 1964; Schafroth, 1968.
 3. Quartzose and arkosic sandstone, thin-bedded to laminated siltstone 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)
1. Gunnison Hills.
 2. Gilluly and others, 1954.
 3. Red siltstone; dolomitic limestone; massive sandstone.
 4. Underlain by Epitaph Dolomite. Overlain by Concha Limestone.
- Schieffelin Granodiorite Tertiary
1. Tombstone area.
 2. Butler and others, 1938; Gilluly, 1956.
 3. Granodiorite to quartz monzonite.
 4. K-Ar age date, 72.2 m.y. (Creasey and Kistler, 1962).
- Shorts Ranch Andesite 120m Tertiary
1. Tucson Mtns.
 2. Brown, 1939; Kinnison, 1959.
 3. Massive volcanics.
 4. Underlain by Ivy May Andesite. Overlain by Water Tank Conglomerate.
 5. K-Ar age date, 56.8 ± 1.7 m.y. (Bikerman and Damon, 1966).
- Sonoita Groupt Upper Upper Cretaceous
1. Sonoita area.
 2. Stoyanow, 1937, 1949; Drewes, 1968.
 3. Conglomerates, sandstone, shale.
 4. Sonoita Group dropped by Drewes.
- Southern Belle Quartzite 9m Middle Cambrian
1. Santa Catalina Mtns.
 2. Stoyanow, 1936; Krieger, 1968a.
 3. Massive quartzite.
 4. Underlain by Santa Catalina Formation. Overlain by Abrigo Formation (restricted).
 5. Part of Abrigo Formation.
- SO Volcanics 1800m Tertiary
1. SO ranch and Hay Mountain.
 2. Gilluly, 1956.
 3. Interbedded quartz latite tuffs and hornblende andesite flows.
 4. Underlain by Bisbee(?) Formation. Overlain by Quaternary alluvium.
 5. K-Ar age date, 47 ± 2 m.y. (Marvin and others, 1973).
- Squaw Gulch Granite Jurassic
1. Santa Rita Mtns.
 2. Drewes, 1968.
 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.
 2. Gray, 1965, 1967.
 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.
 2. Thoms, 1967.
 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.
 2. Gilluly, 1956.
 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.
 2. Gilluly, 1956.
 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.
 2. Thomas, 1967.
 3. Interbedded pyroclastic and clastic rocks.
 4. Underlain unconformably by Paleozoics. Overlain by Ox Frame Volcanics.
- Swishhelm Formation** 190m Upper Devonian
1. Swishhelm.
 2. Epis and others, 1957.
 3. Sandstone, siltstone, shale, impure limestone.
 4. Underlain unconformably by El Paso Formation. Overlain by Escabrosa Limestone.
- Tascuela Red Beds** 600m Triassic or Jurassic
1. Tascuela area, Sierrita Mtns.
 2. Thorns, 1967; Cooper, 1971.
 3. Conglomerate, shale and argillite with some 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.
 2. Drewes, 1968.
 3. Rhyolitic to andesitic tuff, arkosic conglomerate; conglomerate, latite flows; rhyodacite breccia, conglomerate.
 4. Underlain unconformably by Squaw Gulch Granite. Overlain unconformably by Bathub Formation.
- Texas Canyon Quartz Monzonite** Cretaceous or Tertiary
1. Little Dragoon Mtns.
 2. Cooper and Silver, 1964.
 3. Biotite quartz monzonite.
 4. K-Ar age date, 50 ± 3 m.y. (Marvin and others, 1973).
- 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.
 2. Davidson, 1973.
 3. Sandy gravel grading into gypsiferous clay and mudstone.
 4. Underlain unconformably by Pantano Formation. Overlain unconformably by Fort Lowell Formation.
 5. Correlated with Nogales Formation. Tres Alamos Member Pliocene
1. Redington-San Manuel area.
 2. Agenbroad, 1967.
 3. Fine grained deposits.
