



CONTACT INFORMATION
Mining Records Curator
Arizona Geological Survey
416 W. Congress St., Suite 100
Tucson, Arizona 85701
520-770-3500
<http://www.azgs.az.gov>
inquiries@azgs.az.gov

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James D. Sell

GEOLOGY AND MINERALIZATION
OF THE
CONGRESS MINE

Prepared for the Arizona Geological Society
AGS Spring Field Trip
April 20, 1985

Christopher E. Herald
Senior Geologist
Echo Bay Exploration Inc.

Michael D. Russ
Consulting Geologist

LOCATION

The Congress Mine lies in the southeastern part of Yavapai County, central Arizona. The property occupies parts of Sections 10, 11, 14, 15, 22, 23, and 24 in T.10N, R.6W and Section 18, T.10N, R.5W.

It is situated along the southeastern edge of the Date Creek Mountains at an elevation of 3,400 feet above sea level.

HISTORY AND PAST PRODUCTION

The original Congress claims were located in 1887. A 20-stamp mill was constructed to process the ore and was operated until 1891, at which time a three-year shutdown occurred.

Work resumed in 1894 by the Congress Gold Company, which now enjoyed the convenience of a rail spur off the then recently-completed Phoenix to Prescott line. The mill was expanded to 40 stamps. At this time the No. 2 Congress shaft was 1000-feet deep with stoping restricted to above the 650 level.

The mine operated continuously from 1894 to 1911. During this period the cyanide process was introduced to greatly improve recoveries and another 40 stamps were added. The total official tonnage shipped or milled during this period is recorded as 692,332 tons, of which 370,022 tons were mined from the Congress vein with an average recovery of about 0.70 opt Au, 293,215 tons with an average recovery of about 0.415 opt Au from the Niagara vein, and 20,125 tons at 0.40 opt Au from the Queen of the Hills vein. A total of 388,477 oz. of Au and 345,598 oz. Ag were recovered. In addition to the above totals, substantial values were left in the mine fills and ore dumps.

From 1911 to 1935 operations at Congress were principally confined to retreatment of small portions of the mill tailings and ore dumps and robbing pillars. An estimated 50,000 tons of dump and tailings were treated.

A 300 TPD counter-current cyanide mill along with a power plant was erected in 1937. From 1938 to 1942, 385,505 tons of material (276,372 tons from tailings, 106,629 tons from dumps) were treated. The mill head averaged 0.094 opt Au with a recovery rate of about 69%.

The property saw very little production from 1942 to the present. Around 1980, with the gold price rise, a heap leach operation of crushed dump rocks operated for several years.

LOCAL GEOLOGY

LITHOLOGY

The Congress Mining District and surrounding Date Creek Mountains are comprised almost entirely of Early Proterozoic granitic intrusive rocks belonging to the 1320 m.y. to 1460 m.y. central Arizona batholith. The granitic rocks range in composition from coarse-grained granite to granodiorite and contain swarms of coeval pegmatite and aplite dikes comprising 10 to 15% of the rock unit. The granite also contains numerous house-size inclusions of partially digested metasediments (gneiss, biotite schist and quartzite). A few small lenses and dike-like amphibolite bodies of probably early Proterozoic age also cut the granite.

The Proterozoic granitic rocks have been intruded by four types of younger dikes that are, from oldest to youngest: east-west trending "greenstone" diabase dikes; northwest trending andesite porphyry dikes; northeast trending latite porphyry dikes; and northeast trending rhyolite dikes (previously termed alaskite).

Previous workers in the district have considered the greenstone dikes and gold mineralization Tertiary in age. However, a Late Proterozoic age (1080 m.y. to 1180 m.y.) has not been ruled out for the dikes or mineralization. The andesite, latite and rhyolite dikes are all post-mineralization.

STRUCTURE

Foliation in Precambrian igneous rocks is indistinct and variable, but an east-west strike and northerly dip appear to be the most common attitude observed in the area. Older metasedimentary inclusions in the granite have a N35°W foliation, coincident with the regional grain of the area.

