

UNITED STATES DEPARTMENT OF THE INTERIOR
GEOLOGICAL SURVEY

Records of Massive Sulfide Occurrences
in Arizona

By

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

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CONTENTS

	Page
Introduction.....	1
Massive sulfide records	
Antler mine - 00001.....	2
Copper World mine - 00002.....	3
Copper King mine - 00003.....	4
Old Dick/Bruce mine - 00004.....	5
Copper Queen mine - 00005.....	6
Rudkins prospect - 00006.....	7
Red Cloud mine - 00007.....	8
Pinafore prospect - 00008.....	9
Boston Arizona mine - 00009.....	10
United Verde (UV) mine - 00010.....	11
Haynes mine - 00011.....	12
United Verde Extension (UVX) mine - 00012.....	13
Verde Central mine - 00013.....	14
Copper Chief mine - 00014.....	15
Iron King mine - 00015.....	16
Victor-Swindler and Huron-Montezuma pros. - 00016.....	17
Lone Pine mine - 00017.....	18
Boggs mine - 00018.....	19
Butternut mine - 00019.....	20
Iron Queen mine - 00020.....	21
Pentland prospect - 00021.....	22
Upshot prospect - 00022.....	23
Carbine prospect - 00023.....	24
Hackberry mine - 00024.....	25
Bell Ranch gold prospect - 00025.....	26
Binghampton mine - 00026.....	27
Copper Queen mine - 00027.....	28
Stoddard mine - 00028.....	29
Blue Bell mine - 00029.....	30
De Soto mine - 00030.....	31
Unnamed prospect - 00031.....	32
Unnamed prospect - 00032.....	33
Unnamed prospect - 00033.....	34
Kay mine - 00034.....	35
Orizaba mine - 00035.....	36
Gray's Gulch prospects - 00036.....	37
Bronco Creek mine - 00037.....	38
Copper Camp Creek prospect - 00038.....	39
Pittsburg-Tonto prospect - 00039.....	40
Ernie's Tank - 00040.....	41
Pranty's Cabin prospect - 00041.....	42

Name of site: Antler mine County: Mohave Quadrangle: Wabayuma Peak
 Commodities: Cu, Zn, Pb, Ag, Au
 Nature of site: Inactive underground mine
 Exposure: Gossans are exposed at the surface.
 Production: Discovered in 1879, the Antler produced about 78,000 tons of ore that averaged 3% copper, 6.5% zinc, 0.75% lead, 1.1 oz/ton silver and 0.01 oz/ton gold.

Ore minerals: Chalcopyrite, sphalerite, galena
 Gangue: Gangue minerals include pyrite, pyrrhotite, cordierite, anthophyllite, biotite-phlogopite, actinolite-tremolite, muscovite, chlorite, garnet, sillimanite, carbonate, epidote, and rare cummingtonite-grunerite.
 Alteration: The mineral assemblage cordierite-anthophyllite-almandine garnet-magnetite-biotite suggests the presence of an earlier chloritic alteration zone.
 Metamorphic grade: Amphibolite facies with late thermal overprinting and retrograde metamorphism.

Unit name: Proterozoic undivided.
 Lithology: Host rocks include quartz-biotite schist and quartz-biotite-(potassium) feldspar schist/gneiss. Host rocks are interpreted to represent felsic tuffs.
 Age: Paragneiss in the Hualapai and Peacock Mountains are reported to yield Rb-Sr age dates of 1,800 plus or minus 80 Ma (Anderson and Guilbert, 1979).
 Volcanism: Bimodal, basalt - (dacite) rhyolite volcanism is inferred.
 Sedimentary rocks: Thin oxide- and sulfide-facies iron formations, deformed into pod-shaped bodies.

Ore types: Massive and semi-massive.
 Ore texture: Metamorphically coarsened sulfides are enmeshed in silicate gangue. Ductile sulfides locally show plastic flowage features.

Structure: Strong, tight to isoclinal folding by passive-slip deformation. Two periods of folding are evident, but the structure is dominated by a N30E regional foliation trend.
 Geometry: The orebody is a thin sulfide lense that ranges from 0.6 to 12 meters thick and averages 2.7 meters. The sulfide body extends for at least 730 meters along strike, dips to the northwest, and plunges 63 degrees north.

Comments: Metal ratios, alteration patterns, and the interpretation of volcanic protoliths suggest that the Antler is a proximal deposit.

Coordinates: Latitude 34-52-57.000N Longitude 113-58-06.000W

Reporter: M. Donnelly Affiliation: Noranda

References: Anderson, P., and Guilbert, J. M., 1979, The Precambrian massive sulfides of Arizona--a distinct metallogenic epoch and province: Papers on mineral deposits of western North America: Nev. Bureau of Mines and Geol., Rept. 33, p. 39-48.

More, S. W., 1980, The geology and mineralization of the Antler mine and vicinity, Mohave county, Arizona: Tucson, Un. of Arizona, unpublished master's thesis, 149 p.

Stensrud, H. L., and More, S. W., 1980, Precambrian geology and massive sulfide environments of the west-central Hualapai Mountains, Mohave county, Arizona--a preliminary report: Arizona Geol. Soc. Digest v. 12, p. 155-165.

Name of site: Copper World mine County: Mohave Quadrangle: Wabayuma Peak
 Commodities: Cu, Zn, Ag, Au, Pb
 Nature of site: Small underground mine and prospect pits
 Exposure: Not determined.
 Production: 61,000 tons of ore that graded 3.55% Cu, 10.29% Zn, 0.66 oz/ton Ag, and 0.0017 oz/ton Au were shipped during the period 1944-1959 (Stensrud and others, 1980). In addition, 1,480 tons were shipped to the Antler mill. Ore shipments also contained about 0.3% Pb.

Ore minerals: Chalcopyrite, sphalerite, galena
 Gangue: Gangue minerals include pyrite, pyrrhotite, anthophyllite, tremolite, biotite, phlogopite, sillimanite, chlorite, magnetite, quartz, and calcite.
 Alteration: Cordierite(?), anthophyllite, almandine garnet, magnetite, and biotite. The biotite, and possibly anthophyllite, suggests the presence of an earlier chloritic alteration zone.
 Metamorphic grade: Amphibolite facies.

Unit name: Proterozoic undivided.
 Lithology: Host rocks are quartzofeldspathic biotite and muscovite schists believed to represent rhyodacitic to rhyolite tuffs or tuffaceous sediments (Stensrud and others, 1980).
 Age: Paragneiss closely associated with the occurrence in the Hualapai and Peacock Mountains yield Rb-Sr dates of 1,800 plus or minus 80 Ma (Anderson and Guilbert, 1979).
 Volcanism: Felsic tuffaceous.
 Sedimentary rocks: Possible tuffaceous sediments.

Ore types: Massive and semi-massive.
 Ore texture: Coarse-grained sulfides are enmeshed with silicates.

Structure: Two fold systems are evident. The latest system is characterized by strong, tight to isoclinal folds and by passive slip deformation.
 Geometry: Small underground mine and prospect pits.

Comments: The Copper World deposit is probably a proximal type massive sulfide occurrence.

Coordinates: Latitude 34-54-35.000N Longitude 113-55-15.000W

Reporter: M. Donnelly Affiliation: Noranda

References: Anderson, P., and Guilbert, J. M., 1979, The Precambrian massive sulfides of Arizona--a distinct metallogenic epoch and province: Papers on mineral deposits of western North America: Nev. Bureau of Mines and Geol., Rept. 33, p. 39-48.

More, S. W., 1980, The geology and mineralization of the Antler mine and vicinity, Mohave county, Arizona: Tucson, Un. of Arizona, unpublished master's thesis, 149 p.

Stensrud, H. L., and More, S. W., 1980, Precambrian geology and massive sulfide environments of the west-central Hualapai Mountains, Mohave county, Arizona--a preliminary report: Arizona Geol. Soc. Digest v. 12, p. 155-165.

Name of site: Copper King mine County: Yavapai Quadrangle: Bagdad
 Commodities: Zn, Pb, Cu, Ag, Au
 Nature of site: Inactive underground mine
 Exposure: Several small gossans.
 Production: Intermittent production between 1917 and 1955 yielded about 23,000 tons of ore. The tenor of the ore is uncertain.

Ore minerals: Sphalerite, galena, chalcopyrite
 Gangue: Gangue minerals include quartz, pyrite, arsenopyrite, chlorite, calcite, and sericite.
 Alteration: Alteration includes sericitization within the exhalative zone and chloritization in the stratigraphic footwall rocks.
 Metamorphic grade: Lower amphibolite facies. Weakly to moderately foliated. Primary textures are poorly to well preserved.

Unit name: Primarily basaltic volcanic rocks and minor felsic volcanoclastics of the Bridle Formation.
 Lithology: The massive sulfides are immediately above a minor felsic volcanoclastic succession within the dominantly basaltic Bridle Formation.

Age: Age of the host rocks is 1.75 Ga as determined by Silver (1968). This age is 1720 Ma plus or minus 15 Ma when recalculated using new decay constants.
 Volcanism: Bimodal basalt-rhyolite of possible island arc tholeiitic affinity.
 Sedimentary rocks: Minor chert and magnetite-rich epiclastic rocks.

Ore types: Massive sphalerite and massive, compositionally-layered galena-sphalerite-chalcopyrite ore.
 Ore texture: Fine- to medium-grained. Metamorphically recrystallized.

Structure: Steeply dipping, overturned, homoclinal succession.
 Geometry: Lens-shaped sulfide body that plunges steeply to the southwest.

Comments: The Copper King is the only mine in the Bagdad District that contained appreciable amounts of lead.

Coordinates: Latitude 34-34-11.914N Longitude 113-12-45.318W

Reporter: M. Donnelly & C. Conway Affiliation: Noranda & U.S.G.S.

References: Anderson, C. A., 1968, Arizona and adjacent New Mexico, in Ore Deposits of the United States 1933/1967, v. 2: New York, American Institute of Mining, Metallurgical, and Petroleum Engineers, p. 1163-1190.
 Anderson, C. A., Scholz, E. A., and Strobell, J. D. Jr., 1955, Geology and ore deposits of the Bagdad area, Yavapai County, Arizona: U.S. Geological Survey Professional Paper 278, 103 p.
 Baker, A. III, and Clayton, R. L., 1968, Massive sulfide deposits of the Bagdad district, Yavapai County, Arizona, in Ore deposits in the United States 1933/1967, v. 2: New York, American Institute of Mining, Metallurgical, and Petroleum Engineers, p. 1311-1327.
 Silver, L. T., 1968, U-Pb isotope relations and their historical implications in Precambrian zircons from Bagdad, Arizona: Geological Society of America Special Paper 101, p. 420.

