



*Haul Truck - 1938
Morenci mine, Greenlee County
ADMMR Photo A-125-20*



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Mineral Resource

Resolution Copper Takes Over

A porphyry copper deposit discovered near Superior has the copper-mining industry excited – an industry that has had little to cheer about for the past 6 years. Now, along with copper prices being close to record-high levels, there is the Resolution Copper deposit. It is difficult to decide what is the most remarkable aspect of this discovery. That it is huge? It may be the largest copper deposit in North America. Although resources have not yet been fully defined, it is estimated to contain at least a billion tons. That it is deep? It lies about 1000 feet below sea level and 7,000 feet below the surface. That it is high-grade? The deposit has mineralization of 1.5 percent copper, two or more times the grade of ore typically mined here. Or is it the nature of this deposit that is most amazing? The presence of this huge, high-grade deposit, underlying the Magma mine has implications for the other copper mines in the Southwest and has mining companies wondering what lies beneath *their* deposits.

The deposit, deeply buried under post-mineral rocks, was first intersected by drill holes from the underground workings of the Magma mine in 1995 by Magma Copper. In July 2001 Kennecott Exploration started a surface drill exploration program southeast of the #9 shaft. Drilling recovered 10 miles of HQ core from 17 holes at a cost of \$500,000 per hole. Initially, drill rigs occupied four existing sites. Kennecott Exploration later developed a fifth site further to the east. Holes were initially drilled with a rotary rig to a depth of 3,000 feet. This was

followed by drilling core holes another 3,000 to 4,000 feet. From each initial drill hole deflection holes were then drilled using wedges and a directional drill.

Before releasing reserve figures, more drilling needs to be done to define the deposit's limits and copper content. The bottom of the deposit is not totally known, but is estimated to be generally about 2500 feet below sea level.

Three technical problems will need to be overcome to develop the mine: depth, heat, and rock stress. Mining at 6,500 feet means local rock temperatures of up to 170 degrees F. Rock stress at that depth is obviously going to be a concern. No mining method has been selected. Before these matters can be addressed Resolution Copper Company, Kennecott Exploration's successor in interest, must deal with surface multiple-use concerns, complete the regional ground water study being conducted by Montgomery and Associates, and continue gathering baseline data.



London-based Rio Tinto earned a 55 percent controlling interest in the property from BHP-Billiton by spending \$25 million on exploration. The resulting joint venture company, Resolution Copper Company, took over management of the project, which includes the Superior underground mine, concentrator, and smelter, on May 1 of this year. Initial exploration was completed in February of 2003. Resolution plans to continue evaluation for the next three years. They will also undertake two voluntary remediation projects at the existing mine site. Many of the adits, tunnels, and other workings in Queen Creek from previous mining operations will be closed or gated to retain their function as habitats for bats, snakes and other

Geology of the Resolution Deposit

The following excerpts are from technical papers on the geology of the Resolution deposit. Citations are provided.

"The upper kilometer of the deposit, pervasively sericitized and with abundant pyrite and later bornite-chalcocite, is overprinted by advanced argillic alteration with kaolinite, dickite, and less alunite, topaz, pyrophyllite, and zunyite. The vein-controlled, high sulfidation assemblage pyrite + chalcocite correlates most strongly with advanced argillic alteration and copper grades greater than 10%. Deposits sharing features seen in the upper portions of the Magma porphyry include some of the world's largest copper deposits (e.g. Butte and Chuquicamata). The discovery of this style of porphyry ore in the southwestern US should serve as an incentive for renewed exploration efforts there."

Sandra Troutman, *Advanced argillic alteration in the deeply buried Magma Porphyry Cu-Mo prospect, Superior, Arizona*, Abstract from SME Meeting, 2002

"Surface and underground drilling into the deposit has outlined a zone of >1.0 percent hypogene Cu that is at least 750m long by 250m wide by 300m high, elongated to the eastnortheast. The same volume of rock also averages 0.02 percent MO and 2 ppm Ag. The zone apexes approximately 300m below sea level, slight more than 1.5 km below the ground surface, and remains open in all directions laterally and at depth. Four of the last five drill holes penetrating this zone ended in rock assaying >2.0 percent Cu."

