Geology of Gold in Southeastern Arizona

By Jan C. Rasmussen, Ph.D., R.G.

www.JanRasmussen.com

Greaterville ~1-2”
Gold photos from displays at the
Arizona Mining and Mineral Museum, Phoenix, 2010
With Thanks to the gold prospectors group in Phoenix

Monday Crew at the Arizona Mining and Mineral Museum, Phoenix, 2010

Still active in 2018

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Safety Share

Dangers: Snakes, Scorpions, Cacti, Illegal Aliens, Drug Smugglers, Mine Owners who shoot trespassers

Check Land ownership – Make sure you are not trespassing on someone else’s mining claim, Indian Reservation, or Military Gunnery Range

Jan Rasmussen, Ph.D.
February 17, 2018
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Mining districts in Cochise, Pima, and Santa Cruz counties with gold production, Placer gold specimens, Lode gold specimens, and production from copper or silver mines
Arizona Geological Survey:
AZGS Document Repository = http://repository.azgs.az.gov
Bulletins 137=Lode Gold; 168=Placer Gold
Bulletins 187=Cochise; 189=Pima; 191=Santa Cruz
Production information=Bull. 194
MinDat.org = https://www.mindat.org

Santa Rita Mts
Greaterville District
- Argonaut placer group
- Arrastra Mine
Box Canyon
- Unnamed prospects
- Colchis placer group
Greaterville
- Buckhorn Mine (Wisconsin Mine)
- Greaterville placer deposits
- Boston Gulch
- Chispa Gulch
Empire Ranch area
- Colorado Gulch
- Succor Gulch (Sucker Gulch)
- Fulton Mine (Fulton claim)
- Graham Gulch
- Harshaw Gulch
- Unnamed prospects
- Hughes Gulch
- St. Louis Gulch
- St. Louis Mine (Morning Star Mine; Isabel)
- Yuba Mine (Inghram Mine)
- Kentucky Gulch
- Los Pozos Gulch
- Louisiana Gulch

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Hydrothermal deposits

Ore and silicate minerals deposited by hot magmatic fluids in cracks in surrounding rocks.

Cooling magma.
Hydrothermal Ore Deposits

A

1 Kilometer

Ore
Pluton

B

1 Kilometer

Hydrothermal veins
Pluton

C

1 Kilometer

Disseminated ore
Pluton

D

1 Kilometer

Sea level
Hot spring
Ore
Oceanic crust
Gold- and Silver-rich Mineral Deposits

Veins from hot water

Veins in metamorphic rocks

Gold in gravel

Gold-bearing conglomerates

Low-grade gold deposits

By-product gold
Gold in Quartz Veins

Courtland-Gleeson-Pearce – quartz vein

Quartz – hardness =7 – resists erosion

Visible Gold in drill core

Billali Mine, New Mexico, Steeple Rock district
Dikes or Veins on Geologic Maps

Look on the legend for quartz vein or dikes

Find veins, dikes, or mine symbols on geologic map
Gold (heavy) is deposited wherever stream slowed down and could not carry the gravel, magnetite (black sand), or gold.
By-product Gold
Porphyry Copper Mines, Lead-Zinc-Silver Mines

Lavender Pit at Bisbee (Warren district)
Largest Gold Producer in Arizona (to 1981)
Porphyry Copper Mines

Early production of copper had gold and silver as a by-product of smelting. Current copper leaching does not recover the gold or silver or other metals.
Laramide porphyry copper (65-55 Ma)

<table>
<thead>
<tr>
<th>Orogeny</th>
<th>Orogenic Phase</th>
<th>Age (Ma)</th>
<th>Age (period)</th>
<th>Arizona Magmatism</th>
<th>Alkalinity</th>
<th>Resources</th>
<th>Mining districts</th>
</tr>
</thead>
<tbody>
<tr>
<td>Laramide</td>
<td>Middle (Morenci)</td>
<td>65-55</td>
<td>Cretaceous-Tertiary</td>
<td>granodiorite - quartz monzonite porphyry stocks, NE to ENE-striking dike swarms</td>
<td>Metaluminous Calc-alkalic</td>
<td>large disseminated porphyry Cu systems, local skarns &amp; veins, fringing Zn-Pb-Ag</td>
<td>Ajo, Ray, Christmas, San Manuel, Mineral Park, Pima, Bagdad, Silver Bell, Globe-Miami, Morenci, Superior</td>
</tr>
</tbody>
</table>

