

**Arizona Mining Update – 2005**Circular 118, July 2006  
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*Record copper and molybdenum prices and strong demand for industrial mineral commodities resulted in a 44 percent increase in the value of Arizona's mineral production. A strong rise in copper prices to record levels, resulted in a large increase in the value of Arizona's copper production to \$2.64 billion. Arizona regained its number one ranking nationally by value of non-fuel mineral production, according to preliminary data released by the USGS. The value of non-fuel mineral production for the year was \$4.7 billion. Arizona produced over 60 percent of the nation's copper and was also a leading producer of molybdenum, sand and gravel, and gemstones. Property acquisition and exploration for copper and uranium increased significantly.*

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

<b>Commodity</b>	<b>2001</b>	<b>2002</b>	<b>2003</b>	<b>2004<sup>4</sup></b>	<b>2005</b>
<b>Copper</b>	1,490,000	1,280,000	1,390,000	2,130,000	2,600,000
<b>Gemstone</b>	1,610	1,670	1,440	1,450	na
<b>S&amp;G construction</b>	288,000	294,000	340,000	430,000	na
<b>Stone crushed</b>	49,600	51,500	49,100	57,200	na
<b>Combined values<sup>2</sup></b>	343,000	318,000	394,000	710,000	na
<b>Subtotal from USGS</b>	<b>\$2,170,000</b>	<b>\$1,950,000</b>	<b>\$2,180,000</b>	<b>3,330,000</b>	<b>4,700,000</b>
<b>Coal<sup>3</sup></b>	322,000	307,000	289,000	312,000	300,000
<b>Total</b>	<b>\$2,492,000</b>	<b>\$2,235,000</b>	<b>2,469,000</b>	<b>3,462,000</b>	<b>5,000,000</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), zeolites and values shown as na.

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

4. Unpublished USGS data, subject to change; official preliminary 2005 data. Final 2004 data will be published in the Arizona Chapter of the USGS Mineral Yearbook, Area Reports: Domestic 2004, volume II.

**Copper and Molybdenum**

The copper price shot up dramatically in 2005, increasing \$.40 per pound, a 29.5 percent increase. The US producer cathode price averaged \$1.73, a record level. The value of by-product molybdenum recovered at the Bagdad and Sierrita mines also increased dramatically. The mean annual Molybdenum Dealer Oxide price reported by Platts Metals Week doubled,

rising from \$16.41 in 2004 to \$31.10 per pound. The metal contributed significantly to the dramatic rise in the value of the state's mineral production. Despite the rise in copper prices and by-product credits, shortages of tires, pit flooding, and labor strikes resulted in a 4.4 percent decline in copper production for 2005.

### 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
2001	1,340,000	885,000	1.951	-8%	77.0	-12.6%
2002	1,140,000	767,000	1.691	-13.3%	75.8	-1.6%
2003	1,130,000	741,000	1.634	-3.3%	85.25	12.4%
2004	1,170,000	723,000	1.594	-2.5%	133.94	57.1%
2005	1,140,000	691,000	1.523	-4.4%	173.49	29.5%

Source: USGS production data

1. Metals Week US Copper Cathode Producer

#### Phelps Dodge

Five Phelps Dodge mines accounted for 78 percent of Arizona's copper production. They also helped the company post a record annual net income of more than \$1.6 billion for 2005. The company announced that it would establish a global environmental reclamation and remediation fund and make an initial contribution of \$400 million to it in 2006.

The Morenci mine is the largest copper-producing complex in the U.S. In 2005 it produced 800 million pounds of copper via leaching. That was more than 52 percent of Arizona's total.

In June, Phelps Dodge's board approved spending \$210 million at Morenci to construct the first commercial scale concentrate leach direct electrowinning facility and restart the flotation mill. Production is expected to begin mid-2007 with a capacity of 150 million pounds per year. The concentrator is expected to resume production during 2006 from chalcopyrite ore from the Western Copper, Garfield, and other mine areas and produce 32,000 tons of concentrate.

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, but requires less oxygen. It was recently tested successfully for seven months at the demonstration pressure leach plant at Bagdad. That plant has now reverted to the high temperature (225° C) process so that the Bagdad mine can take advantage of the greater amount of acid required for its oxide leaching operations. The technology used is proprietary and is shared under a development agreement between Placer Dome (being acquired by Barrick) and Phelps Dodge.

Phelps Dodge's byproduct molybdenum production totaled 29.9 million pounds, largely from the Sierrita and Bagdad mines. Both benefited from the doubling in price of molybdenum oxide. Calling molybdenum a byproduct was the wrong phrase this year as skyrocketing molybdenum prices reversed the role with copper and made Sierrita the top revenue producer outperforming Morenci in earnings for Phelps Dodge for part of the year!

The electrolytic refinery at Miami was permanently closed in 2005. Smelting continued there along with residual leaching operations at the Miami mine.

