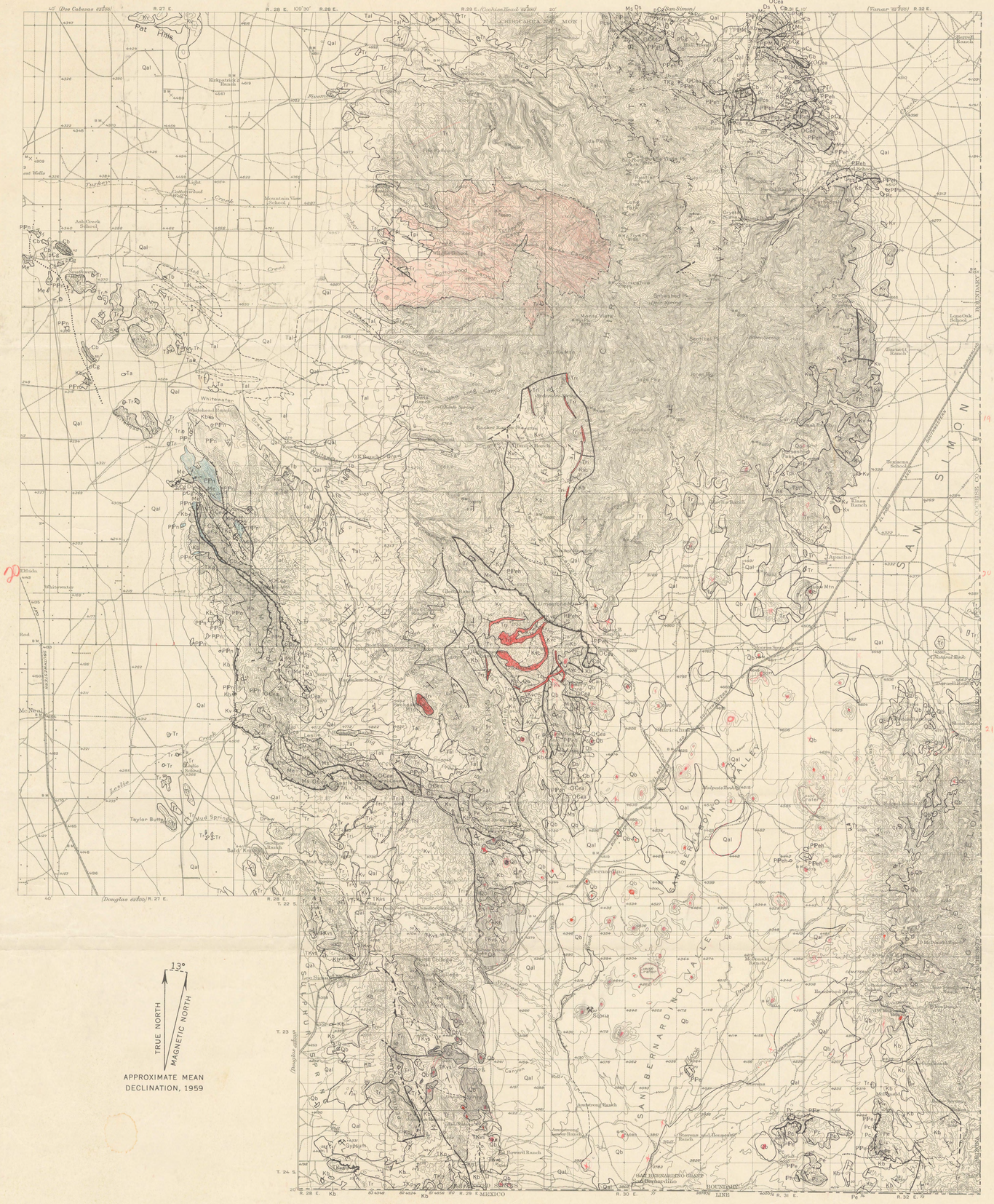
DEPARTMENT OF THE INTERIOR
UNITED STATES GEOLOGICAL SURVEY

MINERAL INVESTIGATIONS
FIELD STUDIES MAP MF-213



Base map by Topographic Division
U. S. Geological Survey

Geology compiled in 1957

13°
TRUE NORTH
MAGNETIC NORTH
APPROXIMATE MEAN
DECLINATION, 1959

REFERENCES

Enlows, H. E., 1955, Welded tuffs of Chiricahua National Monument, Arizona: Geol. Soc. America Bull., v. 66, p. 1215–1246.