There are at least six recognized periods of fault movement in the Congress area. From oldest to youngest, they are:

1. Minor pre-mineral thrusting from the north in Precambrian granite dipping 20° to 25° north (Congress Vein);
2. Pre-mineral west-northwest faults, dipping 40° to 45° north, (Niagara Vein);
3. Minor post-mineral movement on west-northwest thrust faults;
4. Cenozoic normal faults, striking N20°W to N30°W;
5. Cenozoic normal faults, striking N30°E to N50°E;
6. Basin and Range faulting striking N0°W to N20°W.

The minor east-west trending, north dipping thrust faults appear to be the oldest of the six main periods of faulting

and are probably Late Proterozoic or Early Tertiary in age. Thrusting appears the simplest explanation for these shallow dipping greenstones. The amount of displacement on the thrusts is not known, but is probably small.

GOLD MINERALIZATION

The Congress Mining District has produced a minimum of 388,000 ounces of gold from relatively high-grade ore shoots in hypogene auriferous quartz veins. The district ranks second in primary gold production in Arizona. Essentially all of the district's gold production has come from two vein systems: The Congress and Niagara veins.

CONGRESS VEIN

The location of the Congress ore shoot was controlled by the intersection of the Congress greenstone dike with the Cross vein. This line of intersection accounts for the northerly rake of mineralization along which stoping was conducted nearly continuously down to the 3100 level and exploration with minor production to the 3900 level. The orebody obtained a maximum width of 1300 feet on the 650 level. Ore widths varied in the shoot from 3 to 7 feet.

The location and strength of quartz veining in the Congress vein was controlled by pre-mineral movement that broke and shattered the greenstone and granite providing open spaces for auriferous quartz-pyrite deposition. The pre-mineral displacement between the hanging and footwalls of the Congress dike was probably small, but sufficient to provide enough fracturing to act as a favorable conduit for the circulation of hydrothermal fluids. There is no reported change in vein mineralogy between the surface and the deepest mine workings, excluding surface oxidation.

NIAGARA VEIN

The Niagara vein strikes west-northwest, dips 41° north, and is located about 250 feet south of the Congress vein. The Niagara vein is a mineralized fault cutting Precambrian granitic rocks. Unlike the Congress vein, which it parallels in outcrop, the Niagara vein does not follow a greenstone dike and has the steeper dip, characteristic of most of the quartz veins in granite. The Niagara vein has been mined in four different areas along a strike length of 4000 feet.

The character of the Niagara vein ranges from a narrow zone of broken and hydrothermally altered granite with a little disseminated pyrite, to massive quartz vein material up to 14 feet thick with sharp wallrock contacts. In Niagara ore zones, the quartz vein averages 3 to 5 feet in thickness, usually with an additional 3 to 5 feet of altered granite wallrock containing a large proportion of quartz stringers and veinlets. The quartz stringer zone commonly constitutes ore grade material. The mineralogy of the Niagara vein material is similar to the Congress vein and consists of quartz, carbonate, pyrite, galena, chalcopryite, hemitite, gold and silver. The galena and silver content is higher and the average gold grade is lower than in the Congress vein.

STRUCTURAL ORE CONTROLS

Pre-ore faulting and secondary permeability within the vein hosting structures appear to be the most significant structural controls on mineralization. Portions of the east-west trending greenstone dikes and east-west trending 40° north dipping faults were open to circulating hydrothermal solutions during the mineralizing period. Undulations and dilations in the walls of mineralized structures also appear to have increased secondary permeability and consequently, mineralization.

CHEMICAL CONTROLS

Wallrock chemistry does not appear to be as important a factor in controlling mineralization as structure. The higher mafic content of the greenstone dikes may in part account for the higher overall grade of the Congress vein ore. It has been noted in drill cores from the Niagara vein that pegmatitic wallrocks are generally less favorable for good ore (pyrite) deposition than granite wallrocks, and that a higher mafic content of the granite (granodiorite) generally corresponds to higher gold content.

VEIN MINERALOGY

The auriferous quartz veins are composed predominantly of vein quartz along with variable, but generally minor, amounts of carbonates. Pyrite, galena, and chalcopryite are the only sulfides megascopically identifiable. Molybdenite has been tentatively identified in trace amounts. Reddish-brown hemitite is locally abundant as an oxidation product of pyrite. Gold probably occurs as micron-sized particles in pyrite.

