



## Arizona Department of Mines and Mineral Resources

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### Arizona Mining Update – 2006

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*A phenomenal rise in copper price resulted in a record value of \$6.7 billion of mineral production for Arizona. That value ranked Arizona first in the nation according to preliminary data released by the USGS. The value of copper reached \$5 billion, driven by prices that broke \$4 per pound for the first time. Also contributing significantly were strong molybdenum prices and the second largest output of sand and gravel in the U.S. Arizona also ranked first in the value of mined gemstones. Exploration activity for copper and uranium were strong; the latter benefiting from a price that doubled during the year.*

#### Value of Arizona Mineral Production<sup>1</sup> (value in \$000)

Commodity	2002	2003	2004	2005 <sup>4</sup>	2006 <sup>4</sup>
Copper	1,280,000	1,390,000	2,130,000	2,640,000	5,080,000
Gemstone	1,670	1,440	1,450	1,370	1,370
S&G construction	294,000	340,000	430,000	516,000	555,000
Stone crushed	51,500	49,100	57,200	69,300	61,900
Combined values <sup>2</sup>	318,000	394,000	710,000	1,120,000	1,020,000
Subtotal from USGS	<b>\$1,950,000</b>	<b>\$2,180,000</b>	<b>3,330,000</b>	<b>4,350,000</b>	<b>6,710,000</b>
Coal <sup>3</sup>	307,000	289,000	312,000	296,000	208,000
<b>Total</b>	<b>\$2,235,000</b>	<b>2,469,000</b>	<b>3,462,000</b>	<b>4,646,000</b>	<b>6,918,000</b>

1. US Geological Survey (USGS) data except as noted; totals rounded to nearest million.

2. Includes cement, clay, gold, gypsum, lime, molybdenum, perlite, salt, sand and gravel (industrial), silver, stone (dimension), and zeolites.

3. Arizona Department of Mines and Mineral Resources value for coal.

4. Unpublished USGS data, subject to change; official preliminary 2006 data. Final 2005 data will be published in the Arizona Chapter of the USGS Mineral Yearbook, Area Reports: Domestic 2005, volume II.

### Copper and Molybdenum

The copper price continued to increase spectacularly, rising to a record average price in 2006. The U.S. Copper Cathode Producer price increased \$1.41 per pound, an 82% increase to average \$3.14 per pound. Prices rose during the year to reach an all time high of \$4.13 in May, after which they trended slowly downward for the rest of the year. The value of by-product molybdenum recovered at the Bagdad and Sierrita mines remained near historic highs but

decreased from last year's record levels. The mean annual Molybdenum Dealer Oxide price reported by Platts Metals Week averaged \$24.75 per pound in 2006, a \$6.98 decline. The metal contributed significantly to the dramatic rise in the value of the state's mineral production. Increased production at Mission and the other major mines was enough to offset a large drop at Bagdad, resulting in Arizona's copper production rising for the first time since 1997.

#### US and Arizona Copper Production and Prices

Year	US (metric ton)	Arizona (metric ton)	Arizona (billion lbs)	Change	Price <sup>1</sup> cents/lb	Change
2002	1,140,000	767,000	1.690	-13.3%	75.8	-1.6%
2003	1,130,000	741,000	1.630	-3.3%	85.25	12.4%
2004	1,170,000	723,000	1.590	-2.5%	133.94	57.1%
2005	1,140,000	691,000	1.520	-4.4%	173.49	29.5%
2006	1,200,000	713,000	1.570	5.7	314.75	81.9%

Source: USGS production data

1. Metals Week U.S. Copper Cathode Producer

## **Phelps Dodge**

The high copper prices produced record results for Phelps Dodge. For 2006 the company posted a record \$3.0 billion net income. A relatively "pure" copper producer, Phelps Dodge's financial performance is heavily influenced by the price of copper. The company reported that based on anticipated market and production conditions for 2007 every penny change in the copper market would impact its earnings by \$29 million! Such financial success does not come without attracting attention or complications however. In an attempt to invest its rapidly accumulating assets in mid-year, Phelps Dodge made an unsuccessful bid to acquire both Inco and Falconbridge. In November the company agreed to merge with Freeport McMoran Copper and Gold (FCX). The merger was completed in early 2007 and FCX has moved its headquarters into Phelps Dodge's offices in Phoenix. The \$25.9 billion acquisition forms the world's largest publicly traded copper company.