Epis, R. C., 1956, Geology of the Pedregosa Mountains, Cochise County, Arizona: PhD. dissertation, Univ. California, Berkeley, 263 p.

Epis, R. C. and Gilbert, C. M., 1957, Early Paleozoic strata in southeastern Arizona: Am. Assoc. Petroleum Geologists Bull., v. 41, p. 2223–2242.

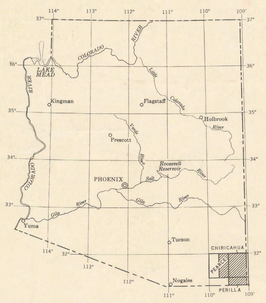
Epis, R. C., Gilbert, C. M., and Langenheim, R. L., 1957, Upper Devonian Swisshelm formation of southeastern Arizona: Am. Assoc. Petroleum Geologists Bull., v. 41, p. 2243–2256.

Galbraith, F. W., and Loring, W. B., 1951, Swisshelm district (in Arizona zinc and lead deposits, part 2): Ariz. Bur. Mines Bull. 158, Geol. ser. 19, p. 30–36.

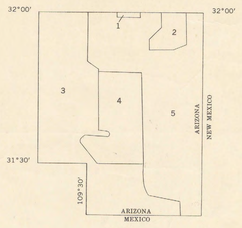
Hernon, R. M., 1935, The Paradise formation and its fauna: Jour. Paleontology, v. 9, p. 653–696.

Raydon, G. T., 1952, Geology of the northeastern Chiricahua Mountains, Cochise County, Arizona: M. A. thesis, Univ. California, Berkeley.

Sabins, F. F., Jr., 1957, Stratigraphic relations in Chiricahua and Dos Cabezas Mountains, Arizona: Am. Assoc. Petroleum Geologists Bull., v. 41, p. 466–510.

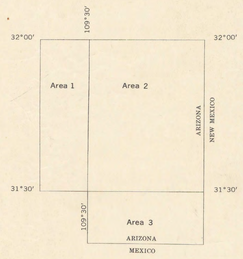


INDEX MAP OF ARIZONA SHOWING AREA AND QUADRANGLE NAMES INCLUDED IN THIS MAP



MAP SHOWING SOURCES OF GEOLOGIC DATA

1. Detailed study of volcanic rocks of the Chiricahua National Monument by Enlows (1955), whose map is here generalized
2. Detailed study by Raydon (1952), whose map has been modified as a result of reconnaissance by J. R. Cooper and J. K. Grunig, April 1957
3. Reconnaissance mapping by J. R. Cooper and R. G. Schmidt, November and December 1956
4. Detailed study by Epis (1956) whose map has been generalized, and extended and modified slightly on the basis of additional information furnished by Epis (written communication) in 1957
5. Reconnaissance mapping by J. R. Cooper and J. K. Grunig, April and May 1957



MAP SHOWING AREAS OF ROCK UNITS AS SUBDIVIDED IN EXPLANATION

EXPLANATION

ROCK UNITS COMMON TO ENTIRE MAP AREA

Qal — Younger alluvium
Unconsolidated gravel, sand, and silt; 1 to about 100 feet thick. In area 2 includes alluvial deposits, gypsiferous limestones, and marls that are probably equivalent to older alluvium

Qb — Younger basalt
Olivine basalt flows, tuffs, breccias, and cinder cones; 10 to over 500 feet thick

QUATERNARY — Pleistocene and Recent

UNCONFORMITY

Tal — Older alluvium
Poorly consolidated alluvium, possibly in part contemporaneous with Tertiary rhyolite and associated volcanic rocks, but mostly younger. Probably at least 1,000 feet thick. Included with younger alluvium in area 2

Tb — Older basalt
Olivine basalt flows intercalated with older alluvium. Individual flows 10 to 50 feet thick

UNCONFORMITY

Tr, Ta — Rhyolite and associated volcanic rocks
Rhyolite welded tuffs, flows, and unwelded pyroclastic rocks that weather red, purple, orange, pale brown, and white, Tr; contains some units as mafic as andesite, especially in lower part; probably two or more volcanic series represented (Enlows, 1955). About 4,500 feet thick.
Andesite flows, tuffs, and breccias, Ta. Separately mapped in area 1 only

