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Arizona 2004 Mining Review Nyal Niemuth, Mining Engineer

Large increases in metal prices and strong demand for industrial mineral commodities resulted in a 39% increase in the value of Arizona's mineral production. A spectacular rise in copper prices to near record levels, resulted in a similar large increase in the value of Arizona's copper production to \$2.13 billion. According to preliminary data released by the USGS Arizona continued to rank 3rd nationally in the value of non-fuel mineral production. Total value of value of mineral production for the year exceeded \$3.3 billion dollars. Arizona produced over 60% of the nation's copper and was also a leading producer of molybdenum, sand and gravel, and gemstones. Astonishingly for the first time in many years uranium properties were highly sought, thanks to a significant rise in price.

Value of Arizona Mineral Production¹ (value in \$000)

Commodity	2001	2002	2003 ⁴	2004 ⁴
Copper	1,490,000	1,280,000	1,350,000	2,130,000
Gemstone	1,610	1,670	1,450	1,450
S&G construction	288,000	294,000	319,000	372,000
Stone crushed	49,600	51,800	57,500	52,000
Combined values ²	343,000	318,000	372,000	447,000
Subtotal from USGS	\$2,170,000	\$1,950,000	\$2,100,000	3,000,000
Coal ³	322,000	307,000	289,000	312,000
Total	\$2,492,000	\$2,235,000	2,389,000	3,312,000

1. US Geological Survey (USGS) data except as noted; totals rounded to nearest million
2. Includes cement, clay, lime, gypsum, gold, molybdenum, perlite, salt, silver, dimension stone, zeolites, and iron oxides
3. Arizona Department of Mines and Mineral Resources value for coal
4. Unpublished USGS data, subject to change; official preliminary 2004 and final 2003 data will be published in the Arizona Chapter of the USGS Mineral Yearbook, Area Reports: Domestic 2004, volume II.

Copper

The very strong copper prices resulted in Arizona copper mines returning to near normal operations. However the damaging effects of the lengthy depressed market could not be totally overcome and production declined 2% to 1.6 billion pounds. Factors precluding a reversal of that many year trend included: the lag in increasing production, producers finally able to extend reserves by lowering cutoff grades, and an increased stripping to return strip ratios to long term targets.

The copper price shot up dramatically increasing \$.48 per pound, a 57% increase. The US producer cathode price averaged \$1.34 for 2004, a near record level. In early 2005 the price trended even higher ranging in the \$1.50 range. By-product molybdenum value at Bagdad and Sierrita also increased dramatically. The annual average price for Metal Week Dealer Oxide tripled rising from 5.21 to 15.92 per pound.

US and Arizona Copper Production and Prices

Year	US (metric ton)	Arizona (metric ton)	Arizona (billion lbs)	Change	Price ¹ cents/lb	Change
2000	1,440,000	963,000	2.123	-8%	88.1	16.1%
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%

Source: USGS production data

1. Metals Week US Copper Cathode Producer

Asarco

Asarco's three operating mines produced over 340 million pounds in 2004, about 20% of Arizona's production. Production fell 30 million pounds at Ray while increasing slightly at Mission and remaining stable at Silver Bell. In April 2004 Asarco increased stripping taking advantage of the higher revenues and to achieve a long-term cash break-even point below \$.75 per pound of copper. As a result, waste removal in 2004 increased by about 65% compared with that in 2003, while ore mined declined slightly. Increased costs were associated with the increased tonnage moved and with upgrading equipment maintenance to raise availability to industry standards levels, a situation that had been adversely affected during the period of low prices. The Ray mine completed 80% of its stripping objective and will return to normal operations during the first quarter of 2005. Mission completed over half of its stripping goal and is forecast to return to normal operations in mid-2005. Both mines may then achieve production increases of 40%.

Santa Cruz, the former federal government supported in situ leach research project and pilot producer, was sold by Asarco and joint venture partner Freeport McMoran to one of the nation's largest real estate developers D.R. Horton. Freeport McMoran reported \$21.3 million in income from the sale land included with the deposit located west of Casa Grande. If some enterprising company is interested in anchoring a future industrial park with an in-situ leach field and a SX-EW facility now would be an excellent time to step forward. Such a creative proposal needs to come forward soon to become part of the master development plan for the area prior to its development. Roughly a billion tons of soluble atacamite (copper chloride) mineralization grading about 0.7% Cu is at stake.