Phelps Dodge's mines accounted for the majority, nearly three fourths, of Arizona's copper production. The Morenci mine is the largest copper-producing complex in the U.S. In 2006 it produced 815 million pounds of copper, over half of Arizona's total. After being an all leach operation since 2001, concentration resumed in the second quarter. The 54,000 TPD concentrator restart is part of a \$210 million investment at Morenci. Phelps Dodge is installing two pressure leach vessels as the heart of the world's first commercial scale concentrate-leach, direct electrowinning plant. The plant is projected to begin operation in mid-2007 with a capacity of 150 million pounds per year. When completed, the pressure leaching plant will use medium-temperature technology (160° C) to produce 150 million pounds annually. This process generates significantly less sulfuric acid than the high temperature process used at Bagdad, but requires less oxygen. Morenci's mining capacity is expected to be 870,000 TPD by mid-2007 for the combined leach and mill operation.

Phelps Dodge also operates the state's third and fourth largest copper mines that recover large amounts of by-product molybdenum. In 2006 Bagdad recovered 10.3 million pounds

while Sierrita, with Arizona's largest mill capacity of 112,000 TPD, recovered 20 million pounds. Sierrita operates two molybdenum roasters, a rhenium processing facility, as well as a copper sulfate plant. That plant produced an additional 8.3 million pounds of copper sulfate (approximately 25% copper) not reported in the copper production table below. In addition to its proven and probable reserves of 1.02 billion tons grading 0.26% copper and 0.03% molybdenum Phelps Dodge reported that Sierrita also contains 2.67 billion tons of mineralized material grading 0.21% copper and 0.02 percent molybdenum.

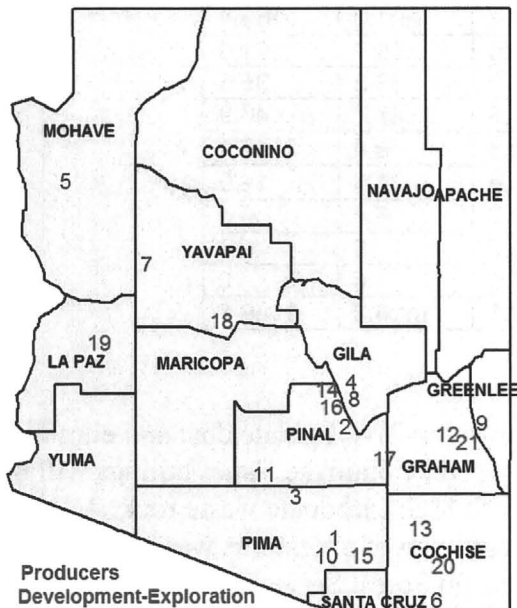
In July the Safford project received its final required permit, an air quality permit from Arizona Dept. of Environmental Quality. Shortly thereafter construction began of the first major open pit mine copper mine since San Manuel open pit mine and leach operation opened in 1986. Phelps Dodge is investing \$550 million to build the two new open pits, Dos Pobres and San Juan, and a giant heap leach SX-EW facility. Production is anticipated to begin in mid-2008 at an annual rate of 240 million pounds per year. An 18-year life is expected for the deposits combined 538-million tons that contain 0.37% copper. The planned crushing facility will have a design rate of 114,000 TPD while mining capacity should be 314,000 TPD. The development is having a major positive impact on the local economy by generating 500 construction and 500 permanent jobs. A major drilling program was conducted at the Lone Star deposit area about 4 miles from Dos Pobres.

## **Asarco**

Asarco benefited not only from higher prices, but continued operation under the protection of the U.S. Bankruptcy Court. Asarco's three mines produced 375 million pounds of copper including Mitsui's share of Silver Bell. Court filings show Asarco had a net income for 2006 of \$571 million and had cash assets of \$497 million at years end. The company received court approval to spend some of those assets on operating equipment. A new labor contract was negotiated that provided not only improved wages and benefits for the workers, but also requires any buyer to honor the union contract in the event the company is sold.

In June Asarco ordered nine 400 ton Liebherr T282B trucks for Ray that were scheduled for early 2007 delivery. These would be the largest capacity haul trucks in Arizona. The Ray mine typically moves 250,000 TPD. Mission would also benefit by getting surplus trucks from Ray to further increase its production. Asarco also purchased the Copper Basin Railway for \$11.5 million. Its 20 miles of rail connects the Ray mine to the Hayden mill and smelter complex and has 37 miles of rail connecting to the mainline.