Ray mine

Ray shovel, haul truck
Dave Briggs photos
Mining Districts in most mountain ranges in Cochise, Pima, and Santa Cruz Counties

Mining district maps for 4th edition of Mineralogy of Arizona (in progress for publication in early 2020)

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Gold In Cochise, Pima, and Santa Cruz Counties

Mining Districts with Gold Production (usually as by-product), and Placer gold or Lode gold specimens
Gold in Cochise County

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February 17, 2018
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# Gold in Cochise County

<table>
<thead>
<tr>
<th>Placer</th>
<th>Lode</th>
<th>Production</th>
</tr>
</thead>
<tbody>
<tr>
<td>Dos Cabeza Mts.-Teviston</td>
<td>Dos Cabeza Mts.</td>
<td>Mascot</td>
</tr>
<tr>
<td>Huachuca Mts.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Bisbee (Gold Gulch)</td>
<td>Bisbee (Warren)</td>
<td></td>
</tr>
<tr>
<td>Gleeson</td>
<td>Gleeson</td>
<td></td>
</tr>
<tr>
<td>Pearce</td>
<td>Courtland</td>
<td></td>
</tr>
<tr>
<td>Golden Rule</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Tombstone</td>
<td>Tombstone</td>
<td></td>
</tr>
</tbody>
</table>

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Placer Gold in Dos Cabeza Mts.

Teviston - Dos Cabezas/ Silver Camp – Derived from northern foot of Dos Cabezas Mountains in granite and dike rocks in pediment
Small quantities from dry placering in gulches – coarser near mountains, fine-grained away from mountains

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Placer Gold in Cochise County

Huachuca Placers
Ash Canyon. SE Huachuca Mts, SW of Hereford
Placer gravels for 3 mi. elev. 6500-5000 ft at bedrock, flakes to rounded nuggets ¼ in in diameter

Gold Gulch Placer Bisbee area
4 mi SE of Bisbee derived from Glance Congl. Concentrated in sand and gravel of present arroyo not economic

Gleeson Placers
1 ¾ mi E of post office. Thin mantle of gravel and soil on gullied pediment of limestone; at base of soil, small speck to nuggets. Associated with black sand, hematite, oxidized copper, native silver, galena, oxidized lead minerals

Pearce Placer
E and W margins of Pearce Hill, derived by weathering of quartz veing in Pearce Hill. In Mn-stained sugary quartz with cerargyrite, embolite, and free gold.
<table>
<thead>
<tr>
<th>District</th>
<th>type of gold</th>
<th>Period</th>
<th>Age (Million Years)</th>
<th>Au oz to 1981</th>
</tr>
</thead>
<tbody>
<tr>
<td>Courtland</td>
<td>by-product</td>
<td>Middle Jurassic</td>
<td>150</td>
<td>18,200</td>
</tr>
<tr>
<td>Gleeson</td>
<td>by-product</td>
<td>Late Cretaceous</td>
<td>75</td>
<td>Included above</td>
</tr>
<tr>
<td>Gold Gulch/Gold Hill</td>
<td>by-product</td>
<td>Middle Cretaceous</td>
<td>100 ?</td>
<td>1,600</td>
</tr>
<tr>
<td>Golden Rule</td>
<td>by-product</td>
<td>Middle Cretaceous</td>
<td>100</td>
<td>10,400</td>
</tr>
<tr>
<td>Pearce</td>
<td>by-product</td>
<td>Early Miocene</td>
<td>22</td>
<td>81,000</td>
</tr>
<tr>
<td>Silver Camp</td>
<td>by-product</td>
<td>Paleocene</td>
<td>65</td>
<td>600</td>
</tr>
<tr>
<td>Tombstone</td>
<td>by-product</td>
<td>Late Cretaceous</td>
<td>75</td>
<td>131,600</td>
</tr>
<tr>
<td>Warren (Bisbee)</td>
<td>by-product</td>
<td>Middle Jurassic</td>
<td>190</td>
<td>2,700,000</td>
</tr>
<tr>
<td>Huachuca/Hartford</td>
<td>lode</td>
<td>Early Eocene</td>
<td>50</td>
<td>400</td>
</tr>
<tr>
<td>Mascot</td>
<td>lode</td>
<td>Paleocene</td>
<td>65</td>
<td>13,400</td>
</tr>
<tr>
<td>Teviston</td>
<td>placer</td>
<td>Paleocene</td>
<td>65</td>
<td>740</td>
</tr>
</tbody>
</table>
By-Product Gold in Cochise County

