Giant King Gold Mine, Nevada County, California
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Overview

From August 10th to 14th, 2012, a cursory field examination of the Giant King mine was conducted by the author (see vitae, page 13) which included the lower two tunnels (referred to as No. 1 Tunnel and No. 2 Tunnel) and walked a small portion of the property (Figure 1). The Upper tunnel was partially caved and not entered, but at some point, these workings need to be examined and sampled.

Figure 1. Looking down a 40° slope above the Giant King Mine.

The Giant King mine is in the Washington District of Nevada County a short distance from the town of Washington (~200 residents), and 14 to 16 miles east of Nevada City and Grass Valley.

According to claim maps provided by the mine owners, the property includes 480 acres of contiguous claims within 24 unpatented lode claims that enclose the Giant King mine and much of the Alpha hydraulic mine (Figure 2).

Figure 2. Lode claim map. The Alpha mine lies on the eastern edge of the claims block.

The Giant King mine lies along the Melones Fault Zone (MFZ) that includes the Mother Lode trend to the south and the 16-to-1 Mine to the north. Gold was recovered from both placer and lode deposits throughout this belt. Total gold production from California to date, has been approximately 118 million ounces – more than most countries in the world.
A few hundred diamonds were also found nearby. Many were recovered from placers in the Oroville area 40 miles to the west-northwest. The Cherokee and French Corral gold placers in the Oroville region also yielded diamonds: Nevada County lies upslope from these. Other gems (benitoite and sapphire) were identified in a placer 25 miles to the north of the Giant King mine (Hausel, personal field notes). A possible source for such gems would be aluminous serpentinite and a source for diamonds has been postulated as tectonically emplaced, mantle-derived serpentinitized peridotites (serpentinites) similar to those discovered at Beni Bousera in Morocco (Erlich and Hausel, 2000). Whether such high-pressure serpentinites exist in the Washington district was not investigated.

History & Geology

According to Western Mining History, the Washington district (which includes the Giant King mine) was caught up in the great California gold rush during the second half of the 19th century, and placers in the Middle Yuba River immediately downstream from the Giant King were mined for gold. The Omega and Alpha hydraulic mines were opened in the middle 1850s and worked on a major scale through the 1880s.

Lode mining began in the 1850s and continued until about 1915. There was renewed activity during the 1930s (author’s note – gold mines were closed during the two world wars). The nearby Red Ledge mine was worked for gold and chromite. The Red Ledge produced some samples with visible gold. According to a brief summary at Mindat.org, the gold-quartz veins at Red Ledge were in sedimentary rocks close to a contact with serpentine (author’s note – this geology is similar the Giant King). At the Red Ledge, mariposite was reported to be associated with altered serpentine as well as in close proximity to gold; and this appears to be a very important association with gold at the 16 to 1 mine north of the Giant King mine. Mariposite is distinctly colored, chrome-bearing mica.

Western Mining History’s website further describes the Washington district as being underlain by slate, schist and quartzite of the Blue Canyon Formation. A serpentine body one to two miles wide crops out in the central portion of the district. The Relief quartzite (Carboniferous) and amphibolite lie to the west and granodiorite to the east. The serpentine is a south extension of a belt that passes north-northwest through Alleghany and Goodyear’s Bar in Sierra County to the north. Tertiary andesite overlies the main ridges to the north and south.

The auriferous Tertiary channel gravels at Alpha and Omega are part of the main channel that extends west and north to Relief and North Bloomfield. Jarmin (1927) estimated that, at Omega, 13 million yards were mined and yielded 13.5 cents in gold per yard. Lindgren (1911) estimated that 40 million yards remained. The quartz veins contain small but rich ore bodies, similar to those of the Alleghany district to the north, but are not as plentiful.
Except for arsenopyrite, sulfides are not usually abundant. A number of beautiful specimens of crystallized gold have been found in the Red Ledge mine. The Spanish mine also has yielded large amounts of barite.

Following discovery of a quartz vein in Washington Creek (a tributary of the Yuba River) in 1891, development of the Giant King mine and mill began. Some gold was mined from the property, which was closed during World War I and World War II. And like several gold mines closed by the War Minerals Board, the Giant King never re-opened. The history of the mine and events can be reviewed at the Giant King Mine’s website.

Figure 3. Geological map of the Giant King mine area (Saucedo and Wagner, 1992). The central purple band is serpentinized peridotite in the Melones fault zone. The light-blue band to the east is slate of the Shoo Fly complex (the primary host for the Giant King mine). To the west of the MFZ (light-blue band) are Calaveras Complex rocks (includes chert and argillites).

The mine was dug in metasedimentary rocks (slate) along the edge of the MFZ of the California gold belt (Figure 3). The Giant King encloses three main veins referred to as the Queen Vein, Central Vein, and King Vein in this report. Minor veins also occur in the mine and some may have potential as unrecognized mineralized zones. These need to be investigated for gold content. Recommendations are summarized in the last section of this report.