Another copper deposit, the undeveloped Helvetia/Rosemont was sold by Asarco to Rosemont Ranch LLC and other parties for \$4.5 million. In January 2005 the Rosemont Ranch partners offered the property to Pima County for purchase as open space for \$11.5 million and noted they had received an offer from mining group Augusta Capital Corp for a similar amount. No sale has been announced

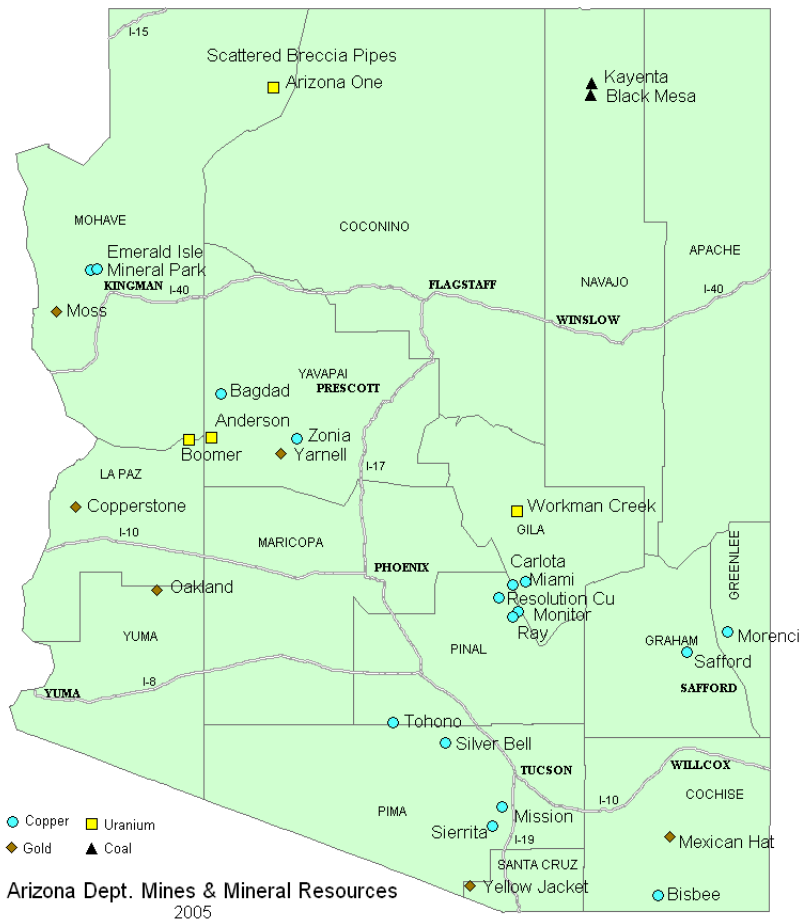
Phelps Dodge

Four Arizona mines contributed to Phelps Dodge producing half of the U.S.'s and over 75% of Arizona's copper production. They also helped the company post a record annual net income of more than \$1 billion for 2004.

Morenci for the second time produced over half of the state's total copper output. 840 million pounds were recovered solely by leaching from its four SX plants and three electrowinning tankhouses. In 2004, Morenci added reserves from the Shannon, American Mountain, and Garfield areas of Morenci and at years end reported a total tonnage including both milling and leaching material of 3.24 billion tons!

The Bagdad mine returned to full capacity in the second quarter of 2004 and produced 220 million pounds of copper via concentration and leaching. The demonstration concentrate pressure leach plant operated for its second year and processed 58,000 tons of chalcopyrite concentrate recovering 35 million pounds of copper cathode, its design capacity. The plant operated very well with an average extraction of copper from concentrate of 98.9 percent, slightly more than design recovery, while availability averaged 83 percent during 2004. In March 2004, a decision was made to convert the facility to the medium-temperature mode of operation of this new technology that generates significantly less sulfuric acid but requires less oxygen than the high-temperature process. It was shut down in December for the conversion that will also include new proprietary direct electrowinning technology. The new configuration is scheduled for an 8-month test run.