Name of site: Old Dick/Bruce mine County: Yavapai Quadrangle: Bagdad
 Commodities: Zn, Cu, Pb, Au, Ag
 Nature of site: Inactive underground mine
 Exposure: Discovery gossan of the Old Dick, and of the footwall alteration zone.
 Production: From 1943 to 1965, the Old Dick mine produced 676,810 tons of ore that graded 10.6% zinc and 3.36% copper. The Bruce orebody was discovered in the mid 1960's by underground drilling in the Old Dick mine. Between 1968 and 1977, it produced 822,611 tons of ore that averaged 12.7% zinc and 3.65% copper. The ore deposits contained from 0.32 to 0.35 oz/ton Ag, and .0014 to .0026 oz/ton Au.

Ore minerals: Sphalerite, chalcopyrite, galena, auriferous pyrite
 Gangue: Gangue minerals include pyrrhotite, sericite, chlorite, quartz, calcite, magnetite, and arsenopyrite.
 Alteration: Extensive chloritization in a funnel-like alteration pipe: strong sericitic alteration immediately adjacent to the orebodies; semi-conformable zones of silicification and epidotization outside the chlorite pipe; and albitic alteration adjacent to a felsic hypabyssal sill lower in the volcanic section (Conway et al, 1985; Larson, 1984).
 Metamorphic grade: Lower amphibolite facies metamorphism accompanied by a weak to moderately developed foliation.

Unit name: At contact between Bridle Formation and overlying Dick Rhyolite (Anderson and others, 1955).
 Lithology: Pillowed basalt and basaltic andesite flows, agglomerates and associated volcanic rocks of the Bridle Formation.
 Age: 1,740 to 1,760 Ma (Silver, 1968). This date recalculated using new decay constants is 1,740 plus or minus 15 Ma. A model Pb isotopic age of approximately 1,740 Ma was obtained from the Bruce (Clayton and Baker, 1973).
 Volcanism: Bimodal basalt-rhyolite of possible island-arc tholeiitic affinity. The rocks were deposited in a shallow-water, subaqueous environment.
 Sedimentary rocks: Chert, shale, fine-grained mafic to felsic tuffaceous metasediments, and exhalative(?) quartz-sericite-pyrite schist.

Ore types: Massive sulfides and minor Cu-rich "stringer ore" in the stratigraphic footwall.
 Ore texture: Medium- to coarse-grained ores are typically compositionally layered. The ores were recrystallized and remobilized to an unknown degree during metamorphism. Stringer ore consists of more than 50% altered andesite fragments in a stringer-like matrix of sulfides.

Structure: Steeply dipping, overturned, homoclinal sequence with steeply plunging secondary folds. The ore bodies rake parallel to the plunge of a major secondary fold.
 Geometry: Massive sulfides occur in two conformable lenses: the Bruce and the Old Dick orebodies. The upper edge of the Bruce lens is 60 meters downdip from the lower edge of the Old Dick. The Old Dick lens measures 150 x 290 x 23 meters. The maximum dimensions of the Bruce deposit are 175 x 500 x 20 meters with the long axis of the deposit raking 70 degrees southwest. Both orebodies plunge steeply to the southwest parallel to lineations in the surrounding rocks.

Comments: The Old Dick/Bruce deposit is proximal to a mafic volcanic pile. Mapping and alteration studies by Conway and others (1985) indicate that the hydrothermal system was driven by a large sill-like body of alaskite/granophyre. Stacked alteration zones suggest that the hydrothermal system was active as the upper portion of the Bridle volcanic unit accumulated. The Old Dick and Bruce deposits formed during a hiatus between bimodal mafic and felsic volcanism represented by the Bridle Formation and the Dick Rhyolite.

Coordinates: Latitude 34-32-48.838N Longitude 113-13-46.145W

Reporter: M. Donnelly & C. Conway Affiliation: Noranda & U.S.G.S.

References: Anderson, C. A., Scholz, E. A., and Strobell, J. D. Jr., 1955, Geology and ore deposits of the Bagdad area, Yavapai County, Arizona: U.S. Geological Survey Professional Paper 278, 103 p.

Baker, A. III, and Clayton, R. L., 1968, Massive sulfide deposits of the Bagdad district, Yavapai County, Arizona, in Ore deposits in the United States 1933/1967, v. 2: New York, American Institute of Mining, Metallurgical, and Petroleum Engineers, p. 1311-1327.

Clayton, R. L., and Baker, A. III, 1973, Pb-Pb ages of a galena sample from the Bruce mine, Yavapai County, Arizona: Isochron/West, no. 6, p. 35.

Conway, C. M., Connelly, T. J., and Robison, L. C., 1985, Volcanic and hydrothermal systems: Early Proterozoic massive sulfide deposits, Bagdad, Arizona, in Kraft, K., ed., USGS Research on Mineral Deposits, 1985, Program and Abstracts; V. E. McKelvey Forum on Mineral and Energy Resources: U.S. Geological Survey Circular 949, p. 8-9.

Larson, P. B., 1984, Geochemistry of the alteration pipe at the Bruce volcanogenic massive sulfide deposit, Arizona: Economic Geology, v. 79, no. 8, p. 1880-1896.

Name of site: Copper Queen mine County: Yavapai Quadrangle: Bagdad
 Commodities: Zn, Cu, Au, Ag
 Nature of site: Exhausted and closed underground mine
 Exposure: Not exposed at the surface.
 Production: The Copper Queen produced 140,350 tons of ore grading 14.4% Zn and 4.70% Cu between 1961 and 1965, and minor production of about 6000 tons before 1961. The ore contained 0.38 oz/ton silver and 0.0016 oz/ton Au.

Ore minerals: Sphalerite, chalcopyrite, Azurite, Chalcocite
 Gangue: Gangue minerals include pyrite, quartz, chlorite, calcite, arsenopyrite, sericite, and magnetite.
 Alteration: Alteration includes widespread semi-conformable zones of silicification and sericitization in the stratigraphic footwall and in the massive sulfide lenses.
 Metamorphic grade: Lower amphibolite facies accompanied by weak to moderate foliation. Relict sedimentary and volcanic textures are poorly to well preserved.

Unit name: Andesitic and felsic volcanoclastic rocks that overlie the Dick Rhyolite.
 Lithology: Host rocks include andesite flows, felsic tuffs, and epiclastic rocks.
 Age: Massive sulfide host rocks are about 1.75 Ga as determined by Silver (1968), and 1720 Ma plus or minus 15 Ma as calculated using new decay constants.
 Volcanism: Bimodal basalt-rhyolite of possible tholeiitic, island arc affinity.
 Sedimentary rocks: Associated sedimentary rocks include reworked felsic volcanoclastic rocks, minor shale, and rare limestone. Dark purplish-gray chert occurs stratigraphically below the deposit.

Ore types: Massive sulfides.
 Ore texture: Fine-grained and compositionally layered.

Structure: Steeply dipping, overturned, homoclinal succession.
 Geometry: Steeply plunging massive sulfide lenses.

Comments: The Copper Queen is a proximal massive sulfide deposit and is located about 1 km south of the Old Dick/Bruce deposit.

Coordinates: Latitude 34-32-17.000N Longitude 113-13-45.000W

Reporter: M. Donnelly & C. Conway Affiliation: Noranda & U.S.G.S.

References: Anderson, C. A., Scholz, E. A., and Strobell, J. D. Jr., 1955, Geology and ore deposits of the Bagdad area, Yavapai County, Arizona: U.S. Geological Survey Professional Paper 278, 103 p.
 Baker, A. III, and Clayton, R. L., 1968, Massive sulfide deposits of the Bagdad district, Yavapai County, Arizona, in Ore deposits in the United States 1933/1967, v. 2: New York, American Institute of Mining, Metallurgical, and Petroleum Engineers, p. 1311-1327.
 Silver, L. T., 1968, U-Pb isotope relations and their historical implications in Precambrian zircons from Bagdad, Arizona: Geological Society of America Special Paper 101, p. 420.

Name of site: Red Cloud mine County: Yavapai Quadrangle: Bagdad
 Commodities: Zn, Cu, Au, Ag,
 Nature of site: Prospect with shaft and adit
 Exposure: The exposure of the occurrence consists of a small gossan and a chloritic alteration zone.
 Production: The Red Cloud prospect produced about 200 tons of ore with an average grade of 6.4% Cu, 2.7% Zn, 0.69 oz/ton Ag and 0.075 oz/ton Au.

Ore minerals: Sphalerite, chalcopyrite
 Gangue: Gangue minerals include pyrite and quartz.
 Alteration: Conformable lenses of intensely chloritized basalt are immediately beneath the deposit.
 Metamorphic grade: Lower amphibolite facies.

Unit name: Bimodal volcanic and volcanoclastic succession that overlies the Dick Rhyolite.
 Lithology: The sulfides occur at the top of a 15 to 20 meter thick unit of basalt that in turn overlies the Dick Rhyolite. The sulfides are interbedded with felsic tuffaceous rocks.
 Age: The age of the host rocks as determined by Silver (1968) is about 1.75 Ga. Recalculated using new decay constants, the age is 1720 Ma plus or minus 15 Ma.
 Volcanism: Bimodal basalt-rhyolite of possible tholeiitic, island arc affinity.
 Sedimentary rocks: Chert lenses, a few hundred meters long, extend on-strike with the deposit. Large chert lenses are at the base of the basalt that is below the deposit.

Ore types: Ore types have not been determined.
 Ore texture: Ore textures have not been determined.

Structure: Steeply dipping, overturned, homoclinal succession.
 Geometry: A description of the deposit has not been determined.

Comments: The Red Cloud prospect is known for the occurrence of gem-quality wulfenite crystals.

Coordinates: Latitude 34-31-19.000N Longitude 113-14-05.000W

Reporter: M. Donnelly & C. Conway Affiliation: Noranda & U.S.G.S.