Figure 4. Left, folded slate. Right, narrow fault with offset veins.
Based on the geological map compiled by Saucedo and Wagner (1992), the primary host for the Giant King mine is the northerly-trending Shoo Fly Slate. The slate is dark-gray, fissile, clayey metamorphosed sedimentary rock that weathers brown to tan and has strong foliation likely paralleling original sedimentary bedding. The rock units are tilted in the mine and sit on edge and may even be overturned locally. The slate is folded with several minor faults with only apparent minor offset (Figure 4). No major offsets were observed on any fault in the mine. The Slate lies in contact with serpentinite of the MFZ a very short distance west of the mine portals (the contact is likely marked by Washington Creek).

The MFZ is an important structure recognized in the Mother Lode district to the south, where it represents a major fracture of the foothills fault system of the western Sierra Nevada Mountains separating Mesozoic rocks to the west from Paleozoic rocks to the east. It is likely a conduit that tapped auriferous solutions at great depth during tectonic deformation in the geological past. Gold and silica (quartz) rose from these depths in the Mother Lode district as illustrated by some mines in the district that reached depths as great as 5,000 feet. It is likely that much of this gold was derived from the serpentinites of the MFZ.

Along the northern portion of the MFZ (and in the vicinity of the Giant King mine), this suture cuts Paleozoic stratigraphy exposing Paleozoic rocks on both sides of the fault. Movement along the MFZ is complex and may include both strike-slip and dip-slip components (Cebull and Russell, 1979).

The MFZ is likely important in controlling emplacement of gold-quartz veins in the Alleghany and the Mother Lode districts to the north and south of the Washington district, and should also be a gold target in the Washington district (Figure 5).

The MFZ is mapped immediately west of the Giant King mine portals. Even so, the Lower Tunnel cuts a distinct shear zone characteristic of the MFZ that could represent a narrow off-shoot of the MFZ near the mine face. This shear encloses several; narrow, vertical quartz veins that were followed by a north-northeasterly drift for a short distance (Figure 6). The drift likely was the last development in the mine.
prior to closure during World War II and it does not appear that this suture was sampled or tested for gold (see Recommendations). This structure is identified as the King Vein in this report (see Figures 6 and 8).

Figure 6. King vein (shear zone) exposed in mine drift. Photo taken at manway connecting Lower Tunnel (No. 1) to Middle Tunnel (No. 2).

Comments on Cushwa Letters to Marshall (Spring Hill Gold Mines)

Author’s note: Giant King Mine LLC recovered a group of historical letters written to Mr. Stewart M. Marshall with Spring Hill Gold Mines Inc, in San Francisco from Mr. C.C. Cushwa with Spring Hill Gold Mines Inc., in Grass Valley, California. These letters are dated in the years 1938 and 1939.

It is apparent Mr. Cushwa was either a geologist or mining engineer employed by Spring Hill Gold Mines sent to examine the Giant King mine with the possibility of acquiring the property. These letters are available on Giant King Mine, LLC’s website at: http://giantkingmine.com and are downloadable under the ‘Mine History’ section. The letters provide insight into the mine’s ore grades and mill recoveries. After reviewing these letters following my field examination, there were comments I felt necessary, as they provide insight into the nature of the ore at the Giant King.

Letter dated September 30th, 1939 (gold prices ~ $35/ounce): Mr. C.C. Cushwa writes, “Above the intermediate tunnel (Middle Tunnel 2) there are at least two places in which a thickness of 20 feet of quartz is exposed. Rondoni says these exposures will assay $10 to $15 (0.29 to 0.43 opt Au) (note WDH: I converted these values to ounces per ton: opt Au = troy ounces per ton of gold) while the general average of the orebody will hold around $8.00 per ton” (0.23 opt Au).

Cushwa continues, “...there is little chance of establishing the presence of considerable ore deposits unless a definite connection with igneous intrusions is evident.”

Note (WDH = W. Dan Hausel) – There are many ways ore bodies form: notable are metamorphogenic gold deposits (Hausel and Hausel, 2011). At depth in the crust beneath California, rocks were subjected to high pressures and temperatures related to burial and to plate tectonic movements; thus no igneous intrusion is necessary to provide quartz and gold for ore bodies. Such metamorphic processes are well-established as a source for many gold deposits in the world. Most important are pathways from the deep crust and source rocks that have greater than average crustal abundance of gold. Serpentinites (and other ultramafic rocks) provide excellent source rocks for gold if the gold can be leached from the rocks and mobilized. Shear zones and other faults provide conduits for gold solutions and the metamorphic and tectonic processes provide a method for mobilizing gold from host rocks at depth.
The assays reported by Rondoni in Cushwa’s letter are respectable and if these values are continuous throughout the vein and a large resource tonnage can be established, the property should be of interest for further exploration. In the recent past (2000-2006) many gold companies focused on deposits with at least 1 million contained ounces of gold. Since that time, the price of gold has risen more than $1,000 per ounce (costs in mining have also risen). Thus, exploration should focus on identifying a resource of 0.5 to 1 million ounces within the Giant King property.