Tombstone – MAC-IK 131,600 oz to 1981

Tombstone Hills (Google Earth)
After the first silver strike, Schieffelin found two more rich silver claims, which he registered as the “Lucky Cuss” and the “Toughnut.” Word spread that silver had been discovered, and other prospectors began to search the area. Before long, more mines began to open, including the Grand Central, the Charleston, and the Contention Mines, and a mining camp was born named after Ed’s first claim—Tombstone. (Don Taylor.)
By-Product Gold in Bisbee

- Bisbee – Metaluminous Quartz Alkalic - middle Jurassic (~150 Ma)
- 2,700,000 oz to 1981
- Largest Gold Producer in Arizona

Photo from Dick Graeme: gold, as massive material in a hematite-rich silica breccia. Shattuck mine. specimen 10.3 cm. U.S. Museum of Natural History collection. Richard Graeme III photo.
## Gold Production in Pima County

<table>
<thead>
<tr>
<th>Placer</th>
<th>Lode</th>
<th>By-Product</th>
<th>Production (Au ounces)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Greaterville</td>
<td>Greaterville</td>
<td>Greaterville</td>
<td>324</td>
</tr>
<tr>
<td>Canada del Oro/Old Hat, Marble Peak</td>
<td></td>
<td></td>
<td>260</td>
</tr>
<tr>
<td>Quijotoa</td>
<td>Quijotoa</td>
<td>Quijotoa</td>
<td>1,450</td>
</tr>
<tr>
<td>Las Guijas – Arivaca</td>
<td></td>
<td></td>
<td>520</td>
</tr>
<tr>
<td>Baboquivvari</td>
<td>Baboquivvari</td>
<td>Baboquivvari</td>
<td>11,300</td>
</tr>
<tr>
<td>Cababi</td>
<td>Cababi</td>
<td></td>
<td>3,000</td>
</tr>
<tr>
<td>Old Baldy</td>
<td></td>
<td></td>
<td>1</td>
</tr>
<tr>
<td>Papago (Sierrita Mts.)</td>
<td></td>
<td></td>
<td>115</td>
</tr>
<tr>
<td>Ajo</td>
<td></td>
<td></td>
<td>1,562,000</td>
</tr>
<tr>
<td>Pima</td>
<td></td>
<td></td>
<td>20,222</td>
</tr>
<tr>
<td>Silver Bell</td>
<td></td>
<td></td>
<td>2,000</td>
</tr>
</tbody>
</table>
Placer Gold in Canada del Oro

Canada del Oro? – Santa Catalina Mountains

Gold in quartz
Santa Catalina Mts.

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Placer Gold in Papago district

Sierrita Mountains – Papago district
Las Guijas or Arivaca
Pits or shallow shafts sunk to bedrock and a few inches of richer material is
gathered and treated in dry-washers or rockers after rains
San Luis Canyon midway between Arivaca and Buenos Aires placers on inter-
arroyo benches of dissected pediment of sedimentary and volcanic rocks. Gold as
fairly coarse, angular fragments. Gold-bearing veins were original source of
placers; NE side of mountains along Las Guijas Creek. Gulches around Arivaca.
Duzrano, Pisquero, Yaqui, and Sangose are most noted gulches
Mesa gravels contain gold scattered through maximum thickness of 15 to 20 ft.
Highest values at bedrock or at clay-cemented false bedrock. Gold rather finely
divided.
Placer Gold at Greaterville – Santa Rita Mountains

Greaterville – MCA-P - 324 oz to 1981

From AZGS Bull. Placer Gold in Arizona
Placer Gold at Greaterville

Greaterville – MCA-P 324 oz to 1981
Greaterville production 1875-1880;
Productive gulches = Kentucky, Boston, Harshaw, Sucker, Graham, Louisiana, Hughes, Ophir, and Empire Gulches, Nigger and St. Louis gulches, Los Pozos Gulch, Colorado Gulch, Chispa Gulch.
Hydraulic operations - with clay, so dry washing not very practicable;
Gold-bearing quartz vein source;
Upturned, irregularly eroded ridges of underlying sedimentary beds form natural riffles; small gravel < 1 inch; coarse gold; angular with quartz some galena, some iron-stained
Derived from Quartz veins – lode mines of Yuba (Inghram), St. Louis, Quebec, etc. that have free gold
Placer Gold at Greaterville