The Sierrita mine reached full capacity in the fourth quarter producing 155 million pounds of copper from mostly via concentration. A new plant capable of producing approximately 40 million pounds of copper sulfate pentahydrate annually, an alternative to copper cathodes, was completed in late 2004. Phelps Dodge's byproduct molybdenum production totaled 29.9 million pounds largely from the Sierrita and Bagdad mines. Both benefited from the threefold increase in price to over \$16 per pound molybdenum oxide.



Major Metal and Coal Mines, and Exploration properties in Arizona 2004.

competitive, “step change” technologies and the continuous improvement of existing processes.

With no mining occurring at Miami production from existing leach dumps fell 45% to less than 20 million pounds of copper. With concentrate production up at Bagdad and Sierrita the Miami smelter resumed operating at full capacity in the second quarter of 2004.

The Tohono mine restarted operation in the fourth quarter of 2004 to recover copper from existing leach piles and resumed cathode production in January 2005. Mining had ceased in mid-1997 but leaching continued until early 1999. Mineralized material reported for the Tohono deposit includes 276 million tons milling material grading 0.70% and 404 million tons leachable material grading 0.63%.

In October Phelps Dodge and Bioteq commissioned a new plant at Bisbee to recover copper in a joint venture known as Copreco LLC. The plant incorporates a bioreactor to selectively precipitate copper sulfide from low-grade stockpile solutions that are then thickened and shipped to the Miami smelter. Thus it makes a marketable product, rather than a sludge that would require disposal, helping to offset its cost of operation.

Other Companies

Early in 2004 Rio Tinto announced it had earned a 55% interest in the Resolution Copper project near Superior by expending \$25 million on exploration drilling. BHP-Billiton retains a 45% stake in the joint venture company, Resolution Copper. Although the deep and hot mineralization will make the property difficult to develop, it may also prove it to be one of the richest and largest copper discoveries in North America. Rio Tinto, through the joint venture, officially took over the mine property including the old Magma mill and smelter plant site, now called the west plant site on May 1. The company spent \$2 million on restoration and clean up improvements.. Focus of the work was to improve dumps and

In July the BLM issued its Record of Decision supporting a land exchange for a proposed copper mining operation at Safford. Two parties have since filed appeals to the decision. BLM is expected to provide a response to those in early 2005. The planned operations two deposits, Dos Pobres and San Juan, contain an estimated 538 million tons of leachable reserves with a grade of 0.37% copper.

Phelps Dodge began construction of a central analytical service center in Safford to provide analytical services for the company’s operations in Arizona and New Mexico. The center is expected to be completed in late 2005 and will replace existing analytical facilities at most mine sites. Also at Safford is a process technology center that employs approximately 96 engineers, scientists and technical support staff. The activities at the technology center are directed at the development of new cost-

spillways resistance to erosion and closure of some the old underground mine's surface openings. Other activities underway are a hydrological investigation of the site and land acquisition for possible exchange. It is estimated \$200 million may be spent on the project prior to any production decision. Preliminary plans are to develop the deposit by block caving. Drilling to gather geotechnical information for mine development, shaft sinking and further definition of the deposit resumed in early 2005.

Mercator Minerals hired N.A. Degerstrom as mining contractor and resumed mining and placing ore on a leach pad at Mineral Park in late July. Despite heavy rainfall in early winter production increased a half million pounds to 3.7 million pounds of copper. Expansion of the SX plant and piping was completed and a drilling program to confirm/expand reserves and define higher grade areas was underway. Increased molybdenum prices had Mercator reevaluating the mine, previously a coproducer of molybdenum and copper, to once again recover that metal.

Cambior announced that a study to joint venture Carlota and Pinto Valley facilities has been completed. BHP Copper is apparently not interested in a joint venture, but may lease or sell some facilities. The 105 million ton copper oxide deposit remains fully permitted and awaits development.