References: Anderson, C. A., Scholz, E. A., and Strobell, J. D. Jr., 1955, Geology and ore deposits of the Bagdad area, Yavapai County, Arizona: U.S. Geological Survey Professional Paper 278, 103 p.

Collins, D. E., 1977, Metamorphic geology of a portion of the Bagdad mining district, Yavapai County, Arizona: Reno, Un. of Nevada, M.S. thesis, 113 p.

Silver, L. T., 1968, U-Pb isotope relations and their historical implications in Precambrian zircons from Bagdad, Arizona: Geological Society of America Special Paper 101, p. 420.

Name of site: Pinafore prospect County: Yavapai Quadrangle: Arrastra Mtn. NE
 Commodities: Zn, Cu, Ag, Au
 Nature of site: Prospect
 Exposure: The exposure consists of a small gossan.
 Production: Produced about 1900 tons with an average grade of 3.2% Cu, 13% Zn, 1.04 oz/ton Ag, and 0.014 oz/ton Au.

Ore minerals: Sphalerite, chalcopyrite, chalcocite
 Gangue: Gangue minerals include quartz, sericite, chlorite, and talc(?).
 Alteration: Minor silicification and sericitization in and lateral to the ore zone. Weak chloritic alteration in the footwall. Sparse tourmaline in the footwall may be an alteration product.
 Metamorphic grade: Amphibolite facies.

Unit name: At contact between Bridle Formation(?) and overlying Dick Rhyolite.
 Lithology: The massive sulfides occur at the contact between basalt in the footwall and rhyolite in the hangingwall.
 Age: Age of the host rocks is about 1.75 Ga as determined by Silver (1968). Recalculated using new decay constants the age is 1720 Ma plus or minus 15 Ma.
 Volcanism: Bimodal basalt-rhyolite of possible tholeiitic, island arc affinity.
 Sedimentary rocks: No sedimentary rocks are known.

Ore types: Massive sulfides.
 Ore texture: Ore textures have not been determined.

Structure: The occurrence is in a steeply dipping, overturned, homoclinal succession and is deformed by steeply plunging secondary folds. Pronounced lineations plunge steeply southwest and are thought to parallel the axes of the secondary folds.
 Geometry: The deposit is a steeply plunging sulfide lense.

Comments: The prospect occurs at a stratigraphic setting similar to that of the Old Dick/Bruce deposit 8 km to the NNE.

Coordinates: Latitude 34-29-27.000N Longitude 113-16-39.000W

Reporter: M. Donnelly & C. Conway Affiliation: Noranda & U.S.G.S.

References: Collins, D. E., 1977, Metamorphic geology of a portion of the Bagdad mining district, Yavapai County, Arizona: Reno, Un. of Nevada, M.S. thesis, 113 p.

Name of site: Boston Arizona mine

County: Yavapai

Quadrangle: Iron Springs

Commodities: Zn, Cu

Nature of site: Prospect pits and underground workings

Exposure: Exposed in prospect pits and underground workings.

Production: Minor production from an adit and shaft.

Ore minerals: Sphalerite and chalcopyrite

Gangue: Gangue minerals include quartz, chlorite, carbonate, pyrite, and pyrrhotite.

Alteration: Mg-rich chloritization has been metamorphosed to a talc-actinolite/tremolite-sericite-chlorite assemblage.

Metamorphic grade: Lower amphibolite facies.

Unit name: Proterozoic undivided

Lithology: The host rocks include volcanic wackes, phyllites, and felsic volcanoclastic rocks.

Age: An age between 1.71 and 1.79 Ga is inferred.

Volcanism: Felsic volcanoclastic rocks are thought to represent basinal lithofacies of a mafic to felsic volcanic transition.

Sedimentary rocks: Associated sedimentary rocks include cherty tuffs and volcanic mudstones.

Ore types: Massive and semi-massive.

Ore texture: Coarse, clastic and brecciated ores contain lapilli-size lithic clasts that are suspended in a fine-grained sulfide matrix.

Structure: Steeply dipping to slightly overturned stratigraphic sequence. Steep to moderate inclined open folds are developed with attendant stretching, rodding, and boudinage that plunge 45 to 50 degrees NE.

Geometry: Conformable pod-like sulfide bodies strike N50W to N75W, dip 65 to 90 degrees SW, and rake 45 to 50 degrees NW.

Comments: The volcano-sedimentary sequence at the Boston Arizona mine occurs in a large roof pendent in a Precambrian diorite stock. The occurrence is probably a distal deposit.

Coordinates: Latitude 34-31-24.018N Longitude 112-36-45.889W

Reporter: M. Donnelly

Affiliation: Noranda

Name of site: United Verde (UV) mine County: Yavapai Quadrangle: Clarkdale
 Commodities: Cu, Zn, Au, Ag
 Nature of site: Inactive underground and open pit mine
 Exposure: Exposed from hangingwall to footwall in the open pit.
 Production: Production of ore at the United Verde Mine totaled 30,672,846 tons with an estimated average grade of 4.77% Cu, 0.046 oz/ton Au, and 1.65 oz/ton Ag. Zinc was not recovered during most of the mining activity, but Anderson and others (1968) report that as much as 10 million tons of zinc reserves remain.

Ore minerals: Chalcopyrite, sphalerite, and tennantite
 Gangue: Gangue minerals include pyrite, quartz, carbonate (dolomite and ankerite), chlorite, arsenopyrite, and specular hematite.
 Alteration: Extensive Mg-rich chlorite in footwall; minor localized chlorite in hangingwall, and pervasive sericitization locally.
 Metamorphic grade: Greenschist facies. Volcanics contain albite, sericite, chlorite, epidote group, actinolitic amphibole, quartz, calcite, and dolomite.

Unit name: Cleopatra Member of Deception Rhyolite and lower part of Grapevine Gulch Formation. Both units are in the Ash Creek Group.
 Lithology: The host rocks are the Cleopatra Member of the Deception Rhyolite and the lower part of the Grapevine Gulch. Both units are a part of the Ash Creek Group.
 Age: Zircons from the Cleopatra Member of the Deception Rhyolite yield an apparent age of about 1,790 Ma (Anderson and others 1971).
 Volcanism: Volcanism includes basalt-andesite-(dacite) rhyolite; exhalites associated with rhyolitic tuffs which were deposited largely by subaqueous pyroclastic flows.
 Sedimentary rocks: Associated sedimentary rocks include lenticular to irregular bodies of fine grained ferruginous chert and fine-grained volcanoclastic rocks.

Ore types: Massive and semi-massive sulfides; black chlorite stringer ore (black schist), chalcopyrite veins and veinlets in tuffs (quartz porphyry ore).
 Ore texture: Massive sulfide ore is locally banded; pyritic massive sulfide ore is fine-grained--pyrite grains range from 0.04 to 0.2 mm. Intersecting and branching sulfide veinlets in stringer ore and quartz porphyry ore.
 Structure: Ash Creek Group is deformed into series of northwestward-trending, open folds that were refolded along steep axes.
 Geometry: Several massive sulfide lenses, two of which are major orebodies: the Main Orebody and the North Orebody. The main orebody is pipe-shaped and trends N20W and plunges 50 to 65 degrees N. On the upper levels, the horizontal outline of the orebody is bulbous. At depth, the bulbous outline gradually flares to crescent-shaped.

Comments: The pipe-shaped orebody extends from the surface to below the 4500 foot level. The North orebody occurs in the lower levels of the mine, about 500 feet northwest of the roots of the Main orebody. The two are separated by a younger gabbro intrusive rock. The North orebody consists of two or more lenses. The United Verde is a proximal massive sulfide deposit.

Coordinates: Latitude 34-45-26.376N Longitude 112-07-47.158W

Reporter: M. Donnelly, P. Handverger Affiliation: Noranda

References: Anderson, C. A., 1968, Arizona and adjacent New Mexico, in Ore Deposits of the United States 1933/1967, v. 2: New York, American Institute of Mining, Metallurgical, and Petroleum Engineers, p. 1163-1190.
 Anderson, C. A., and Creasy, S. C., 1958, Geology and ore deposits of the Jerome area, Yavapai County, Arizona: U.S. Geol. Survey Prof. Paper 308, 185 p.
 Anderson, C. A., and Nash, J. T., 1972, Geology of the massive sulfide deposits at Jerome, Arizona--A reinterpretation: Econ. Geology v. 67, no. 7, p. 845-863.
 Anderson, C. A., Blacet, P. M., Silver, L. T., and Stern, T. W., 1971, Revision of Precambrian stratigraphy in the Prescott-Jerome area: U.S. Geol. Survey Bull. 1324C, 15 p.

Name of site: Haynes mine County: Yavapai Quadrangle: Munds Draw
 Commodities: Cu, Zn, Au, Ag
 Nature of site: Inaccessible underground mine
 Exposure: The Haynes is a blind orebody that occurs at a depth of more than 2500 feet.
 Production: Production included in United Verde mine.

Ore minerals: Chalcopyrite, sphalerite, auriferous pyrite
 Gangue: Gangue minerals include pyrite, quartz, carbonate, chlorite, pyrrhotite, and magnetite.

Alteration: Footwall tuffs are extensively chloritized.
 Metamorphic grade: Greenschist facies; mineralogy consists of albite, sericite, chlorite, epidote group, actinolitic amphibole, quartz, calcite, and dolomite.

Unit name: Cleopatra Member of the Deception Rhyolite in the Ash Creek Group.
 Lithology: Felsic crystal tuff of the Cleopatra Member forms the footwall; gabbro forms the hangingwall.
 Age: Zircons from the Cleopatra Member yield an apparent age of about 1,790 Ma (Anderson and others, 1971).
 Volcanism: Basalt-andesite-(dacite) rhyolite.
 Sedimentary rocks: Associated sedimentary rocks include ferruginous chert.

Ore types: Massive and semi-massive.
 Ore texture: Fine-grained massive and siliceous semi-massive ore.

Structure: The Ash Creek Group, which includes the Deception Rhyolite, is deformed into a series of northwest-trending open folds that were later refolded along steep axes.
 Geometry: The deposit is a steeply dipping pipe-shaped body with a triangular horizontal outline. The axis of the pipe bears N60E to N76E and the plunge ranges from 67 to 75 degrees NE.