Scott Manske and Alex Paul, *Geology of a Major New Porphyry Copper Center in the Superior (Pioneer) District, Arizona*, in *Economic Geology*, Vol. 97, March-April 2002.

wildlife. Also, stormwater retention capabilities on the West Plant Site near Superior are being expanded. The existing tailings are being studied to see how they can be sealed. The company has set aside over \$2 million for these projects in 2004.

Development of the project could easily exceed \$1 billion, and although it is too soon for firm target dates, construction could begin sometime after 2010. The mine could generate nearly 1,000 construction jobs and 400 permanent, high-paying mine jobs. The deposit, once developed, would produce for an expected lifespan of 25 years.

Meanwhile, the company is working on solidifying community support for the project. Resolution holds open house festivities, awards scholarships, supports the Boyce Thompson Arboretum, participates in local mining competitions, and hosts ice cream socials. If and when the Resolution Copper mine becomes a reality, Resolution Copper Company and the town of Superior will be ready.

ADMMR's Historical Photograph Collection

Since the time that the Department came into existence in 1940 the staff has been taking photographs of Arizona mines and adding them to their field reports. The Department also accepted donation of photographs from mining companies and individuals. The collection grew.

In 1996, volunteer Keith Halsey began the formidable task of cataloging the collection. He logged more than 100 hours per winter season for the next three years, determining the date of the photographs, labeling them, and entering the data. In addition, he made a photocopy catalog of the collection to relieve use on the original photos by the public.

Currently there are nearly 2,000 photos, and negatives cataloged. They represent 375 mines and other sites. As there are over 10,000 sites in the Department's AzMILS database, this means that most mine sites are not represented. Approxi-

mately 75 percent of the photos are black and white. Negatives exist for about 5 percent of the collection.

In 2003, volunteer Kevin Hart began the equally formidable task of scanning the photographs. Scanning considerations involve resolution, digital format, image size, storage, and portability. The chosen format is jpg at a resolution of 150 dpi. High-resolution scans will be done of select high quality originals as needed. The scanned photographs' file names are derived from the mine name and a unique catalogue number. For future retrieval it may be desirable to create a geographic index or hyperlink map catalog system.

Additional Department photos await cataloging. Not all photographs have been removed from the mine files and therefore are not represented in the catalog, nor have they been scanned. Other uncataloged photos include color slides taken by staff from the 1970s through the 1990s, digital photos taken by staff and others acquired since the 1990s, a black and white collection used in publications from 1980 to 2000, and slides taken by the well-known mineral photographer, Jeff Scovil, of portions of the museum collection in the early 1990s.



Mill, Alvarado Gold mine, Fools gulch, Yavapai County 1907, ADMMR Photo A-7-4

Museum News

By Susan Celestian, Curator

Oh my, there is SO much to mention – here goes!

We had a wonderful "show season," exhibiting in eight different gem & mineral shows around Arizona.

February's Prospector's Day was a blazing success, with 502 attendees! And all because of our WONDERFUL VOLUNTEERS – you know, that group of fabulous folks who have donated 9645 hours of their valuable time to the Museum/Information Center. On April 2, the Volunteer Recognition Banquet was held to honor the invaluable contribution of time and talent.

Two new exhibits now grace the main floor of the Museum. One is built around a recent loan of some outstanding fulgurites – sandy/rocky glass, root-like structures formed when lightning strikes the Earth. The exhibit includes striking examples of local finds. You will be amazed – and will be certain to take cover during the next monsoon storm, OR you will be out following every lightning bolt to the ground!

Mercury is the subject of the other case; in particular, mercury mining of Arizona, especially Maricopa County. Sam Nasser has done a nice job of showcasing ore samples, historical photographs, artifacts, and processing. In addition, the Silver case has been cleaned, relabeled and upgraded at long last; and a wonderful plate of crinoid calices on loan from Dick Zimmerman is on exhibit.

Look soon for a new micromount display. Dick Zimmerman and Jim Sippel have finished engineering and building the beautiful case. It only awaits the mounting of the micro-minerals onto the turntable. I am so excited about being able to fully utilize the wonderful microscope, camera and monitor that the Arizona Mineral & Mining Museum Foundation donated several years ago.