Tri, Tpi — Intrusive rocks
Rhyolite and latite dikes, sills, and plugs. Tri. Shown in southern two-thirds of area 2 only
Fine-grained commonly porphyritic granite and monzonite in moderately large subconcordant bodies, Tpi

TERTIARY — Paleocene to Pliocene

UNCONFORMITY

TKg — Granite to granodiorite
Medium-grained intrusive rocks containing megascopic quartz

TKp — Monzonite to andesite porphyry
Intrusive porphyries with fine-grained to aphanitic groundmasses and without megascopic quartz. Not known to intrude rocks younger than the Bisbee formation and could be as young as the Tertiary rhyolite and associated volcanic rocks

OVERTHRUSTS

ROCK UNITS IN AREA 1

Kv — Volcanic rocks
Propylitized andesite flows and pyroclastic rocks that weather green, maroon, and purple; with scarce lenses of conglomerate, sandstone, and shale; some units in the Pat Hills contain small quartz phenocrysts and may be dacite

Kb — Bisbee formation
Interbedded sandstone and shale, with a coarse limestone conglomerate at the base and scarce thin limy zones higher in the section; several thousand feet thick

ROCK UNITS IN AREA 2

Kv, Kvc — Volcanic and associated sedimentary rocks
Propylitized andesite flows and pyroclastic rocks that weather green, maroon or purple; with some lenses of conglomerate, feldspathic sandstone, shale, and locally rhyolite, Kv. About 3,000 feet thick. Fossils (petrified wood) suggest Cretaceous age
Basal conglomerate with thin beds of coarse sandstone, composed of debris from the Bisbee and various Paleozoic formations, Kvc. Several thousand feet thick locally but commonly absent

UNCONFORMITY

Kb — Bisbee formation
Basal conglomerate (indicated by stippling) overlain by buff to red sandstone and shale; some gray limestone, particularly in lower-middle part; contains intercalated mafic lava flows, tuffs, and some black shales in northeastern part of Chiricahua Mountains. Over 3,000 feet thick

UNCONFORMITY

Pcs — Concha and Scherrer formations
Composed of two readily separable units: (1) Upper unit (Concha limestone), locally as much as 650 feet thick, is light-gray limestone, the lower part cherty and cliff-forming. (2) Lower unit (Scherrer formation) is 120 to 200 feet thick and characterized by nearly white, medium-grained quartzitic sandstone, which in Pedregosa Mountains contains a middle member of gray cherty limestone

Pe — Epitaph dolomite
Gray dolomite with beds of red shale and sandstone in upper part; Epitaph not known north of Pedregosa Mountains where it is 1,250 feet thick

Pc — Colina limestone
Blue-gray to almost black limestone. About 500 feet thick near the Hilltop mine and 1,000 feet thick in the Pedregosa Mountains

PPeh — Earp and Horquilla formations
The upper part (Earp formation, Pennsylvanian and Permian) is approximately half limestone and half shale and sandstone in units commonly 10 to 30 feet thick. Many of the limestone beds contain abundant fusulinids. The terrigenous clastics are buff to greenish except at the top of the Earp formation where there is an easily eroded zone of red beds several hundred feet thick. The lower part (Horquilla limestone, Pennsylvanian) is thin- to thick-bedded, gray, commonly cherty limestone with some thin interbeds of calcareous shale and siltstone. Total thickness probably 3,000 to 4,000 feet

Permian (lower) — Naco group — Middle and Upper Pennsylvanian

PPn — Naco group, undifferentiated
The Horquilla, Earp, and Colina formations of the Naco group are well represented and the Epitaph(?) dolomite forms a small outlier in the Sulphur Spring Valley; total thickness probably about 4,000 feet. Silicified portions large enough to map are indicated by stippling

Me — Escabrosa limestone
Thick-bedded, gray, commonly crinoidal limestone with abundant chert nodules in some beds; apparent thickness 600 to 1,000 feet. Silicified portions large enough to map are indicated by stippling

Lower and Upper(?) Mississippian

Ms — Sedimentary rocks
Composed of two units: (1) Paradise formation as used by Hernon, 1935, (Upper Mississippian) consists of 150 to 275 feet of thin-bedded limestone and shale. The Paradise formation is easily eroded and generally forms a saq between the resistant Escabrosa and Horquilla formations. (2) Escabrosa limestone (Lower and Upper(?) Mississippian) consists of 700 to 1,200 feet of thick-bedded, gray, commonly crinoidal limestone with abundant chert nodules in some beds