Comments: The Haynes orebody is separated from the United Verde orebody by the United Verde gabbro. The emplacement of the gabbro may have dilated the Haynes from the U.V. orebody. Haynes is a proximal massive sulfide deposit.

Coordinates: Latitude 34-45-23.000N Longitude 112-07-48.000W

Reporter: M. Donnelly, P. Handverger Affiliation: Noranda

References: Anderson, C. A., and Creasy, S. C., 1958, Geology and ore deposits of the Jerome area, Yavapai County, Arizona: U.S. Geol. Survey Prof. Paper 308, 185 p.

Anderson, C. A., Blacet, P. M., Silver, L. T., and Stern, T. W., 1971, Revision of Precambrian stratigraphy in the Prescott-Jerome area: U.S. Geol. Survey Bull. 1324C, 15 p.

Anderson, C. A., and Nash, J. T., 1972, Geology of the massive sulfide deposits at Jerome, Arizona--A reinterpretation: Econ. Geology v. 67, no. 7, p. 845-863.

Name of site: United Verde Extension (UVX) mine County: Yavapai
 Commodities: Cu, Au, Ag Quadrangle: Clarkdale
 Nature of site: Underground mine
 Exposure: The United Verde Extension is a blind orebody.
 Production: The United Verde Extension mine produced 3,878,825 tons of ore that averaged 10.23% copper, 0.039 oz/ton gold, and 1.71 oz/ton silver. The high grade of the copper reflected a supergene enriched zone over the massive sulfide body. The sulfides below the supergene zone contained 0.5 to 1.5% copper and 2 to 4% zinc.

Ore minerals: Chalcocite, cuprite, native copper, malachite, chrysocolla, azurite
 Gangue: Gangue minerals include quartz, limonite, pyrite, carbonate, chlorite, and sericite.
 Alteration: Alteration consists of Mg-rich chloritization and sericitization in the footwall and strong carbonatization and local epidotization in the hangingwall.
 Metamorphic grade: Greenschist facies; mineralogy consists of albite, sericite, chlorite, epidote group, actinolitic amphibole, quartz, calcite, and dolomite.

Unit name: Deception Rhyolite of the Ash Creek Group.
 Lithology: The host rocks include massive rhyolite, felsic fragmental rocks, and tuffaceous metasediments of the Deception Rhyolite. The feeder zone is in quartz porphyry of the Cleopatra Member.
 Age: Zircons from the Cleopatra Member of the Deception Rhyolite yield an apparent age of about 1,790 Ma (Anderson and others, 1971).

Volcanism: Basalt-andesite-(dacite)rhyolite.
 Sedimentary rocks: Associated sedimentary rocks include oxide- and sulfide-facies ferruginous chert, jasper, and fine-grained, bedded pyroclastic rocks.

Ore types: The ore types include chalcocite-rich supergene ore, massive and semi-massive sulfides beneath the supergene zone, chloritic stringer ore, silicious gossan, and auiferous chert.
 Ore texture: The supergene zone contained fine-grained orthorhombic chalcocite with well developed pisolitic structures. The massive sulfides are fine-grained and locally banded. The gold ore included spongy, silicious gossan, and locally brecciated and recemented chert.

Structure: The United Verde Extension is on the east limb of a regional anticline. The steeply dipping Verde Fault is immediately west of the orebody.
 Geometry: The massive sulfide zones are steeply dipping, pod-shaped bodies that are intruded by gabbro and locally faulted. The long dimension of the main orebody trends east-west.

Comments: The United Verde Extension is a proximal massive sulfide deposit.

Coordinates: Latitude 34-35-04.000N Longitude 112-06-38.000W

Reporter: M. Donnelly, P. Handverger Affiliation: Noranda

References: Anderson, C. A., Blacet, P. M., Silver, L. T., and Stern, T. W., 1971, Revision of Precambrian stratigraphy in the Prescott-Jerome area: U.S. Geol. Survey Bull. 1324C, 15 p.
 Anderson, C. A., and Creasy, S. C., 1958, Geology and ore deposits of the Jerome area, Yavapai County, Arizona: U.S. Geol. Survey Prof. Paper 308, 185 p.
 Anderson, C. A., and Nash, J. T., 1972, Geology of the massive sulfide deposits at Jerome, Arizona--A reinterpretation: Econ. Geology v. 67, no. 7, p. 845-863.
 Reber, L. E. Jr., 1938, Jerome District, some Arizona ore deposits: Arizona Bureau of Mines Bull. 145, p. 41-65.

Name of site: Verde Central mine County: Yavapai Quadrangle: Hickey Mtn.
 Commodities: Cu, Ag, Au
 Nature of site: Inactive underground mine
 Exposure: The exposure consists of a small outcrop of black Mg-rich chloritic rock and copper oxide staining.
 Production: Produced 93,000 tons of ore that averaged 2.4% Cu, 0.2 oz/ton Ag and 0.0005 oz/ton Au. In 1930, ore reserves at the Verde Central were 121,124 tons that averaged 2.94% copper.

Ore minerals: Chalcopyrite
 Gangue: Gangue minerals include quartz, pyrite, calcite, and chlorite.
 Alteration: Alteration consists of sericitization and Mg-rich chloritization in the footwall.
 Metamorphic grade: Greenschist facies; mineralogy consists of albite, sericite, chlorite, epidote group, actinolitic amphibole, quartz, calcite, and dolomite.

Unit name: Deception Rhyolite of the Ash Creek Group.
 Lithology: Host rocks include massive rhyolite, coarse fragmental rhyolite, and felsic tuffs.
 Age: Zircons from the Cleopatra Member of the Deception Rhyolite yield an apparent age of about 1,790 Ma (Anderson and others, 1971).
 Volcanism: Basalt-andesite-(dacite) rhyolite.
 Sedimentary rocks: Associated sedimentary rocks include jasper, red and black chert, and fine-grained volcanoclastic rocks.

Ore types: Massive and semi-massive sulfides, and chloritic stringer ore.
 Ore texture: The massive sulfides are locally banded. The stringer ore consists of intersecting and branching veins and veinlets of chalcopyrite.

Structure: West limb of a regional anticline. Rocks are deformed into a series of northwest-trending open folds that were refolded along steep axes.

Geometry: Two orebodies occur at the Verde Central. The larger orebody is tabular and strikes NW, dips east, and is 1.5 to 9 meters thick. The second orebody is steeply dipping, tabular, and is about 60 meters long and an average of 1.5 meters thick.

Comments: The Verde Central is a proximal massive sulfide deposit.

Coordinates: Latitude 34-44-23.401N Longitude 112-07-16.103W

Reporter: M. Donnelly, P. Handverger Affiliation: Noranda

References: Anderson, C. A., Blacet, P. M., Silver, L. T., and Stern, T. W., 1971, Revision of Precambrian stratigraphy in the Prescott-Jerome area: U.S. Geol. Survey Bull. 1324C, 15 p.

Anderson, C. A., and Creasy, S. C., 1958, Geology and ore deposits of the Jerome area, Yavapai County, Arizona: U.S. Geol. Survey Prof. Paper 308, 185 p.

Lindgren, Waldemar, 1926, Ore deposits of the Jerome and Bradshaw Mountains Quadrangles, Arizona: U.S. Geol. Survey Bull. 782, 192 p.

Reber, L. E. Jr., 1938, Jerome District, some Arizona ore deposits: Arizona Bureau of Mines Bulletin 145, p. 41-65.

Name of site: Copper Chief mine County: Yavapai Quadrangle: Cottonwood
 Commodities: Cu, Au, Ag
 Nature of site: Inactive underground mine
 Exposure: Gossan and copper oxides of the main part of the orebody.
 Production: In 1904 and 1905 about 30,000 tons of ore, mostly from the oxide zone, was mined. Total production is about 400,000 tons that averaged 0.4% Cu, 2.72 oz/ton Ag, and 0.13 oz/ton Au.

Ore minerals: Chalcopyrite
 Gangue: Gangue minerals include quartz, limonite, chlorite, and carbonate.
 Alteration: Alteration includes Mg-rich chloritization in the footwall rocks.
 Metamorphic grade: Greenschist facies.

Unit name: Shea Basalt of the Ash Creek Group.
 Lithology: Host rocks include basalt flows and associated tuffs and volcanoclastic rocks.
 Age: Zircons from the Ash Creek Group yield an apparent age of about 1,790 m.y. (Anderson and others, 1971).
 Volcanism: Basalt-andesite-(dacite)rhyolite
 Sedimentary rocks: Associated sedimentary rocks have not been determined.

Ore types: Ore types include massive sulfide, gossan and copper oxide ore.
 Ore texture: Not determined.

Structure: The Ash Creek Group was deformed into a series of northwestward-trending open folds that were refolded along steep axes.
 Geometry: The sulfide ore was a pod-shaped lense; oxide ores were in irregular chimney-shaped bodies.

Comments: The Copper Chief is probably a proximal type massive sulfide deposit.

Coordinates: Latitude 34-42-02.266N Longitude 112-05-31.079W

Reporter: M. Donnelly, P. Handverger Affiliation: Noranda

References: Anderson, C. A., Blacet, P. M., Silver, L. T., and Stern, T. W., 1971, Revision of Precambrian stratigraphy in the Prescott-Jerome area: U.S. Geol. Survey Bull. 1324C, 15 p.
 Anderson, C. A., and Creasy, S. C., 1958, Geology and ore deposits of the Jerome area, Yavapai County, Arizona: U.S. Geol. Survey Prof. Paper 308, 185 p.
 Reber, L. E. Jr., 1938, Jerome District, some Arizona ore deposits: Arizona Bureau of Mines Bull. 145, p. 41-65.

Name of site: Iron King mine County: Yavapai Quadrangle: Poland Junction
 Commodities: Cu, Pb, Zn, Au, Ag
 Nature of site: Inactive underground mine and prospects
 Exposure: Eight of the 12 sulfide lenses that make up the orebody are exposed at the surface as gossans. Altered footwall rocks are also exposed.
 Production: From 1906 to 1964, 5,007,406 tons of ore was mined that averaged 0.123 oz/ton Au, 3.69 oz/ton Ag, 2.50% Pb, 7.34% Zn, and 0.19% Cu. (Gilmour and Still, 1968). An addition 652,343 tons mined in 1965 and 1966 yielded 29,977 ounces of gold, 1,185,377 ounces of silver, 19,160,020 pounds of lead, 56,250,330 pounds of zinc, and 1,248,251 pounds of copper.