Production at Mission increased 150%, reaching the highest level since 2001. Mission's output will further increase with the restart of the byproduct molybdenum concentration circuit. Production resumed in December following a \$775 thousand refurbishing and hiring 17 new employees. It is expected to recover 450,000 pounds of molybdenum per year. Consultants SRK were hired to reevaluate Mission's resource and mining plans.



### Copper mines 2007

#### Producers

- 1) Mission - Asarco
- 2) Ray - Asarco
- 3) Silver Bell - Asarco / Mitsui
- 4) Pinto Valley - BHP Copper
- 5) Mineral Park - Mercator Minerals
- 6) Bisbee - Phelps Dodge
- 7) Bagdad - Phelps Dodge
- 8) Miami - Phelps Dodge
- 9) Morenci - Phelps Dodge /Sumitomo
- 10) Sierrita - Phelps Dodge
- 11) Tohono - Phelps Dodge

#### Development & Exploration

- 12) Safford - Phelps Dodge
- 13) Johnson Camp - Nord
- 14) Carlota - Quadra
- 15) Rosemont - Augusta
- 16) Resolution - Rio Tinto/BHP
- 17) Copper Creek - Red Hawk; Bell Res.
- 18) Sheep Mtn - Lebon Gold; Lone Tree
- 19) Yuma King - Big Bar Gold
- 20) Turquoise Dist. Aurelio
- 21) Red Knoll - Franconia

### Other Companies

Resolution Copper Company continued drilling on the deep, high grade Resolution Copper deposit in Pinal County. By year's end about 50 holes had been completed as limited access and the required directional drilling make for slow exploration. An aggressive drill campaign is planned for the next three years to reach a stage where a pre-feasibility study can be conducted. Underground work was initiated to rehab and extend the Neversweat tunnel in preparation for the deepening of the number 9 shaft and sinking of the number 10 shaft. The Arizona Legislature passed a bill that would create Tam O'Shanter Park, a climbing area to compensate for the loss of climbing areas at Oak Flats. Its creation would also require passage by Congress of a land exchange facilitating the development of Resolution Copper.

Mercator Minerals' improvements to the SX-EW plant led to a 48% increase in copper production to 9.5 million pounds. Far larger increases are planned for the resumption of concentrating copper and molybdenum. Mercator had planned to expand to a 37,000 TPD milling operation using Asarco's inactive Mission South Mill. Asarco, in U.S. Bankruptcy Court, challenged that purchase, even though the purchase was made prior to Asarco declaring bankruptcy. Mercator decided to proceed with an even larger expansion. In December it placed orders for two new 7,500 hp ball mills and three used 32-foot SAG mills with a projected capacity of 50,000 TPD. When the expansion is completed annual mill recovery of over 40 million pounds of copper and 10 million pounds of molybdenum is expected. A preliminary feasibility study reported proven

and probable mill reserves of 437 million having a copper equivalent grade of 0.38%

Quadra's board approved raising the money to construct the Carlota open pit, leach, SX-EW project. Initial capital costs are estimated to be \$189 million. The solvent extraction plant (formerly San Manuel's) acquired as part of the

purchase is on site while the mining equipment is expected to arrive and be assembled soon. A NI43-101 compliant report published in October reported resources of 88 million tons grading 0.45% copper for the deposit, enough for a nine-year mine life at a production rate of 66 million pounds per year.

### Arizona Copper Production – 2002 – 2006

Cu (million lb.)

Mine, Company	2002	2003	2004	2005	2006
Morenci, Phelps Dodge and Sumitomo	825.4	842.4	840.6	800.0	815.6
Ray, Asarco	382.1	272.0	241.2	225.1	232.9
Bagdad, Phelps Dodge	168.0	214.0	220.2	201.2	165.4
Sierrita, Phelps Dodge	152.4	151.2	155.0	158.6	161.6
Mission, Asarco	80.7	51.6	54.0	38.2	95.6
Silver Bell, Asarco and Mitsui	45.0	48.6	47.5	47.7	46.9
Pinto Valley, BHP	25.1	22.0	20.3	19.4	18.1
Miami, Phelps Dodge	21.0	35.6	19.6	24.6	19.0
Mineral Park, Mercator <sup>1</sup>	3.1	3.2	3.7	6.4	9.5
Tohono, Phelps Dodge	0	0	0	5	5.2
San Manuel, BHP	4.0	0	0	0	0
<b>Total</b>	<b>1,706.8</b>	<b>1640.6</b>	<b>1602.1</b>	<b>1526.2</b>	<b>1569.8</b>

Data from company annual reports, form 10-Ks, etc.