Greaterville – MCA-P 324 oz to 1981

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Placer Gold at Greaterville

Greaterville – MCA-P 324 oz to 1981
Placer Gold at Greaterville

Greaterville – MCA-P 324 oz to 1981
Gold at Greaterville

Greaterville – MCA-P 324 oz to 1981
Other Gold Placers in Pima County

**Old Baldy Placers**
NW base of Santa Rita Mts in vicinity of Madera Canyon. Gravels contain colors of gold.

**Sierrite (Papago, Armagosa)**
Along Ash Creek on Sunshine-Sunrise group of claims and in Pascola Canyon – small area

**Armagosa Placers (included in Pima District)**
Gold placers occur along upper course of Armargosa Arroyo in the Tinaja Hills 6 mi. W of Continental. Minor dry washing in gravels of tributaries to arroyo. A little gold in thin soil and hillside detritus
# Gold in Pima County

<table>
<thead>
<tr>
<th>District</th>
<th>type of gold</th>
<th>Geologic period</th>
<th>age in Ma</th>
<th>Au oz to 1981</th>
</tr>
</thead>
<tbody>
<tr>
<td>Ajo (New Cornelia)</td>
<td>by-product</td>
<td>Paleocene</td>
<td>65</td>
<td>1,562,000</td>
</tr>
<tr>
<td>Old Hat (Marble Peak, Catalina)</td>
<td>by-product</td>
<td>Paleocene</td>
<td>62</td>
<td>260</td>
</tr>
<tr>
<td>Pima</td>
<td>by-product</td>
<td>Paleocene</td>
<td>65</td>
<td>20,222</td>
</tr>
<tr>
<td>Silver Bell</td>
<td>by-product</td>
<td>Paleocene</td>
<td>65</td>
<td>2,000</td>
</tr>
<tr>
<td>Arivaca</td>
<td>lode</td>
<td>early Miocene</td>
<td>25</td>
<td>520</td>
</tr>
<tr>
<td>Baboquivari/Allison Camp</td>
<td>lode</td>
<td>early Miocene</td>
<td>25</td>
<td>11,300</td>
</tr>
<tr>
<td>Cababi</td>
<td>lode</td>
<td>late Jurassic</td>
<td>150</td>
<td>3,000</td>
</tr>
<tr>
<td>Papago (Sierrita)</td>
<td>lode</td>
<td>middle Jurassic</td>
<td>190</td>
<td>115</td>
</tr>
<tr>
<td>Canada del Oro</td>
<td>placer</td>
<td>?</td>
<td>?</td>
<td></td>
</tr>
<tr>
<td>Greaterville</td>
<td>placer</td>
<td>Paleocene</td>
<td>65</td>
<td>32,400</td>
</tr>
<tr>
<td>Las Guijas</td>
<td>placer</td>
<td>Eocene</td>
<td>50</td>
<td>&lt;100</td>
</tr>
<tr>
<td>Old Baldy/Jackson</td>
<td>placer</td>
<td>Paleocene</td>
<td>65</td>
<td>1</td>
</tr>
<tr>
<td>Quijotoa</td>
<td>placer</td>
<td>late Jurassic or Eocene</td>
<td>150 or 50</td>
<td>1,450</td>
</tr>
</tbody>
</table>
By-Product Gold in Pima County

Ajo district  MCA-P 1,562,000 oz

Silver Bell district  MCA-P 2,000 to 1981

Pima district MCA-P 20,000 oz to 1981

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Gold in Santa Cruz County

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## Gold in Santa Cruz County