Ore minerals: Chalcopyrite, sphalerite, galena, tennantite, free gold in pyrite
 Gangue: Gangue minerals include pyrite, quartz, ankerite, sericite, chlorite, and arsenopyrite.
 Alteration: Alteration zone in the footwall is about 30 meters wide. Alteration consists of chloritization, sericitization, and silicification.
 Metamorphic grade: Greenschist facies.

Unit name: Upper unit of the Spud Mountain Volcanics of the Big Bug Group, Yavapai Series.
 Lithology: Host rocks are intercalated andesitic and felsic tuffs.
 Age: Zircons from rhyolite in the Spud Mountain Volcanics yield an isotopic age date of about 1,745 Ma (Anderson and others, 1971).
 Volcanism: Principally andesitic volcanism with minor basalt and felsic pyroclastic rocks.
 Sedimentary rocks: Associated sedimentary rocks include chert, ferruginous chert, and reworked intermediate pyroclastic rocks.

Ore types: Ore types include banded massive, semi-massive, and disseminated siliceous ores.
 Ore texture: Ore is very fine grained (100-300 microns) and mineralogically banded.

Structure: Deposit occurs on the east limb of a tight to isoclinal, regional anticline.
 Geometry: Massive sulfides occur in 12 en-echelon lenses that are 0.3 to 4 meters thick. The sulfide bodies strike about N22E, dip 71 degrees W, and plunge 55 to 60 degrees northward. The deposits are overturned to the west.

Comments: The Iron King is probably a distal massive sulfide deposit.

Coordinates: Latitude 34-30-02.452N Longitude 112-15-24.922W

Reporter: M. Donnelly Affiliation: Noranda

References: Anderson, C. A., Blacet, P. M., Silver, L. T., and Stern, T. W., 1971, Revision of Precambrian stratigraphy in the Prescott-Jerome area: U.S. Geol. Survey Bull. 1324C, 15 p.
 Anderson, C. A., and Creasy, S. C., 1958, Geology and ore deposits of the Jerome area, Yavapai County, Arizona: U.S. Geol. Survey Prof. Paper 308, 185 p.
 Creasy, S. C., 1952, Geology of the Iron King Mine, Yavapai County, Arizona: Econ. Geology, v. 47, p. 24-56.
 Gilmour, D., and Still, A. R., 1968, The Geology of the Iron King Mine, in Ore Deposits of the United States, 1933-1967: AIME, v. 2 p. 1239-1257.

Name of site: Victor-Swindler & Huron-Montezuma pros. County: Yavapai
 Commodities: Cu, Ag, Au Quadrangle: Poland Junction
 Nature of site: Numerous prospect pits
 Exposure: Limonite stained rhyolite in prospect pits.
 Production: No recorded production.

Ore minerals: Chalcopyrite
 Gangue: Gangue minerals include pyrite, quartz, hematite, and chlorite.
 Alteration: The rocks are locally altered to chlorite, sericite, and quartz. Andalusite-bearing units in the vicinity are believed to be hydrothermally altered and metamorphosed felsic volcanic rocks.
 Metamorphic grade: Greenschist facies.

Unit name: Iron King Volcanics of the Big Bug Group, Yavapai Series.
 Lithology: Host rocks are quartz crystal tuff and tuffaceous metasediments.
 Age: Host rocks are about 1.75 Ga according to Anderson and others (1971).
 Volcanism: Felsic tuffaceous.
 Sedimentary rocks: Associated sedimentary rocks include chert, and cherty, felsic volcanoclastic rocks.

Ore types: Ore type not determined.
 Ore texture: Ore texture not determined.

Structure: The deposits are included in isoclinally folded strata on the west limb of an overturned syncline.
 Geometry: The occurrences consist of three narrow, subparallel, discontinuous mineralized zones that can be traced for about 2 km.

Comments: The prospects in the north part of the zone are the Huron-Montezuma prospects. Those in the southern part are the Victor-Swindler prospects.

Coordinates: Latitude 34-28-02.010N Longitude 112-15-38.403W

Reporter: M. Donnelly & C. Conway Affiliation: Noranda & U.S.G.S.

References: Anderson, C. A., and Blacet, P. M., 1972, Precambrian geology of the northern Bradshaw Mountains, Yavapai County, Arizona: U.S. Geological Survey Bull. 1336, 82 p.

Anderson, C. A., Blacet, P. M., Silver, L. T., and Stern, T. W., 1971, Revision of Precambrian stratigraphy in the Prescott-Jerome area: U.S. Geol. Survey Bull. 1324C, 15 p.

Lindgren, Waldemar, 1926, Ore deposits of the Jerome and Bradshaw Mountains Quadrangles, Arizona: U.S. Geol. Survey Bull. 782, 192 p.

Webb, W. F., 1979, Precambrian geology and ore deposits near Poland Junction, Yavapai County, Arizona: Tucson, Un. of Arizona, unpublished M.S. thesis, 113 p.

Name of site: Lone Pine mine County: Yavapai Quadrangle: Mayer
 Commodities: Cu, Pb, Zn, Au, Ag
 Nature of site: Underground workings & prospects
 Exposure: A chloritic alteration zone is exposed in outcrops.
 Production: Incomplete records from 1907-1957 indicate that 2,763 tons of ore were produced. The ore averaged 5.35% copper, 0.20 oz/ton gold, and 3.16 oz/ton silver (Anderson and Blacet, 1972).

Ore minerals: Chalcopyrite, sphalerite, galena, and auriferous pyrite
 Gangue: Gangue minerals include quartz, pyrite, chlorite, and ankerite.
 Alteration: Alteration consists of intense Mg-rich chloritization, minor to moderate silicification, and carbonitization(?).
 Metamorphic grade: Upper greenschist facies. Some hornblende hornfels adjacent to stock of Larsmide age.

Unit name: Upper part of the Iron King Volcanics of the Big Bug Group, Yavapai Series.
 Lithology: The sulfide body overlies rhyolitic tuff and tuff breccia.
 Age: Age is about 1.75 Ga as determined by Anderson and others (1971).
 Volcanism: Felsic pyroclastics.
 Sedimentary rocks: Associated sedimentary rocks include ferruginous chert which overlies the sulfide body.

Ore types: Massive and chloritic stringer ore.
 Ore texture: Not determined.

Structure: The occurrence is on the east limb of an overturned syncline.
 Geometry: An old mine map indicates a northerly plunging, tabular sulfide body that trends subparallel to foliation.

Comments: The Lone Pine is a proximal deposit that occurs at the stratigraphic break between felsic and mafic volcanics.

Coordinates: Latitude 34-27-56.009N Longitude 112-14-56.615W

Reporter: M. Donnelly & C. Conway Affiliation: Noranda & U.S.G.S.

References: Anderson, C. A., and Blacet, P. M., 1972, Precambrian geology of the northern Bradshaw Mountains, Yavapai County, Arizona: U.S. Geological Survey Bull. 1336, 82 p.
 Anderson, C. A., Blacet, P. M., Silver, L. T., and Stern, T. W., 1971, Revision of Precambrian stratigraphy in the Prescott-Jerome area: U.S. Geol. Survey Bull. 1324C, 15 p.
 Lindgren, Waldemar, 1926, Ore deposits of the Jerome and Bradshaw Mountains Quadrangles, Arizona: U.S. Geol. Survey Bull. 782, 192 p.
 Webb, W. F., 1979, Precambrian geology and ore deposits near Poland Junction, Yavapai County, Arizona: Tucson, Un. of Arizona, unpublished M.S. thesis, 113 p.

Name of site: Boggs mine County: Yavapai Quadrangle: Poland Junction
 Commodities: Cu, Zn, Au, Ag
 Nature of site: Inaccessible workings, pits-trenches
 Exposure: Limonite-stained rhyolite outcrops.
 Production: During 1943-1945, 98 tons of ore were produced. The ore averaged 0.45 oz/ton gold, 5.2 oz/ton silver, 1.07% copper, and 4.3% zinc.

Ore minerals: Chalcopyrite, sphalerite, and gold in pyrite
 Gangue: Gangue minerals include pyrite, quartz, chlorite, arsenopyrite, ankerite, sericite, garnet, epidote, and amphibole.
 Alteration: Alteration mineralogy has not been determined.
 Metamorphic grade: Upper greenschist to lower amphibolite facies; contact hornfels developed locally.

Unit name: Upper part of the Iron King Volcanics of the Big Bug Group, Yavapai Series.
 Lithology: The host rocks are rhyolitic crystal tuffs from near the stratigraphic break between felsic and mafic volcanic rocks.
 Age: The age of the host rocks is about 1.75 b.y. as determined by Anderson and others (1971).
 Volcanism: Rhyolitic pyroclastic volcanism.

Sedimentary rocks: Associated sedimentary rocks include ferruginous chert.

Ore types: Massive and semi-massive.
 Ore texture: Ore texture has not been determined.

Structure: Deposit is included in isoclinally folded rocks in the east limb of an overturned syncline.
 Geometry: The occurrence consists of a tabular body 0.25 to 1 meter thick that strikes N20E and dips steeply NW.

Comments: The Boggs mine is about 1.8 km south of the Lone Pine mine and occurs at the same stratigraphic position. It contains bourninite ($PbCuSbS_3$), a mineral rarely found in massive sulfide deposits.

Coordinates: Latitude 34-27-02.437N Longitude 112-15-16.175W

Reporter: M. Donnelly & C. Conway Affiliation: Noranda & U.S.G.S.

References: Anderson, C. A., and Blacet, P. M., 1972, Precambrian geology of the northern Bradshaw Mountains, Yavapai County, Arizona: U.S. Geological Survey Bull. 1336, 82 p.

Anderson, C. A., Blacet, P. M., Silver, L. T., and Stern, T. W., 1971, Revision of Precambrian stratigraphy in the Prescott-Jerome area: U.S. Geol. Survey Bull. 1324C, 15 p.

Lindgren, Waldemar, 1926, Ore deposits of the Jerome and Bradshaw Mountains Quadrangles, Arizona: U.S. Geol. Survey Bull. 782, 192 p.