 4. Overlain by younger alluvial deposits.
 5. Member of Quiburis Formation.
- Troy Quartzite** 120m Upper Precambrian
1. Ray area.
 2. Ransome, 1915; Peterson, 1962; Krieger, 1968b.
 3. Conglomerate; coarse grained quartzite and sandstone, cross-bedded in part.
 4. Underlain unconformably by Mescal Limestone. Overlain by Abrigo Formation.
 5. Intruded by 1150-1200 m.y. old diabase.
- Tucson Mountain Chaos** Upper Cretaceous
1. Tucson Mtns.
 2. Brown, 1959; Hayes and Drewes, 1968.
 3. Exotic blocks of Cretaceous and Paleozoics in conglomerate, silt and andesitic matrix.
 4. Underlain unconformably by arkoses of Cretaceous age. Overlain by Cat Mountain Rhyolite.
- Tucson Wash Member** 300m Middle Tertiary
1. Tucson, Pinal Co.
 2. Heindl, 1963.
 3. Dark-gray to purplish-gray, containing boulder-sized fragments of volcanic and conglomerate rocks.
 4. Underlain unconformably by Kannally Member. Overlain by Quiburis Formation.
 5. Member of Heindl's San Manuel Formation.
- Tungsten King Granite** Precambrian
1. Dragoon quadrangle.
 2. Cooper and Silver, 1964.
 3. Medium- to coarse-grained granite (see Silver, this guidebook).
- Turkey Track Porphyry** Oligocene-Miocene
1. Aravaipa
 2. Denton, 1947; Cooper, 1961; Damon and Bikerman, 1964.
 3. Andesite or basalt porphyry with tabular phenocrysts of plagioclase.
 4. K-Ar age date, 28 ± 2.6 m.y.
- Turney Ranch Formation** 300m+ Cretaceous
1. Whetstone Mtns.
 2. Tyrrell, 1964; Schafroth, 1968.
 3. Repetitive thin- to thick-bedded sandstone, siltstone, shale sequence.
 4. Underlain by Schellenburger Canyon Formation. Overlain unconformably by Hilton Ranch Conglomerate (in Empire Mtns.).
- Turquoise Granite** Triassic or Jurassic
1. Near Courtland.
 2. Gilluly, 1956.
 3. Greenish-gray to pinkish-gray, highly altered granite.
- Uncle Sam Porphyry** Cretaceous or lower Tertiary
1. Tombstone area.
 2. Butler and others, 1938; Gilluly, 1956.
 3. Quartz latite porphyry to quartz monzonite porphyry.
 4. K-Ar age date, 71.9 ± 2.7 m.y. (Marvin and others, 1973).
- Walnut Gap Volcanics** 150m Triassic or Jurassic
1. Gunnison Hills.
 2. Cooper and Silver, 1964.
 3. Andesitic and dacitic tuff, pyroclastic breccia and conglomerate.
 4. Underlain unconformably by Concha Limestone and Scherrer Formation. Overlain unconformably by Glance Conglomerate.
- Water Tank Conglomerate** Tertiary
1. Tucson Mtns.
 2. Kinnison, 1959.

Whetstone Granite Precambrian

1. Whetstone Mtns.
2. Tyrrell, 1964.
3. Nonfoliated granite.
4. Intrudes Pinal Schist.

Whitcomb Quartzite 180m Lower(?) Cretaceous

1. Sierrita Mtns.
2. Cooper, 1971.
3. Medium-grained orthoquartzite with lenses of rhyolitic tuff in upper part.
4. Underlain disconformably by Rodolfo Formation. Overlain disconformably by Angelica Arkose.

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.
2. Simons, 1964; Krieger, 1974.
3. Agglomerates, tuffs, lavas, flow breccias.
4. Underlain disconformably by Pin kard Formation. Overlain unconformably by Horse Mountain Volcanics.
5. K-Ar age date, 75.6 ± 1.4 m.y. (Keith and Damon, oral comm.).

Wrong Mountain Quartz Monzonite Precambrian(?)

1. Happy Valley area.
2. Drewes, 1974, 1977.
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).

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