NEW NIAGARA OREBODY

OREBODY CHARACTERISTICS

The Niagara orebody appears to be a classic fissure quartz vein deposit. The vein structure strikes N45°W and dips at about 41° to the northeast. The main ore shoot is oblique to the strike and dip of the structure, trending east-west. Several subsidiary shoots deviate from the main shoot.

Mineralization and Alteration

Mineralization in the new Niagara orebody is similar to areas previously mined in the Niagara structure. Mineralization in the orebody occurs in two basic styles, with the one common denominator observed in all mineralization being the presence of quartz and pyrite. High grade (+1 opt Au) mineralization will contain 10 to 25% sulfides over two feet. The higher grade mineralization usually occurs as a discreet vein of massive quartz from 1 to 14 feet thick with minor amounts of sulfides. The second style of mineralization has been termed the quartz stringer zone. The quartz stringer zone consists of 20 to 70% quartz veinlets flooding altered wallrock. The zone is generally lower grade to barren and usually envelopes the main quartz vein both on the foot and hanging walls.

As no definitive alteration analysis has been conducted on the core, the breakdown of alteration types is tentative, based only on visual identification. Alteration associated with mineralization appears to be relatively simple. Chloritic/propylitic and argillic alteration are the most common alteration types. The chloritic alteration assemblage consists of chlorite + quartz + pyrite that grades into propylitic alteration with the addition of epidote. Both the chloritic and propylitic alteration assemblages, which are closely associated, may contain carbonate, clay, K-feldspar, magnetite, biotite, sericite, and fluorite in minor amounts.

The chloritic/propylitic assemblage extends anywhere from a few inches to 50 feet away from the vein, with the average being less than 15 feet. The width of alteration is largely dependent on the degree of structural preparation. Alteration intensity decreases away from the vein. The alteration zone is widespread at the base of the main ore shoot and becomes much more narrow updip from the shoot and upper parts of the shoot itself.

Argillic alteration does not appear to be associated with mineralization, but with post-ore structures. The argillic alteration is very pale green to white in color and is closely restricted to structures.

April 18, 1988

FILE NOTE

Congress Mine
Martinez District
Yavapai County, AZ

As related by Jan Lamb, former employee of Echo Bay Exploration who was operating the new "Niagara" orebody, during the recent 1988 AGS Spring Field Trip she stated that Echo Bay has now closed down their operations as they have mined out the orebody. So far they have been unsuccessful in finding additional ore.

Echo Bay started exploration in 1984 (George Cross Newsletter No. 116, June 15, 1984).

Little else is new in the files other than the 1985 AGS Spring Field Trip guidebook to the Vulture and Congress Mines, where no tonnage-grade figures were given for the new "Niagara" orebody.

JDS:mek



James D. Sell

cc: W.L. Kurtz

01-23-1988

FROM: DOUGLAS M. SMITH, JR.

TO: JDS

JAN 25 1989

Congress

Brad Mills (303 592-5464) says that there is no hand-out data package on the Congress, but volumes are available for review at the mine as well as in Denver.

A test batch of fluxing ore was recently shipped to Hayden.

Cheers,

Doug

January 17, 1989

FILE MEMOCongress Mine
Echo Bay Mining Co.

On January 11, 1989 J.D. Sell and M.A. Miller visited the Congress Mine of Echo Bay Mining Co. The property is currently for sale; asking price \$10M. Current ore reserves are 4-500,000 T at .3 opt Au or \approx 140,000 oz. Exploration potential is \pm 1 mt @ .3 opt. according to Scott Petsel, mine geologist. Exploration potential exists on the down-dip extensions of the Niagara vein, possible low grade left on the Congress vein and a possible faulted offset of the Congress vein. The general geology consists of quartz veins emplaced within structural E-W trending "fault zones" in a granite, granodiorite with some aplitic phases. The Niagara vein is continuous for \pm 3800' of strike length, but pinches and swells for its entire length. Vein widths seen underground varied from $<6'' \rightarrow >10'$. The veins are mined with a modified underhand mining method with open stopes and stull support. Dip is fairly uniform $\pm 45^\circ$. The ore is blasted, falls to the sublevel, is mucked with a 1 yd. bucket and then to an ore "bin" and is then mucked from the ore bin into trucks where it is transported to the surface. The ore is sent to Playas, New Mexico for smelter flux. Shipping is approximately \$24/ton and the smelter credits 85% of the gold back to Congress. (Incidentally, they have sent \approx 600 T of sand tails to Hayden for testing.) Shipping costs to Playas are in the \$100/oz. range according to one of the geologists. He also told us that Echo Bay is making \$15-20/oz. profit on the ore.