<table>
<thead>
<tr>
<th>Placer</th>
<th>Lode</th>
<th>By-product</th>
<th>Production (Au oz)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Oro Blanco</td>
<td>Oro Blanco</td>
<td>Oro Blanco</td>
<td>4,000</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Ruby</td>
<td>37,000</td>
</tr>
<tr>
<td>Patagonia/Mowry</td>
<td></td>
<td>Patagonia</td>
<td>670</td>
</tr>
<tr>
<td>Harshaw</td>
<td></td>
<td>Harshaw</td>
<td>1,850</td>
</tr>
<tr>
<td>Tyndall</td>
<td></td>
<td>Tyndall</td>
<td>200</td>
</tr>
<tr>
<td>Nogales</td>
<td></td>
<td>Nogales</td>
<td>400</td>
</tr>
<tr>
<td>Palmetto</td>
<td></td>
<td>Palmetto</td>
<td>19,400</td>
</tr>
<tr>
<td></td>
<td>Wrightson</td>
<td>Wrightston</td>
<td>12</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Austerlitz</td>
<td>2,700</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Salero</td>
<td>5,000</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Washington Camp</td>
<td>8,900</td>
</tr>
</tbody>
</table>
Placer Gold in Santa Cruz County

Oro Blanco district  MQA-eJ 4,000 to 37,000 oz to 1981

**Oro Blanco Placers**
Gold in California or
Oro Blanco Viejo Gulch
near mouth of Warsaw
Creek – gold too fine
From gold-bearing quartz veins and stringers in gulches that come from mineralized areas.
Patagonia or Mowry Placers
In Mowry Wash and its tributaries, Quajolote Flat SW of Mowry etc.

Harshaw Placers
2 Mi SW of Patagonia between Sonoita Creek on the NW and Alum Canyon on the SW. Placer gold in Quaternary gravels underlying the mesa-like area

Tyndall Placers
Some placer gold produced 12-14 mi SW of Salero and 1 mi S of Mt. Allen at the SW base of Grosvenor Hills and adjoining ground in open basin-headed canyon that is tributary to Ash Canyon

Nogales Placers
NE part of Nogales district on Guebabi Canyon. Gold placers in Quaternary gravels
Lode Gold in Santa Cruz County

Oro Blanco and Ruby district MQA-eJ 4,000 plus 37,000 oz to 1981

Oro Blanco vein -1873; Yellow Jacket, Ostrich, etc. later; ore treated in arrastres. Montana, Warsaw, Old Glory, Ragnarole, Golden Eagle, St. Patrick, Tres Amigos, San Juan, Franklin, Cleveland, Oro, Nil Desperandum, Last Chance deposits. Margarita Mine. Austerlitz

Arkosic ss, qtzt, cgl, sh some volc. Rest on altered, grayish diorite. Intruded by dikes of basic to acid composition. Gold occurs as medium fine-grained to coarse particles. Mineralized shear zones.
## Gold in Santa Cruz County

<table>
<thead>
<tr>
<th>District</th>
<th>type of gold</th>
<th>Geologic period</th>
<th>age in Ma</th>
<th>Au oz to 1981</th>
</tr>
</thead>
<tbody>
<tr>
<td>Austerlitz</td>
<td>lode</td>
<td>late Jurassic</td>
<td>190</td>
<td>2,700</td>
</tr>
<tr>
<td>Oro Blanco</td>
<td>lode</td>
<td>late Jurassic</td>
<td>190</td>
<td>37,000</td>
</tr>
<tr>
<td>Harshaw</td>
<td>by-product</td>
<td>Paleocene</td>
<td>65</td>
<td>1,850</td>
</tr>
<tr>
<td>Nogales</td>
<td>by-product</td>
<td>late Jurassic</td>
<td>190</td>
<td>400</td>
</tr>
<tr>
<td>Palmetto</td>
<td>by-product</td>
<td>late Cretaceous</td>
<td>75</td>
<td>19,400</td>
</tr>
<tr>
<td>Patagonia</td>
<td>by-product</td>
<td>Paleocene</td>
<td>65</td>
<td>670</td>
</tr>
<tr>
<td>Salero</td>
<td>by-product</td>
<td>late Cretaceous</td>
<td>75</td>
<td>5,000</td>
</tr>
<tr>
<td>Tyndall</td>
<td>by-product</td>
<td>late Cretaceous</td>
<td>75</td>
<td>200</td>
</tr>
<tr>
<td>Washington</td>
<td>by-product</td>
<td>late Cretaceous</td>
<td>75</td>
<td>8,900</td>
</tr>
<tr>
<td>Camp</td>
<td>by-product</td>
<td>late Cretaceous</td>
<td>75</td>
<td>12</td>
</tr>
</tbody>
</table>

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Good Luck, Have Fun, and Stay Safe

Production, Placer gold, or Lode gold specimens