1. Equatorial prior to June 2003.

BHP Copper worked toward reopening the Pinto Valley mine in 2007 with plans to mine slice 6 that is expected to provide 5 years of feed for the mill. BHP and Carlota Copper began cleanup of the Gibson mine acid mine drainage located above both properties. As part of the \$2.5 million cleanup of Pinto Creek about 120,000 tons of sulfide material is being moved from the Gibson mine to Pinto Valley. The Friars own the Gibson mine, but BHP and Quadra provided funds for the project.

Augusta Resources continued with an aggressive schedule for the Rosemont project. Although the project contains four deposits, work has focused on advancing the Rosemont porphyry skarn occurrence with 543 million tons with a 0.75% Cu equivalent grade. It conducted a 20,000 meter drill program to better define areas of oxide mineralization, provide information on gold and silver grades, and obtain geotechnical information to support open pit slope design. The company acquired rights to use Central Arizona Project water for the project and plans to begin storing water underground in 2007. Dry tailings disposal is planned to

conserve water. To eliminate dust and eliminate future acid mine drainage issues tailings will be placed with high carbonate waste rock. A preliminary plan of operations was submitted to the Coronado Forest Service for mill, leach, and waste facilities.

Two companies were active exploring in the Copper Creek district. Redhawk Resources has acquired a large portion of this district consisting of high-level breccia pipes and lower level porphyry copper targets. The company conducted re-logging and sampling program of 80,000 feet of existing core to complete a NI43-101 compliant resource estimate for Mammoth, Childs-Aldwinkle, and Old Reliable and Keel zone. Redhawk announced a 10,000 feet core-drilling program to begin at the Mammoth deposit. Goals are to expand the deposit, test the deeper Keel zone, and to drill across the breccia structure to test contact zones. Bell Resources began a 10-hole, 4,500-foot drill program on the Sombrero Butte property including portions acquired from Silver Nickel Mining. Results reported included grades of 4.7% copper over plus 20 meters. These and other encouraging



Englehard Corporation broke ground on a multi-million dollar facility to produce hydro frac sand proppants in Sanders near its Cheto deposit. Proppants are used to enhance production rates of oil and gas fields. The plant is expected to reach full production in 2007.

Georgia Pacific has opened new gypsum quarries on Arizona Strip state land in northern Arizona. These will become the largest producers of mineral revenue on state trust lands. The gypsum will go to the Las Vegas market for wallboard.

Drake Cement received the record of decision for Cedar Glade, a proposed limestone quarry near Drake, in north central Arizona in November. After reviewing their Environmental Assessment, the Prescott National Forest found no significant impact. Drake plans to extract up to 1 million TPY of limestone for a proposed cement plant.

#### **Uranium /Coal**

With the spot price for uranium hitting \$72/lb. in December of 2006, doubling the price at the end of 2005, uranium exploration in Arizona continued at a high level.

Uranium activity was concentrated in three areas of Arizona in 2006 - the collapse breccia pipes on the Colorado Plateau, central Arizona, and the Date Creek Basin in west central Arizona.

#### **Plateau Breccia Pipes**

Numerous companies were active acquiring prospective ground hosting high grade (up to 1%) uranium mineralization in solution collapse breccia pipes. Highlights of activity are as follows.

International Uranium (merged with Denison in December) anticipates its developed Arizona One (grade 0.65%) property will be online in summer 2007. Resulting ore will be trucked to its White Mesa mill located in southeastern Utah. Denison also controls the developed Pine Nut and partially developed Canyon Pipe (grade 0.95%).

Tournigan Gold and its US partner Sweetwater River Resources announced results from soil geochemical surveys over 65 suspected pipes that returned positive anomalies over 17 pipes on the north rim. Further geophysical investigations are planned. The company acquired additional ground and now

controls 84 potential pipe targets. Tournigan believes these claims may represent the largest holding of breccia pipe targets in the Arizona Strip district.

Liberty Star Gold continued exploration on its extensive holdings with drilling on three of its most appealing targets.