St. Genevieve Resources acquired Emerald Isle and Zonia properties from Arimetco via bankruptcy court. This company plans to quickly return Emerald Isle to production. The exotic copper deposit contains about 1 million tons of 0.75% copper and has an SX-EW plant on site.

General Minerals expanded its holdings and defined geophysical anomaly 3 miles northwest of Phelps Dodge's Dos Pobres deposit in the Safford district. The company also conducted geological and geophysical work defining a copper target at the Monitor mine northeast of the Ray Mine. In early 2005 they announced they had optioned the property to Teck Cominco.

Arizona Copper Production – 1999-2004

Cu (million lb.)

Mine, Company	2004	2003	2002	2001	2000
Morenci, Phelps Dodge and Sumitomo	840.6	842.4	825.4	783.2	834
Ray, Asarco	241.2	272.0	382.1	352.5	304
Bagdad, Phelps Dodge	220.2	214.0	168.0	257.2	247
Sierrita, Phelps Dodge	155.0	151.2	152.4	241.8	245
Mission, Asarco	54.0	51.6	80.7	138.9	189
Silver Bell, Asarco and Mitsui	47.5	48.6	45.0	41.9	40
Pinto Valley, BHP	20.3	22.0	25.1	32.0	38
Miami, Phelps Dodge	19.6	35.6	21.0	88.2	137
Mineral Park, Mercator ¹	3.7	3.2	3.1	3.6	5.0
San Manuel, BHP	0	0	4.0	20.5	23
Total	1602.1	1640.6	1,706.8	1,959.8	2,062

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

1. Equatorial prior to June 2003.

Gold

American Bonanza executed the most significant gold program in Arizona during 2004. At year's end it was half-way through a 40,000 meter drill program at Copperstone in La Paz County with six six rigs continuing to drill from surface and underground. The high grade D zone was drilled from an underground drill bay. Additional targets included the Footwall target about 400 feet below the main Copperstone Fault in the central part of the open-pit and the High Wall area north of the open-pit, to the southeast of the D zone and the C zone. Data from approximately 100 holes has been released with assay results that include many with high-grade intercepts. Announcement of a mineable reserve and a production decision is expected in 2005. Bonanza also initiated both metallurgical and environmental baseline programs to support a feasibility study and permitting of the project

In the first quarter of 2004 Bema announced a write down of \$8.5 million in the carrying value of the Yarnell gold, Yavapai County. On April 30, 2004, Bema entered into a letter of intent to sell the Yarnell

gold property for cash and a net smelter royalty for approximately \$2.2 million. During the fourth quarter, another company, Gold Spring reported it was evaluating the property, reported to contain up to eleven million tons mineralization, and a feasibility study provided by BEMA. In early 2005 the property is believed to still be available from BEMA.

Among other gold exploration projects in Arizona, five companies announced drilling activities. These included: Capital Hill at the Mexican Hat working on the Victoria and 16 zones in Cochise County; Galaxy Minerals at the Yellow Jacket, Santa Cruz county; Patriot Gold put in 30 holes at the Moss Mine and planned more drilling; and Abington Ventures and Hellix Ventures at the Oakland and adjacent Verdstone gold mines.

Uranium

The hottest commodity during the year was undoubtedly uranium. Responding to the nearly three fold increase in price over the last 3 years and a belief in a future supply deficit many groups rushed to stake known resources and acquire holdings in permissive terrains. Tapping a wealth of historical data, three well known, but distinct deposit models were pursued across the state.