MISSISSIPPIAN — CARBONIFEROUS

ROCK UNITS IN AREA 3

TKvs — Volcanic and associated sedimentary rocks
Lava flows and pyroclastic rocks ranging in composition from andesite to rhyolite, with interfingering conglomerate, sandstone, shale, and rare fresh-water limestone; probably in part Cretaceous and in part Tertiary

Kb — Bisbee formation
Interbedded yellow to red sandstone and shale, with some gray limestone and a conspicuous resistant gray limestone unit about 200 feet thick near the top; total exposed thickness probably about 4,000 feet

CRETACEOUS

Pe — Epitaph dolomite
Light- to dark-gray dolomite in medium to thick beds; about 600 feet thick

Pc — Colina limestone
Blue-gray to almost black limestone in medium to thick beds; probably about 700 feet thick

PPM — Mississippian to Permian rocks undifferentiated

PPe — Earp formation
About half fusulinid-bearing limestone and half buff to red shale and calcareous sandstone in units commonly 10 to 50 feet thick; probably about 500 feet of beds exposed

Ph — Horquilla(?) limestone
Almost completely silicified limestone in fault contact with the Earp formation

PERMIAN — PENNSYLVANIAN

ROCK UNITS COMMON TO ENTIRE MAP AREA

Ds — Sedimentary rocks
Approximate age equivalent of the Martin limestone (Upper Devonian): (1) In Pedregosa and Swisshelm Mountains are 400 feet of dolomitic quartz sandstone, platy siltstone, nodular limestone, and marl, and subordinate clastic limestone and silty dolomite called the Swisshelm formation by Epis, Gilbert, and Langenheim (1957); (2) in northern Chiricahua Mountains are 320 feet of thin-bedded limestone and shale, lithologically similar to the Percha shale of New Mexico, called the Portal formation by Sabins (1957)

OCea — El Paso and Abrigo formations
Thin- to thick-bedded gray dolomite and limestone with siltstone and sandstone beds and laminae and some nodules and thin beds of chert; 700 to 850 feet thick. The detailed character and relations of the Abrigo (Cambrian) and El Paso (Ordovician) formations are discussed by Sabins (1957) and Epis and Gilbert (1957)

Cb — Bolsa quartzite
Coarse- to medium-grained quartzite, commonly arkosic in lower part; generally has thin conglomerate at base. About 600 feet thick

Upper Devonian — Lower Ordovician — Middle and Upper Cambrian

DEVONIAN — ORDOVICIAN — CAMBRIAN

UNCONFORMITY

pCg — Granite
Coarse-grained, commonly porphyritic granite. Includes some medium-grained equigranular granitic rock that could be of Mesozoic or Tertiary age

pCs — Pinal schist
Schist and hornfels derived from detrital sedimentary rocks

lower Precambrian — PRECAMBRIAN

Contact
Dashed where approximately located

Fault, showing dip
Dashed where approximately located; dotted where concealed. U, upthrown side; D, downthrown side

Thrust fault
Dashed where approximately located; dotted where concealed. Saw-teeth on side of upper plate

Strike and dip of beds

Strike and dip of overturned beds

Strike of vertical beds

Quarry

Principal mines in the Swisshelm mining district

(Galbraith and Loring, 1951)
1. Great American
2. Heany adit (Swisshelm Mountain?)
3. Scribner or Mountain Queen (Chance located a few hundred feet to the northeast cannot be shown at the map scale)

Note: The California mining district, which includes the Hilltop and many smaller mines in the northeastern part of the map area, has had a larger production than the Swisshelm district.

INTERIOR—GEOLOGICAL SURVEY, WASHINGTON, D.C. MR 6863

RECONNAISSANCE GEOLOGIC MAP OF SOUTHEASTERN COCHISE COUNTY, ARIZONA

By
John R. Cooper

Scale 1:125 000

1 ½ 0 1 2 3 4 5 Miles

Contour interval 100 feet
Datum is mean sea level

1959

Arizona (SE Cochise Co.) geol. 1:125,000. 1959.
cop. 1.

MINERAL INVESTIGATIONS
FIELD STUDIES MAP MF-213