The Safford project received tentative board approval of \$550 million to build the two new open pits, Dos Pobres and San Juan, and the heap leach SX-EW facility. Final approval is contingent on the project receiving state operating permits.

Leach production is anticipated to begin in the late 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 percent copper.

Plans are to construct a plant to produce acid from elemental sulfur in the Safford area. The development is expected to have a major positive impact on the local economy. The project will generate 1000 construction and 500 permanent jobs. A major drilling program, rumored to total 600,000 feet, was getting underway at year's end on two deposits located within 4 miles of Dos Pobres.

Safford is now also the home of the company's Process Technology Center. In addition to its hydrometallurgical research capabilities, it will provide a high quality and cost effective central analytical facility replacing labs located at Arizona and New Mexico mines.



allowed it to double production and achieve a capacity of 11 million pounds per year. Announced reserves for the property are 77 million tons grading 0.23 percent copper, while measured resources total 345 million tons at a copper equivalent grade of 0.41 percent using copper at \$1/pound and molybdenum \$7.00/pound.

Mercator replaced its mining contractor by acquiring its own truck and shovel fleet. To accommodate future production increases the company purchased a 20,000-tpd mill from Asarco. If a feasibility study is positive, the mine may resume concentrating copper and also molybdenum. That would be something it hasn't done in 25 years.

After a joint venture with BHP-Billiton failed to develop, Cambior decided to put the Carlota oxide copper property, along with equipment it had acquired, including ten used 190-ton trucks, 1 used P&H 2800 shovel and a solvent extraction plant up for auction. The winning bid was \$37.5 million in cash and gold by Quadra Mining. Terms required \$15 million cash to be paid at closing and eight quarterly payments of 6,250 ounces of gold to be made beginning in March 31, 2006. Quadra Mining plans to begin construction in mid-2006 and expects production to occur in 2007. Based on a September 2005 NI43-101 technical report, the Carlota project anticipates an 11-year life with

an average production of 66 million pounds per year.

Augusta Resources entered into an agreement to acquire the Rosemont copper deposit located south of Tucson in the Santa Rita Mountains. The purchase price was \$20.8 million to be paid over three years. Previous drilling by Anaconda/AMAX and Asarco had identified 400 million tons of copper/molybdenum skarn-related mineralization in four deposits that contain approximately 5 billion pounds of copper. A 30,000-foot drill program to produce a NI43-101 compliant resource estimate has been completed.

General Minerals advanced three copper exploration targets. It optioned the Monitor property located northeast of the Ray mine to Teck Cominco who began a drilling program in November to test shallow and deep copper and silver targets. Teck Cominco also optioned the Markham Wash geophysical prospect located in the Safford District in early 2006. BHP-Billiton optioned the Dragoon project and planned a drilling project where General Minerals had identified a 3 square km geophysical target. Redhawk Resources acquired a large land position totaling 7 square miles in the Copper Creek district that contains high level breccia pipes as well as porphyry style mineralization. The company is logging and re-logging more

### Arizona Copper Production – 2001-2005

Cu (million lb.)

Mine, Company	2001	2002	2003	2004	2005
Morenci, Phelps Dodge and Sumitomo	783.2	825.4	842.4	840.6	800.0
Ray, Asarco	352.5	382.1	272.0	241.2	225.1
Bagdad, Phelps Dodge	257.2	168.0	214.0	220.2	201.2
Sierrita, Phelps Dodge	241.8	152.4	151.2	155.0	158.6
Mission, Asarco	138.9	80.7	51.6	54.0	38.2
Silver Bell, Asarco and Mitsui	41.9	45.0	48.6	47.5	47.7
Pinto Valley, BHP	32.0	25.1	22.0	20.3	19.4
Miami, Phelps Dodge	88.2	21.0	35.6	19.6	24.6
Mineral Park, Mercator <sup>1</sup>	3.6	3.1	3.2	3.7	6.4
San Manuel, BHP	20.5	4.0	0	0	0
Tohono, Phelps Dodge	0	0	0	0	5
<b>Total</b>	<b>1,959.8</b>	<b>1,706.8</b>	<b>1640.6</b>	<b>1602.1</b>	<b>1526.2</b>

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

1. Equatorial prior to June 2003.



than 400,000 feet from previous drilling. It is also evaluating resources previously announced by AMT for three pipes to determine exploration and mining plans.

Southern Silver acquired an option in the Tombstone project, a multi-target porphyry skarn prospect 5 miles southwest of the town of Tombstone.

Nord Resources completed a geophysical IP survey that identified an anomaly attributed to sulfide mineralization at depth on the Coyote Springs property in the Safford District.