Webb, W. F., 1979, Precambrian geology and ore deposits near Poland Junction, Yavapai County, Arizona: Tucson, Un. of Arizona, unpublished M.S. thesis, 113 p.

Name of site: Butternut mine County: Yavapai Quadrangle: Poland Junction
 Commodities: Au, Ag, Cu, Zn
 Nature of site: Prospect and inaccessible shaft
 Exposure: Limonite-stained outcrops of rhyolite tuff.
 Production: Early unrecorded production amounted to about 800 tons of ore that contained 6.4% Cu, 2.74 oz/ton Ag, and 0.17 oz/ton Au. Ore was primarily from the oxidized part of the occurrence.

Ore minerals: Chalcopyrite and sphalerite
 Gangue: Gangue minerals include pyrite, quartz, chlorite, ankerite, sericite and arsenopyrite.
 Alteration: Alteration consists of sericitization and weak chloritization.
 Metamorphic grade: Greenschist to amphibolite facies; hornfels developed locally near Laramide intrusive.

Unit name: Iron King Volcanics of the Big Bug Group, Yavapai Series.
 Lithology: Host rocks are felsic tuffs and/or tuffaceous metasediments within a dominantly andesite-basalt sequence.
 Age: Age of the host rocks is about 1.75 Ga as determined by Anderson and others (1971).
 Volcanism: Felsic tuffaceous.
 Sedimentary rocks: Associated sedimentary rocks include small lenses of ferruginous chert.

Ore types: Massive and semi-massive.
 Ore texture: Ore texture is fine grained and locally banded.

Structure: The deposit is in isoclinally folded volcanic strata on the west limb of an overturned anticline, and on the east limb of a regional synform.
 Geometry: The size and shape of the deposit are not well known.

Comments: None.

Coordinates: Latitude 34-26-34.026N Longitude 112-17-00.770W

Reporter: M. Donnelly & C. Conway Affiliation: Noranda & U.S.G.S.

References: Anderson, C. A., and Blacet, P. M., 1972, Precambrian geology of the northern Bradshaw Mountains, Yavapai County, Arizona: U.S. Geological Survey Bull. 1336, 82 p.

Anderson, C. A., Blacet, P. M., Silver, L. T., and Stern, T. W., 1971, Revision of Precambrian stratigraphy in the Prescott-Jerome area: U.S. Geol. Survey Bull. 1324C, 15 p.

Lindgren, Waldemar, 1926, Ore deposits of the Jerome and Bradshaw Mountains Quadrangles, Arizona: U.S. Geol. Survey Bull. 782, 192 p.

Webb, W. F., 1979, Precambrian geology and ore deposits near Poland Junction, Yavapai County, Arizona: Tucson, Un. of Arizona, unpublished M.S. thesis, 113 p.

Name of site: Iron Queen mine County: Yavapai Quadrangle: Poland Junction
 Commodities: Zn, Cu, Au, Ag
 Nature of site: Inaccessible underground workings
 Exposure: Not determined.
 Production: Small unrecorded production. Grade was reported to be 0.025 oz/ton gold, 1.0 oz/ton silver and 2.0 to 2.75% copper.

Ore minerals: Chalcopyrite, sphalerite
 Gangue: Gangue minerals include pyrite, quartz, specularite, marcasite, calcite, epidote, actinolite, and magnetite.

Alteration: Alteration consists principally of silicification.

Metamorphic grade: Greenschist to amphibolite facies; hornfels developed locally near Laramide intrusive.

Unit name: Upper part of the Iron King Volcanics of the Big Bug Group, Yavapai Series.
 Lithology: The host rocks are felsic tuffs, phyllites, and tuffaceous metasediments.
 Age: Age of the host rocks was determined to be about 1.75 Ga (Anderson and others, 1971).
 Volcanism: Felsic tuffaceous.
 Sedimentary rocks: Associated sedimentary rocks include chert.

Ore types: Massive and siliceous semi-massive.
 Ore texture: Ore texture not determined.

Structure: The occurrence is in isoclinally folded volcanic strata on the east limb of an overturned syncline.
 Geometry: The size and shape of the deposit have not been determined.

Comments: None.

Coordinates: Latitude 34-26-38.152N Longitude 112-15-27.373W

Reporter: M. Donnelly & C. Conway Affiliation: Noranda & U.S.G.S.

References: Anderson, C. A., and Blacet, P. M., 1972, Precambrian geology of the northern Bradshaw Mountains, Yavapai County, Arizona: U.S. Geological Survey Bull. 1336, 82 p.

Anderson, C. A., Blacet, P. M., Silver, L. T., and Stern, T. W., 1971, Revision of Precambrian stratigraphy in the Prescott-Jerome area: U.S. Geol. Survey Bull. 1324C, 15 p.

Lindgren, Waldemar, 1926, Ore deposits of the Jerome and Bradshaw Mountains Quadrangles, Arizona: U.S. Geol. Survey Bull. 782, 192 p.

Webb, W. F., 1979, Precambrian geology and ore deposits near Poland Junction, Yavapai County, Arizona: Tucson, Un. of Arizona, unpublished M.S. thesis, 113 p.

Name of site: Hackberry mine County: Yavapai Quadrangle: Poland Junction
 Commodities: Cu, Pb, Zn, Au, Ag
 Nature of site: Inaccessible workings
 Exposure: Three of five sulfide lenses are exposed in outcrop.
 Production: Stope volumes suggest that at least 20,000 tons of ore was mined. Between 1943 and 1945, 13,000 tons were shipped; the average grade was 0.113 oz/ton gold, 5.18 oz/ton silver, 2% copper, 3.5% lead, and 9% zinc.

Ore minerals: Chalcopyrite, galena, sphalerite, and tetrahedrite
 Gangue: Gangue minerals include quartz, ankerite, pyrite, chlorite, and sericite.
 Alteration: Alteration consists of sericitization and Mg-rich chloritization.
 Metamorphic grade: Greenschist facies; mineralogy includes albite, chlorite, actinolite, epidote, and clinozoisite.

Unit name: Upper part of the Iron King Volcanics of the Big Bug Group, Yavapai Series.
 Lithology: The host rock is fine-grained rhyolite tuff that is a part of an andesite-rhyolite tuff sequence.
 Age: The age of the host rocks is about 1.75 Ga as determined by Anderson and others (1971).
 Volcanism: Felsic tuffaceous.
 Sedimentary rocks: Associated sedimentary rocks have not been determined.

Ore types: Massive and siliceous semi-massive. The ore is typically highly siliceous.
 Ore texture: Ore texture has not been determined.

Structure: The occurrence is in isoclinally folded volcanic rocks in the trough of a regional syncline.
 Geometry: Five overlapping sulfide lenses strike NE and dip steeply NW. The sulfide bodies are from 18 to 42 meters long and are an average of 1.8 meters wide. The lenses plunge steeply NE.

Comments: None.

Coordinates: Latitude 34-24-55.518N Longitude 112-16-20.951W

Reporter: M. Donnelly & C. Conway Affiliation: Noranda & U.S.G.S.

References: Anderson, C. A., and Blacet, P. M., 1972, Precambrian geology of the northern Bradshaw Mountains, Yavapai County, Arizona: U.S. Geological Survey Bull. 1336, 82 p.

Anderson, C. A., Blacet, P. M., Silver, L. T., and Stern, T. W., 1971, Revision of Precambrian stratigraphy in the Prescott-Jerome area: U.S. Geol. Survey Bull. 1324C, 15 p.

Lindgren, Waldemar, 1926, Ore deposits of the Jerome and Bradshaw Mountains Quadrangles, Arizona: U.S. Geol. Survey Bull. 782, 192 p.

Webb, W. F., 1979, Precambrian geology and ore deposits near Poland Junction, Yavapai County, Arizona: Tucson, Un. of Arizona, unpublished M.S. thesis, 113 p.

Name of site: Bell Ranch gold prospect
 Commodities: Au
 Nature of site: Prospect and shallow shaft.
 Exposure: Not determined.
 Production: No recorded production.

County: Yavapai

Quadrangle: Mayer

Ore minerals: gold
 Gangue: Gangue minerals include pyrite, arsenopyrite, quartz, chlorite, and calcite. Goethite and montmorillonite occur in the oxidized zone.
 Alteration: Alteration includes silicification, sericitization, chloritization, and carbonatization(?).
 Metamorphic grade: Lower greenschist facies.

Unit name: Iron King Volcanics of the Big Bug Group, Yavapai Series.

Lithology: The host rocks for massive sulfide lenses are quartz-chlorite and quartz-sericite schists that are inferred to represent cherty rhyolite tuff and metagraywacke. The gold occurs principally in sulfide-facies iron formation.

Age: The age of the host rocks is about 1.75 Ga as determined by Anderson and others (1971).

Volcanism: Calc-alkalic volcanism (Swan and others, 1981). A white rhyolite dome with local siliceous sinter is about 1.5 km north of the prospect.

Sedimentary rocks: Associated sedimentary rocks include sulfide-, oxide-, and carbonate-facies iron formation; chert, and fine-grained clastic metasediments.

Ore types: Gold-bearing strata is chiefly sulfide-facies iron formation that contains up to 20 percent disseminated sulfides and local lenses of massive sulfides up to 30 cm thick.

Ore texture: Gold occurs chiefly as fine-grained inclusions (1 to 10 microns) in pyrite or in iron oxide pseudomorphs after pyrite.

Structure: The prospect is 2 to 3 km west of the Shylock Fault. The host rocks are locally isoclinally folded.

Geometry: The gold-bearing units are up to 100 meters thick and can be traced along strike for about 1.6 km.

Comments: The Bell Ranch gold prospect occurs in the distal portion of a stratigraphically asymmetrical white rhyolite dome complex. Sulfide-facies iron formation distal to the dome contains anomalous amounts of Au, Sb, As, Cu, Pb, Zn, and Ag.

Coordinates: Latitude 34-27-55.602N Longitude 112-13-11.000W

Reporter: M. Donnelly

Affiliation: Noranda

References: Anderson, C. A., and Blacet, P. M., 1972, Precambrian geology of the northern Bradshaw Mountains, Yavapai County, Arizona: U.S. Geological Survey Bull. 1336, 82 p.

Anderson, C. A., Blacet, P. M., Silver, L. T., and Stern, T. W., 1971, Revision of Precambrian stratigraphy in the Prescott-Jerome area: U.S. Geol. Survey Bull. 1324C, 15 p.