During our tour underground, several things became readily apparent:

1. E.B.M.C. does not have a very aggressive sampling program. All headings and faces are sampled with a lackadaisical effort. Headings are mapped, but it did not appear that stopes were.
2. The vein pinches and swells and this can cause real grade control problems.
3. The details of the deposit do not appear to be understood. No structural contouring or isopaching of vein thickness has been done.
4. No testing of H.W. and F.W. are done and NO diamond drilling has been done underground to help to delineate the ore zones.
5. In defense of all the above, it seems that Echo Bay "fast tracked" the deposit into production to start to generate a cash flow. Development is way behind and there appears to be little flexibility for moving from stopes when the vein decreases in thickness or pinches out.

Geologically the deposit is very interesting and will present many challenges. Economically there are many things that need to be done to improve efficiency.

The deposit might be of interest to Asarco only in light of continuous source of flux to Hayden with significant precious metals now that they have lost their Tiger Mine tails. As the gold occurs in a very clean quartz vein the Si content must be quite high. If the property could be purchased at a reasonable price, additional work could be done to improve on the underground efficiencies. At \$10M it is too expensive.

MAM:mek



Mark A. Miller

cc: J.D. Sell
W.L. Kurtz



The Northern Miner, July 3, 1989, p. 2-3

Congress

June 13 '89 reserves 431,000 tons @ 0.29 Au = 125,000 oz
~~using 0.52 Ag~~ = 224,120 oz

~~Congress
The ~~new~~ VM premise = 990,000 @ 0.48 Au = 432,500 Au + 466,000 Ag
0.52 Ag = 370,000 oz Au prod.
495,000~~

see SECTION, RLW
Yoverai @

Congress

Previous (1887-1950) ~~990,000 tons @ 0.48 Au~~

Tons Au/Ag Au Ag
990,000 @ 0.48 Au / 0.52 Ag = 432,500 oz Au + 466,000 oz Ag

Reserves.

431,000 @ 0.29 Au / say 0.3 Ag = 125,000 oz Au + 129,000 oz Ag
557,000 oz Au + 595,000 oz Ag

W#-K-JDS

RECEIVED

MAY 13 1991

INFORMATION DEPARTMENT

George Cross News Letter

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1710-609 GRANVILLE ST.
P.O. BOX 10363 STOCK EXCHANGE TOWER
VANCOUVER, B.C.
V7Y 1G5

(604) 683-7265
FAX (604) 683-5306

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WESTERN CANADIAN INVESTMENTS

ber 2, 1991

The Northern Miner, Vol. 77, No. 26, Sept 2, 1991 p. 20

left message
on answering phone
12/20/91

Wayne Webber
818/789 4228
Sherman Oaks, CA.

12/10/91

Would like plan of #2 shaft at Octave

1940 mag.
 1400 level connected with #3 shaft ± 400' away
 1500 " probably connected (50' to 80') + 100' west (from both shafts)
 1600 " " " (70' to 80') + 30' west (from both shafts)
 1800 " only 150' west (no stubs on #3 or #2 for connection)
 #2 shaft scarping, 9' by vein ~~is~~ 8' wide, ave 3' @ ^{eastern} Octave.
 prob goes to 2000 level but no station shown, w/ 50' scarp.
 (Same as #3 shaft) (1600' along 30° declivity)

Closest & relevant location
ASARCO left in late 1942, AZ Eastern Gold Mines.

The New York Times, Vol. 79, No. 50
Feb. 14, 1994 p. 3