On the Kaibab and Coconino Plateaus a number of companies rushed to acquire previously drilled breccia pipes as well as ground suspected to contain mineralized pipes for exploration. Some of these were: Goodfellow Resources, with at least 11 pipes, Energy Metals (formerly Clan Resources), claiming a large land position, Quincy Gold with an interest in at least 4 pipes, and others. They joined International Uranium who maintains developed and permitted mines and, in addition, has a mill located at Blanding, Utah. The company's Arizona One deposit, currently on standby, is likely to be the first to return to production. These vertically elongated deposits generally host some of the highest grade uranium mineralization in the U.S. Pipes mined during the 80s averaged 0.65% U_3O_8 and produced 13 million pounds. Historically, the targets consist of pipe-shaped breccias generally less than 1,000 feet in diameter and extending to depths in excess of 2,000 feet, containing uraninite other minerals. These pipes are often clustered, with several other pipes occurring within a few miles of one another, which improves production economies. Many of the projects acquired have had previous exploration activities, an estimated 40 million pounds were discovered during the last boom, and were held by claim until as recently as 3-6 years ago when poor uranium prices dictated their abandonment.

In the Basin and Range Province Concentric Energy and Energy Metals acquired claims covering the Anderson Mine and Boomer mine areas that are believed to host 30 million pounds. The Date Creek Basin may contain as much as 126 million pounds of uranium in Tertiary age lake sediments.

In Gila County Ashworth Exploration acquired the Workman Creek and other mineralized areas in the Precambrian Dripping Springs Quartzite once held by Wyoming Minerals Corp in the Transition Zone. Drilling is planned to confirm areas of previously identified areas of higher-grade mineralization.

Most companies working in Arizona suggest that a continued increase in the uranium price will be required to determine whether this rush becomes a sustained development trend rather than a short-lived speculative play.

Coal

Peabody Coal's Black Mesa mine is faced with the looming possibility of closure, most likely to occur at year-end 2005 when the coal supply contract to the Mohave generating station at Laughlin Nevada expires. Southern California Edison, the plant's operator, is involved in California Public Utilities commission proceedings related to the continued operation or closure of the plant. An EPA mandated consent decree requires the Mohave facility, the mine's sole customer, to have installed scrubbers to reduce sulfate air emissions by then. The Black Mesa mine typically supplies the power plant with about 4.5 million tons of coal annually.

Among other matters affecting the mine and power plant are: unresolved concerns that Hopi Tribe has with water withdrawal used to transport the coal, the coal slurry pipeline, the worlds longest at 273 miles, has aged and many sections require repair or replacement, and other issues with the Navajo Nation. Estimated costs for these issues and other improvements could exceed \$1 billion. If closed, the

mine and plant would likely not return to production until mid-2009 at the earliest. The closure would also have a negative impact on both tribes' economies. The various parties have entered negotiations to extend the deadline and settle issues, but it appears an extended shutdown is likely. The adjacent Kayenta mine that supplies the Navajo power plant at Page with 8 million tons of coal annually via automated unit trains will hopefully be unaffected by the disputes and continue normal operations.

Industrial Minerals

Growth in the production and value industrial minerals by Arizona producers continued. The Phoenix metro area drove demand as it captured title of largest new home market in the U.S. surpassing Atlanta. A number of sales were announced as companies reacted to the perception of a market some view at its peak and others bullish its about it getting larger. Included were the purchase by Western Power and Equipment of Arizona Pacific Materials, a producer of specialty basalt aggregate at the Queen Creek quarry in the southeast corner of metro Phoenix and cinders from the Apple pit near Flagstaff. Kildare Enterprises LLC purchased all of American Sandstone's flagstone operations near Drake from the Blaser family. Cemex S.A. purchased the RMC Group, the world's number one redi-mix concrete maker, for \$4.15 billion to expand its markets in the U.S. and Europe. The purchases effect will be just the opposite in one local market, Tucson, as the FTC will require Cemex to divest the former holdings of RMC there during 2005 to reduce its market share. Quite unsurprising were reports from some of the large publicly traded companies, for e.g. Rinker, that they were benefiting from the construction boom in Arizona and the consequent increased prices for sand and gravel and cement block.

Government News

The first aggregate mine zoning district formed in northwest portion of Phoenix for operations along the Agua Fria River The State Land Department halted sales of land for preservation. The anticipated vote on state land preservation and changes to the State's constitution were delayed.

For more details of the geology and distribution of metallic commodities discussed here download the Arizona Dept. of Mines and Mineral Resource's new OFR22-05 Arizona's Metallic Resources - Trends and Opportunities posted at: www.admmr.state.az.us .