Vane Resources has four confirmed breccia pipes and received approval for drilling at its Miller and Red Dike properties on the Coconino Plateau.

Quaterra Resources in December began a geophysical survey coupled with helicopter-assisted blanket staking of more than 5,000 new claims that have been selectively chosen to cover most of the high priority anomalies in the center of the uranium district. Quaterra is the first company to extensively test the VTEM system in the district. The survey was designed to identify new targets with geophysical signatures that are similar to previously recognized breccia pipes

US Energy has 27 targets to be evaluated; drilling early in 2006 confirmed two breccia pipes. Quincy (acquired by Energy Metals) completed exploratory drilling on the Rose pipe and is evaluating core samples and logging results.

#### **Central Arizona**

Golden Patriot Corp. exercised its option to acquire a 60% interest in the past-producing Lucky Boy mine in Gila County after drilling on the property. The company tested over 4,000 pounds of samples with results showing uranium grades from 0.12% to 0.13%. In the 1950s, the Lucky Boy was one of the first uranium properties to go into production in central Arizona producing over 2,000 tons of 0.16% ore in the 1950s, and one of the last to produce in the late 1970s, 10,000 lbs of U<sub>3</sub>O<sub>8</sub> from heap leach operations.

Rodinia Minerals optioned 40% of the Lucky Boy from Golden Patriot. Rodinia also has a joint venture with Patriot on the Mormon Lake Property in Gila County. The company conducted drilling in the Pennsylvanian sediments below Promontory Butte. Rodinia acquired properties in the Sierra Ancha Mountains where previous production from the area includes the Workman Creek and Red

results are extending the drilling program into 2007.

Bell Resources also conducted airborne and IP geophysics along with geochemistry to identify drill targets at its Kabba porphyry copper target in Mohave County. St. Geneviève Resources released a NI43-101 technical report for the Zonia mine, Yavapai County, that reported an inferred resource of 63 million of 0.37% copper from a database of 447 holes representing 113,297 feet of previous drilling. The company has decided to focus its efforts on the larger leach potential here rather than at the smaller Emerald Isle project. General Minerals optioned the Monitor property, located near the Ray mine, to Teck Cominco who completed a six-hole, 1,160-meter diamond drill program to test previously identified copper and silver targets. Teck dropped their interest after releasing mixed drill results. Big Bar Gold recently optioned the nearby Troy prospect from Silver Nickel Mining. Big Bar Gold also completed a 19-hole -drill program at Yuma King that extends known mineralization of the small, but high grade, 3.0%, copper deposit. Aurelio Resources signed a purchase agreement to acquire Hope Mining and Milling's patented mining claims at Courtland Gleason. It announced approximately 50 million tons of near-surface copper oxide resources. The company began a 7,500-foot core-drilling program designed to confirm and expand prior work from 170 historic drill holes from the MAN and Courtland properties. At Sheep Mountain Lone Tree Exploration LLC has acquired the property and assembled historic exploration and drill data. Structural complexities and Miocene volcanism suggest areas of interest. Lebon Gold optioned a second area of mineralization, to the west, from Minquest. A drill program of 3 to 8 holes began in early 2007.

In addition to Phelps Dodge a number of groups were active in the Safford district. Franconia Resources started a core-drilling program on Red Knoll following up on a 4-line 17 km geophysical (Titan 24 IP) survey. Four holes totaling 10,000 feet are planned. At Sol Dos Entrée Gold conducted 13 miles of IP and magnetic geophysical lines to define drill targets. General Minerals has optioned the

Markham Wash property to Teck Cominco. Nord Resources reported it will do IP work followed by drilling in 2007 on Coyote Springs. Southwest Exploration Group has done work identifying three targets for additional exploration. They include the untested Mine Wash in the northwestern portion of the district, Safford West covering an IP anomaly buried by younger alluvium, and the Teague Springs prospect.

### **Industrial minerals**

National Gypsum announced plans to build a state-of-the-art \$140 million wallboard plant at Eloy, mid-way between Phoenix and Tucson. Expected to be operational by mid-2008 and creating 100 jobs, the plant will have a production-capability of one billion square feet of wallboard annually, enough to complete 100,000 average-sized homes. The site chosen is close to the gypsum quarries located in the San Pedro Valley, near the junction of Interstate Highways 10 and 8, and has rail access. The Eloy plant will serve regional markets from Los Angeles to Albuquerque by truck; distant markets such as Boise and Seattle will be served by rail.