Swan, M. M., Hausen, D. M., and Newell, R. A., 1981, Lithological, structural, chemical, and mineralogical patterns in a Precambrian strataform gold occurrence, Yavapai County, Arizona: in Process Mineralogy Symposium: AIME Annual Meeting 110, Chicago, Illinois, 1981, Proceedings, Met. Soc. of AIME, p. 143-157.

Name of site: Binghampton mine County: Yavapai Quadrangle: Mayer
 Commodities: Cu, Au, Ag,
 Nature of site: Extensive workings and open-cut
 Exposure: Not determined.
 Production: Production between 1916 and 1923 was 150,000 tons that averaged 3% copper, 0.0013 oz/ton gold, and 0.22 oz/ton silver. Smelter concentrates over this period yielded 200 oz gold, 33,197 oz silver, and 4000 tons of copper. Between 1940 and 1947, 25,000 tons of high silica copper ore was produced.

Ore minerals: Chalcopyrite, azurite, malachite, tetrahedrite, auriferous pyrite
 Gangue: Gangue minerals include pyrite, quartz, dolomite, chlorite, and sericite.
 Alteration: Alteration consists of silicification, sericitization, and Mg-rich chloritization.
 Metamorphic grade: Lower greenschist facies.

Unit name: Spud Mountain volcanics of the Big Bug Group.
 Lithology: Host rocks include felsic tuff and breccia.
 Age: The age of the host rocks is about 1.75 Ga as determined by Anderson and others (1971).
 Volcanism: Basalt-andesite-(dacite) rhyolite
 Sedimentary rocks: Associated sedimentary rocks include chert and thin-bedded tuffaceous metasediments.

Ore types: Massive, siliceous semi-massive, and disseminated.
 Ore texture: Fine-grained and siliceous, locally banded.

Structure: The occurrence is within or near the Shylock Fault Zone on the east flank of a regional syncline. The volcanic strata are locally isoclinally folded.
 Geometry: Deposit consists of three oreshoots that are up to 3 m wide.
 Comments: The Copper Queen is less than 300 m southeast of the Binghampton mine. The Binghampton is a proximal deposit.

Coordinates: Latitude 34-27-21.471N Longitude 112-11-36.065W

Reporter: M. Donnelly Affiliation: Noranda

References: Anderson, C. A., and Blacet, P. M., 1972, Precambrian geology of the northern Bradshaw Mountains, Yavapai County, Arizona: U.S. Geological Survey Bull. 1336, 82 p.
 Anderson, C. A., Blacet, P. M., Silver, L. T., and Stern, T. W., 1971, Revision of Precambrian stratigraphy in the Prescott-Jerome area: U.S. Geol. Survey Bull. 1324C, 15 p.
 Brook, D. K. Jr., 1974, Relative ages of strata-form sulfide ore and wall rock determined by a structural analysis of the Copper Queen Mine, Yavapai County, Arizona: Tucson, Un. of Arizona, unpublished M.S. thesis, 60 p.
 Lindgren, Waldemar, 1926, Ore deposits of the Jerome and Bradshaw Mountains Quadrangles, Arizona: U.S. Geol. Survey Bull. 782, 192 p.

Name of site: Stoddard mine County: Yavapai Quadrangle: Mayer
Commodities: Cu
Nature of site: Inaccessible workings and pits
Exposure: Altered, leached, oxidized chlorite schist and quartz porphyry.
Production: Between 1945 and 1950, the Stoddard mine produced 14,000 tons of ore that averaged 3.82% copper.

Ore minerals: Malachite, azurite, and other copper oxide minerals
Gangue: Gangue minerals include hematite and quartz.
Alteration: Alteration includes extensive silicification and sericitization.
Metamorphic grade: Greenschist facies.

Unit name: Spud Mountain Volcanics of the Big Bug Group, Yavapai Series.
Lithology: Host rocks are intensely altered chlorite schist, chert, and schistose quartz porphyry.
Age: The age of the host rocks is about 1.75 Ga as determined by Anderson and others (1971).
Volcanism: Rhyolitic volcanism.
Sedimentary rocks: Associated sedimentary rocks include chert.

Ore types: Highly siliceous ore with copper oxide minerals.
Ore texture: Ore texture has not been determined.

Structure: Isoclinal folding on a regional scale.
Geometry: Irregular-shaped oxide orebody.

Comments: None.

Coordinates: Latitude 34-25-47.944N Longitude 112-13-46.541W

Reporter: M. Donnelly Affiliation: Noranda

References: Anderson, C. A., and Blacet, P. M., 1972, Precambrian geology of the northern Bradshaw Mountains, Yavapai County, Arizona: U.S. Geological Survey Bull. 1336, 82 p.

Anderson, C. A., Blacet, P. M., Silver, L. T., and Stern, T. W., 1971, Revision of Precambrian stratigraphy in the Prescott-Jerome area: U.S. Geol. Survey Bull. 1324C, 15 p.

Lindgren, Waldemar, 1926, Ore deposits of the Jerome and Bradshaw Mountains Quadrangles, Arizona: U.S. Geol. Survey Bull. 782, 192 p.

Name of site: Blue Bell mine County: Yavapai Quadrangle: Cleator
 Commodities: Cu, Au, Ag
 Nature of site: Extensive underground workings
 Exposure: Exposures consist of altered footwall rocks and chert lenses that are on-strike with the sulfide bodies.
 Production: The Blue Bell mine operated intermittently between 1896 and 1948 and produced more than 1 million tons of ore that graded 3.0% copper, 0.05 oz/ton gold, and 1.5 oz/ton silver.

Ore minerals: Chalcopyrite, chalcocite, bornite, native copper, copper oxides
 Gangue: Gangue minerals include pyrite, quartz, sericite, chlorite, calcite, ankerite, biotite, epidote, tremolite-actinolite, and arsenopyrite.
 Alteration: Alteration includes extensive sericitization and moderate chloritization.
 Metamorphic grade: Lower amphibolite facies.

Unit name: Iron King Volcanics of the Big Bug Group, Yavapai Series.
 Lithology: Host rocks include rhyolite tuff and crystal tuff.
 Age: The age of the host rocks is inferred to be about 1.75 Ga (Anderson and others, 1971).
 Volcanism: Bimodal, basalt-rhyolite volcanism.
 Sedimentary rocks: Associated sedimentary rocks include chert, cherty tuff, and pyritic (limonitic) chert.

Ore types: Massive and semi-massive sulfides, some chloritic stringer ore, and some high-grade oxide ore.
 Ore texture: Fine-grained and locally banded.

Structure: Steep, westerly dipping volcanic sequence that is locally deformed into steeply plunging isoclinal folds.
 Geometry: The orebody consisted of 6 sulfide lenses as much as 12 meters thick. The lenses strike N22E and dip 70 degrees west.

Comments: The mine was developed to the 1,570 foot level. On the 800 foot level, the sulfide bodies had an average thickness of 3.6 meters. The six lenses that make up the ore deposit are included in a zone 70 meters wide and 520 meters long.

Coordinates: Latitude 34-20-22.281N Longitude 112-14-25.505W

Reporter: M. Donnelly Affiliation: Noranda

References: Anderson, C. A., 1972, Precambrian rocks in the Cordes area, Yavapai County, Arizona: U.S. Geol. Survey Bull. 1345, 136 p.
 Anderson, C. A., Blacet, P. M., Silver, L. T., and Stern, T. W., 1971, Revision of Precambrian stratigraphy in the Prescott-Jerome area: U.S. Geol. Survey Bull. 1324C, 15 p.
 DeWitt, E. H., 1976, Precambrian geology and ore deposits of the Mayer-Crown King area, Yavapai County, Arizona: Tucson, Un. of Arizona, unpublished M.S. thesis, 150 p.
 Lindgren, Waldemar, 1926, Ore deposits of the Jerome and Bradshaw Mountains Quadrangles, Arizona: U.S. Geol. Survey Bull. 782, 192 p.

Name of site: De Soto mine County: Yavapai Quadrangle: Battleflat
 Commodities: Cu, Au, Ag
 Nature of site: Underground workings and numerous pits
 Exposure: The chloritically altered and mineralized footwall rocks are exposed.
 Production: From 1890 to about 1930, 180,000 tons of ore were produced that graded 3.75% copper, 0.02 oz/ton gold, and 1.0 oz/ton silver.

Ore minerals: Chalcopyrite, bornite, malachite, and azurite
 Gangue: Gangue minerals include quartz, chlorite, pyrite, carbonate minerals, sericite, biotite, epidote, tremolite-actinolite, and arsenopyrite.
 Alteration: Alteration includes chloritization and sericitization.
 Metamorphic grade: Lower amphibolite facies.

Unit name: On a projection of the Iron King Volcanics of the Big Bug Group according to Anderson (1972). Structure and stratigraphic correlations are questioned by DeWitt (1976) and by O'Hara (1980).
 Lithology: Host rocks are rhyolite flow rocks and coarse pyroclastics, including felsic tuffs.
 Age: Age of host rocks is inferred to be between 1.770 and 1.775 Ma.
 Volcanism: Bimodal, basalt-rhyolite.
 Sedimentary rocks: Associated sedimentary rocks include chert and oxide-facies iron formation.

Ore types: Mostly chloritic stringer ore. Some massive and semi-massive sulfides.
 Ore texture: Fine-grained and compositionally banded. The massive sulfides are locally recrystallized, foliated, and sheared.

Structure: Isoclinally folded volcanic strata strike N23E and dip 70 degrees NW in the mine area. The regional structural setting is uncertain.
 Geometry: The East orebody consisted of seven overlapping sulfide lenses. The dip length was 3 to 7 times greater than the strike length. Oreshoots had a maximum width of 15 meters and plunged 65 to 80 degrees southwest.

Comments: The two massive sulfide zones, the East zone and the West zone, are separated by rhyolite and rhyolite breccia. The more productive East zone occurs at or near the base of a felsic pile. The felsic pile overlies basaltic rocks.

Coordinates: Latitude 34-17-10.672N Longitude 112-17-21.202W

Reporter: M. Donnelly Affiliation: Noranda

References: Anderson, C. A., 1972, Precambrian rocks in the Cordes area, Yavapai County, Arizona: U.S. Geol. Survey Bull. 1345, 136 p.