### **Gold**

Precious metals also benefited from increased prices. Gold broke the \$500 per ounce for the first time in 18 years and later reached a 25-year high of \$535. American Bonanza completed a 40,000-meter drill program at the Copperstone gold project in western Arizona. In early 2006 it announced 334,000 ounces gold contained in a million ton underground resource. The work also identified additional targets under aeolian sand cover that are planned to be drill tested in 2006. Also receiving serious exploration drilling were the Mildred Peak/Jupiter project in Pima County by Golden Arch Resources and the Golden Eagle/Bonanza in La Paz County by Terraco Gold. Galaxy Minerals reported acquiring a small mill for its Yellow Jacket mine in Santa Cruz County.

### **Uranium**

Acquisition of uranium properties surged during 2005 with more than 12 companies reporting acquisitions or claim staking targets. The number of State Land prospecting leases issued for uranium increased from 2 to 16 during fiscal year 2005. This activity paralleled the impressive performance of spot prices that reached \$36.25 per pound  $U_3O_8$  at years end.

Most activity occurred on the Arizona Strip and Coconino Plateau related to high-grade uranium mineralized solution collapse breccia pipes. International Uranium reported it was considering reopening its Arizona 1 mine, a process it reportedly could achieve within 18 months. Ore would be processed at its Blanding, Utah mill. US Energy and Uranium Power Corp. announced a drill program that began in November on the Star claim group located near

the Arizona 1 deposit where it reports 23 pipes may occur. The 40-hole project is designed to verify solution collapse features. Where favorable structures are confirmed a second phase of deeper drill will follow. U.S. Energy owns the Shootaring Canyon mill in Garfield County, Utah through its subsidiary Plateau Resources. Quincy Energy drilled a 1,900-foot hole in the Rose Pipe previously identified as a mineralized pipe by Energy Fuels.

Other areas active in the state included Gila County where Ashworth Exploration conducted exploration sampling and drilling on three properties under option to Golden Patriot and Rodinia Minerals. Concentric Energy and other companies pursued deposits hosted in the Tertiary Chapin Wash Formation in Yavapai and Mohave Counties.

### **Coal**

In December, Peabody closed the Black Mesa strip mine after a supply contract to its sole customer expired. The shutdown was directly related to Southern California Edison's decision not to seek California Public Utilities Commission approval to install sulfate scrubbers. Their installation in the Mohave Generating Station was required by a 1999 EPA consent decree to be completed before 2006. The utility had been trying to complete negotiations to secure right's to coal and water to transport it before seeking approval for an estimated \$1 billion in improvements.

The Black Mesa mine typically produced 4.5 million tons of coal annually and had been delivering coal to the power plant since 1970. The closure impacts both Navajo and Hopi tribes but the loss to the Hopis will be especially difficult as the coal royalties represent about a third of the tribal government revenue.

The adjacent Kayenta mine, that supplies the Navajo power plant at Page with eight million tons of coal annually via automated unit trains, continues normal operations.

### **Industrial Minerals**

Another international aggregate producer La Farge North America entered the Phoenix metropolitan sand and gravel market by acquisition in the southwest valley, a likely large future growth area. Interest in additional

sites for exploration and purchase were reported.

U.S. major Vulcan Materials continued its expansion in Arizona by acquiring New West Materials Co. LLC whose assets included three aggregate and asphalt facilities in the Phoenix area and two aggregate and asphalt facilities in Tucson. The Tucson operations are Vulcan's first in that market.

### **Government News**

The Aggregate Mine Land Reclamation bill became law in May. It applies to aggregate operations started after April 1, 1997, of more than five acres of private land. Existing operations must submit plans to the State Mine Inspector by January 1, 2007 and after that date new mines require approval before beginning to operate. The bill requires financial assurance mechanisms and public community notification. It limits authority of flood control districts to regulating stability and capacity of floodplains.

The Maricopa County Board of Supervisors modified Rule 316, *Nonmetallic Mineral Processing*, that tightened dust emissions. It requires pavement of dirt roads on sites, installation of rumble strips, wheel cleaners, and street sweepers.

Comments for the Environmental Assessment for the Drake Quarry located on Prescott Forest Service lands were due in December. Construction of the cement plant on adjacent private land may begin in the second half of 2006. The continuing drought in Arizona has heightened concerns about water supplies in the Verde River watershed and the USGS released OFR2004-1439 *Hydrogeologic Review of the Drake Cement Project*. Drake Cement LLC has planned its operation to minimize consumptive water use.

The U.S. Supreme Court refused to hear the 9<sup>th</sup> Circuit Court of Appeals decision regarding the State of Arizona's refusal to buy aggregate materials from Dale McKinnon's private property known as Woodruff Butte. The Hopi, Navajo and Zuni Indians have declared the butte a sacred site. McKinnon claimed his rights were violated by the State's not issuing commercial source approval, thus prohibiting sale of his aggregate materials to State projects.

For more details of the geology and distribution of metallic commodities discussed here, download the Arizona Department of Mines and Mineral Resource's new OFR23-06 Arizona's Metallic Resources - Trends and Opportunities posted at:  
[www.admmr.state.az.us](http://www.admmr.state.az.us).