Eloy was additionally in the news when El Paso Corporation announced plans to construct an underground natural gas storage facility near there. The plans call for four underground salt caverns capable of storing 3.5 billion cubic feet of natural gas. The facility will be able to deliver 350 million cubic feet of natural gas per day, enough to meet the energy needs of 735,000. El Paso expects to file an application for project approval with the Federal Energy Regulatory Commission. The first cavern could be in service by mid-2010 and the remaining three caverns by 2011-2012. The company based their decision to place this facility in central Arizona on the predication that Arizona will be one of the fastest-growing states in the nation during the next 30 years and the state's lack of natural gas storage.

In September 2007, Lafarge North America purchased Sun State Rock and Materials Corporation in Sun City. Sun State, a private corporation, has been doing business in Phoenix for over 20 years. The operation has 90 employees and 4 aggregate operations.

Bluff mines totaling more than 115,000 lbs of  $U_3O_8$ .

Also nearby, UraniumCore Company agreed to acquire a 75% interest in Rodinia's Suckerite, Pendleton Mesa, Coon Creek, and Oak Creek properties in the same district.

Yukon Resources in August 2006, acquired 69 claims contiguous to Rodinia's Workman Creek project and will evaluate and conduct fieldwork.

#### **Tertiary Chapin Wash Formation (Date Creek Basin)**

Past-producing mines and previously drilled properties were examined and acquired in the Date Creek Basin of west central Arizona. These properties are situated within Miocene lacustrine/Paludal sedimentary rocks. The uranium mineralization occurs as stratabound units in carbonaceous siltstones and mudstones.

Concentric Energy is evaluating extensive historic data on the past-producing Anderson Mine in Yavapai County. The company drilled 23 holes to confirm resources defined during the 1970's from prior explorers plus 1,000 hole drilling programs. The work completed in late 2006 verified 43% of historic resource estimates.

Universal Uranium acquired properties to the west in the Artillery Peak range. The uranium mineralization and stratigraphy is similar to the Anderson uranium mine.

#### **Coal**

Hopes were raised that the Black Mesa mine could resume production when Salt River Project announced that they would organize a group to acquire the closed Mohave generating plant and would increase its 5% ownership share to 20%. The generating plant was the sole consumer of the Black Mesa mine coal. Despite upgrades required at the plant, SRP believed it would be cheaper than building a new plant. Later SRP announced that it was ending its efforts when tribal and regional environmental groups asked the Office of Surface Mining and Reclamation to redraft the Black Mesa Project draft EIS.

Peabody's adjacent Kayenta mine in Navajo County, that supplies the Navajo power

plant at Page, produced over 8 million tons of coal.

#### **Gold/Silver**

American Bonanza completed a 40,000-meter drill program at the detachment-hosted Copperstone deposit in February 2006 and announced a N143-101 compliant resources of 330,000 ounces of gold. In July, a program was announced to test 10 geophysical and structural step-out targets, zones that have the potential of adding significant mineralization. The initial drill phase planned an estimated 75,000 feet of RC drilling in 50 holes. Six of the targets tested returned results that warrant follow-up drilling. On a parallel path with the exploration program, Bonanza has collected environmental, geotechnical, hydrological, and metallurgical baseline data to support mine permitting and project design.

At the Hardshell mine in Santa Cruz County, that was formerly Asarco's, Comcorp Ventures Inc. spent \$10 million to acquire 80% of Arizona Minerals Inc, a private Nevada company, to gain control of the property. A previous resource estimate by Asarco was 66 million ounces of silver from 9.6 million tons grading from 6.94 oz/ton. The company now called Wildcat Silver, plans drilling to confirm those results.

Teryl Resources optioned the Gold Hill patented claims in Cochise County and conducted reconnaissance sampling along fault structures. Columbus Gold explored four projects in western Arizona: Clara Moro, Burnt Well, Silver District, and Clanton Hills. Cordex Exploration carries out the company's exploration work and project generation activities. Patriot Gold resumed drilling on the Moss mine in the Oatman District of Mohave County. Farther north, in the Black Mountains, Tonogold Resources optioned the Van Deeman.

For more details of the geology and distribution of metallic commodities discussed here, download the Arizona Department of Mines and Mineral Resource's OFR24-07 Arizona's Metallic Resources - Trends and Opportunities posted at: [www.mines.az.gov](http://www.mines.az.gov).