DeWitt, E. H., 1976, Precambrian geology and ore deposits of the Mayer-Crown King area, Yavapai County, Arizona: Tucson, Un. of Arizona, unpublished M.S. thesis, 150 p.

DeWitt, E. H., 1979, New data concerning Proterozoic volcanic stratigraphy and structure in central Arizona and its importance in massive sulfide exploration: Econ. Geol., v. 74, p. 1371-1382.

Lindgren, Waldemar, 1926, Ore deposits of the Jerome and Bradshaw Mountains Quadrangles, Arizona: U.S. Geol. Survey Bull. 782, 192 p.

O'Hara, P. F., 1980, Metamorphic and structural geology of the northern Bradshaw Mountains, Yavapai County, Arizona: Arizona State Un., unpublished Ph.D. thesis, 117 p.

Name of site: Kay mine County: Yavapai Quadrangle: Black Canyon City
 Commodities: Cu, Zn, Au, Ag
 Nature of site: Extensive underground workings
 Exposure: Exposure at the surface consists of a siliceous gossan.
 Production: From about 1900 to 1916, about 700 tons of ore was produced. Records show that 470 tons contained an average of 9.1% copper, 1.06 oz/ton silver, and 0.072 oz/ton gold. In 1949, production was 1,571 tons that averaged 5.67% copper, 0.98 oz/ton silver, and 0.059 oz/ton gold. Proven reserves in 1921 were 296,000 tons of ore (Lindgren, 1926).

Ore minerals: Chalcopyrite, sphalerite, and tetrahedrite
 Gangue: Gangue minerals include quartz, pyrite, arsenopyrite, sericite, and chlorite.
 Alteration: Alteration minerals include sericite, and black, Mg-rich chlorite.
 Metamorphic grade: Greenschist facies.

Unit name: In volcanics that may be correlatable with the Spud Mountain Volcanics of the Big Bug Group, Yavapai Series.
 Lithology: The host rocks include fine-grained felsic tuff and tuff breccia.
 Age: The age of the host rocks is inferred to be about 1.75 Ga.

Volcanism: Felsic pyroclastic volcanism.
 Sedimentary rocks: Associated sedimentary rocks include siliceous carbonate units.

Ore types: Massive and semi-massive sulfide ore, copper-rich stringer ore, and siliceous tetrahedrite ore.
 Ore texture: Massive sulfide ore, locally banded.

Structure: The occurrence is in isoclinally folded volcanic strata that were strongly deformed by passive-slip style deformation.
 Geometry: Cigar-shaped, steeply plunging, westerly dipping sulfide body.

Comments: The Kay mine is a proximal deposit.

Coordinates: Latitude 34-03-37.000N Longitude 112-09-35.000W

Reporter: M. Donnelly Affiliation: Noranda

References: Jerome, S. C., 1956, Reconnaissance geologic study of the Black Canyon schist belt, Bradshaw Mountains, Yavapai and Maricopa Counties, Arizona: Un. of Utah, Ph.D. dissertation, 192 p.
 Lindgren, Waldemar, 1926, Ore deposits of the Jerome and Bradshaw Mountains Quadrangles, Arizona: U.S. Geol. Survey Bull. 782, 192 p.

Name of site: Orizaba mine
 County: Maricopa
 Commodities: Zn, Cu, Au, Ag
 Quadrangle: Squaw Creek Mesa
 Nature of site: Inactive mine, pits, and trenches.
 Exposure: Oxidized copper minerals in volcanic-sedimentary rocks exposed in prospects.
 Production: About 40,000 tons of ore that averaged about 4% copper was produced during the 1940s. The last reported shipment during this period contained 14,580 tons that averaged 4.03% copper, 0.004 oz/ton gold, 0.09 oz/ton silver, and 34% SiO₂.

Ore minerals: Chalcopyrite, and sphalerite
 Gangue: Gangue minerals include pyrite, quartz, chlorite, calcite, limonite, and graphite.
 Alteration: Alteration consists of chloritization and sericitization.
 Metamorphic grade: Upper greenschist facies.

Unit name: Proterozoic undivided.
 Lithology: Host rocks are chlorite- and carbonate-rich phyllites that are intercalated with lesser amounts of andesitic and rhyolitic flow rocks.
 Age: The age of the host rocks is inferred to be about 1.7 Ga.
 Volcanism: Andesitic-rhyolitic volcanism.
 Sedimentary rocks: Associated sedimentary rocks include phyllite, fine-grained, laminated graywacke, and numerous thin, interbedded chert and banded-iron formation units.

Ore types: Massive and semi-massive sulfides.
 Ore texture: Fine-grained massive to finely banded.

Structure: The occurrence is in volcanic-sedimentary strata that are isoclinally folded; minor faulting locally.
 Geometry: Irregular sulfide body with the thickest part along the crest of a fold that trends N35W and plunges 60 NW.

Comments: The Orizaba may be a distal deposit.

Coordinates: Latitude 34-00-33.000N Longitude 112-04-50.000W

Reporter: M. Donnelly Affiliation: Noranda

Name of site: Gray's Gulch prospects
 Commodities: Cu, Zn
 Nature of site: Prospect pits
 Exposure: Mineralized outcrops.
 Production: No production.

County: Maricopa

Quadrangle: New River Mesa

Ore minerals: Chalcopyrite and sphalerite
 Gangue: Gangue minerals include pyrite, quartz, and chlorite.
 Alteration: Type of alteration not determined.
 Metamorphic grade: Greenschist facies.

Unit name: Proterozoic undivided.

Lithology: Host rocks include coarse- to fine-grained rhyolitic pyroclastics, felsic wackes, volcanoclastic metasediments, and slate.

Age: Age of the host rocks is inferred to be between 1.71 and 1.75 Ga.

Volcanism: Basalt-andesite-(dacite) rhyolite sequence showing a tholeiitic to calc-alkaline differentiation sequence.

Sedimentary rocks: Associated sedimentary rocks include carbonate- and oxide-facies iron formation and chert.

Ore types: Massive sulfides.

Ore texture: Fine-grained, compositionally banded, locally siliceous.

Structure: Northeast-trending isoclinal folds.

Geometry: Steeply dipping, tabular sulfide body.

Comments: Anderson and Guilbert (1979) consider the Gray's Gulch prospect to be a proximal occurrence.

Coordinates: Latitude 33-59-21.800N Longitude 111-55-50.654W

Reporter: M. Donnelly

Affiliation: Noranda

References: Anderson, P., and Guilbert, J. M., 1979, The Precambrian massive sulfides of Arizona-- a distinct metallogenic epoch and province: Papers on mineral deposits of western North America: Nev. Bureau of Mines and Geol., Rept. 33, p. 39-48.

Name of site: Bronco Creek mine County: Maricopa Quadrangle: Humbolt Mountain
Commodities: Cu, Zn, Au, Pb, Ag
Nature of site: Shallow shaft, workings, and prospects
Exposure: Not determined.
Production: Ten thousand tons mined prior to World War II contained 2.5% copper and 0.16 oz/ton gold.

Ore minerals: Chalcopyrite, sphalerite, and galena
Gangue: Gangue minerals include quartz, chlorite, pyrite, pyrrhotite, carbonate minerals, arsenopyrite, and magnetite.
Alteration: Weak chloritic and sericitic alteration in the footwall.
Metamorphic grade: Greenschist facies.

Unit name: Proterozoic undivided.
Lithology: Sulfide zone occurs at the contacts between felsic crystal tuff, cherty tuff, fine-grained tuff, and a thin sequence of coarse felsic breccia.
Age: Age of the host rocks is inferred to be between 1.71 and 1.77 Ga.
Volcanism: Felsic tuffaceous.
Sedimentary rocks: Associated sedimentary rocks include phyllite, argillite, and minor ferruginous chert.

Ore types: Massive and semi-massive.
Ore texture: Irregular bands of sulfides suspended in fine-grained cherty matrix. Bands are 1 to 3 cm wide.

Structure: The occurrence is in a window of Precambrian rocks that form a steeply dipping, thick, homoclinal sequence that strikes N75W.
Geometry: Tabular pod, reported to be about 0.7 meters wide where exposed in shallow workings.

Comments: The Bronco Creek mine is a proximal occurrence.

Coordinates: Latitude 33-56-48.000N Longitude 111-51-44.000W

Reporter: M. Donnelly Affiliation: Noranda

Name of site: Ernie's Tank County: Gila Quadrangle: Sheep Basin Mountain
 Commodities: Cu, Pb, Zn
 Nature of site: Two caved shafts and an adit
 Exposure: Thin carbonate-bearing gossan lenses are exposed along the contact between rhyolite and phyllite.
 Production: Minor but unknown amount of production.

Ore minerals: Chalcopyrite, galena, sphalerite
 Gangue: Gangue minerals include calcite, quartz, and pyrite.
 Alteration: Alteration consists of sericitization and local chloritization.
 Metamorphic grade: Greenschist facies.

Unit name: Pre-Alder rocks of Gastil (1953).
 Lithology: Quartz-sericite schist (metarhyolite tuff), gray to purple phyllite and slate, mafic volcanic rocks, and siliceous carbonate-rich exhalites.
 Age: Age of the occurrence is inferred to be between 1.71 and 1.77 Ga.
 Volcanism: Sulfides are associated with rhyolitic pyroclastic volcanism.
 Sedimentary rocks: Metagrawacke, felsic tuff, quartzite, and cherty exhalite.

Ore types: Minor lenses of semi-massive sulfides.

Ore texture: Ore texture not determined.

Structure: Complex regional isoclinal folds and open folds.
 Geometry: Small lenticular deposits are suggested from outcrops. Subsurface dimensions and shape are unknown.

Comments:

Coordinates: Latitude 34-03-17.749N Longitude 111-12-07.176W

Reporter: C. Conway, & M. Donnelly Affiliation: U.S.G.S. & Noranda

References: Conway, C. M., 1976, Petrology, structure, and evolution of a Precambrian volcanic and plutonic complex, Tonto Basin, Gila County, Arizona: California Institute of Technology, Ph.D. Dissertation, 460 p.

Gastil, G., 1958, Older Precambrian rocks of the Diamond Butte Quadrangle, Gila County, Arizona: Geol. Soc. Am. Bull., v. 69, 19 p.