When I visited the Homestake Mine in 1990 and 1991, gold prices averaged about $380/ounce, and the underground operations had reached 8,000 feet deep. The cutoff grade and ore thickness was 0.15 opt Au at a minimum 48-foot thickness. Thus portions of the Giant King veins appear to have commercial grades based on the historical assays. However, sufficient tonnage is lacking in the tunnels. Future exploration should focus on finding additional veins on the property, and in particular, following the known veins (Queen, Central and King veins) at depth.

At the Giant King, gold is reportedly found in three tunnels (and likely on the surface above the upper tunnel) from 3500 feet to 3,100 feet (400 feet) in steeply dipping veins. There is considerable rock in-between these tunnels with no drilling and there has been no drilling under the Lower Tunnel. If the veins are typical of the Mother Lode, one should expect continuity to at least 5,000 feet deep, or more. What happens to the veins at depth is unknown – are they offset along faults, do they pinch or swell, does the gold grade decrease or increase? Continuity of the Central and King Veins over the 400 feet cut by the portals needs to be established (see Figure 8).

Cushwa writes “…the upper tunnel, in which the quartz shows a mining thickness of 75 feet, while the length of the entire strike is several hundred feet: over 300”’. He continues, “… estimated the available tonnage of ore at 100,000 tons plus, ranging in grade from $7 to $8 (0.2 to 0.23 opt Au)”. He also writes, “… failure to pay seems to have been due to metallurgical difficulties rather than to grade of the ore.” “…much of the values contained in the sulfides were lost”. “… arsenic and antimony content of the concentrates shipped”.

Note (WDH) – The reported arsenic and antimony suggests presence of arsenic sulfides and antimony sulfides such as arsenopyrite (FeAsS), berthierite (FeSb₂S₄), and/or stibnite (Sb₂S₃). These sulfides often contain gold in mineralized terrains like the Mother Lode. I did not see a large percentage of sulfides in the mine (<1 to 5%). Based on Cushwa’s estimate of 100,000 tons at a grade of 0.23 opt Au, this would imply 23,000 contained ounces present (~$38.6 million at today’s gold price).

Giant King Mine LLC recently submitted a sample of arsenopyrite for assay (May 17, 2012, report # 0517-14-157) to Southern Spectrographic Laboratory, Irvine, TX and showed the following:

<table>
<thead>
<tr>
<th>Element</th>
<th>Concentration</th>
<th>Unit</th>
</tr>
</thead>
<tbody>
<tr>
<td>Gold</td>
<td>74.0 ppm</td>
<td>2.15 oz/ton</td>
</tr>
<tr>
<td>Silver</td>
<td>52.0 ppm</td>
<td>1.51 oz/ton</td>
</tr>
<tr>
<td>Arsenic</td>
<td>17.4 %</td>
<td>4,940 oz/ton</td>
</tr>
<tr>
<td>Platinum</td>
<td>None Detected</td>
<td>&lt; 0.03 oz/ton</td>
</tr>
<tr>
<td>Palladium</td>
<td>None Detected</td>
<td>&lt; 0.03 oz/ton</td>
</tr>
<tr>
<td>Rhodium</td>
<td>None Detected</td>
<td>&lt; 0.03 oz/ton</td>
</tr>
</tbody>
</table>

It is not unreasonable for arsenopyrite to contain significant gold and silver.

Cushwa continues, “… tonnage of ore blocked out: at a guess, it cannot be less than 30,000 tons”.
Note (WDH): A 30,000-ton resource at an average ore grade of 0.23 opt, would have 6,900 contained ounces. At today’s gold price this would be $11 million in gold.

“... there is a total of 340 feet of drifts on the lowest tunnel, only 125 feet of which is on the giant King vein...”

**October 19th, 1938.** In reference to Giant King ore being treated at the Gracie mill, Cushwa writes, “They are treating about 35 tons per day, which their assays show to be running better than $9 per ton (>0.26 opt Au) with tails assays at 0.005 opt Au...”

Note (WDH): The above statement indicates the Gracie Mill was not losing much value because of metallurgical problems at this mill. This could be due to the low percentage of sulfides in the quartz veins in the mine?

“The drift has been advanced a total of 100 feet beyond the north end of the old stope...they say they have found high-grade ore in the north end of the drift.”

Note (WDH): Cushwa does not indicate which mine level – could this be the Giant King vein near the face of the lower tunnel that remains unsampled (see figure 8).

**November 12th, 1939.** Cushwa writes, “the mine is working steadily, filling up the Hoff stope with ore from the walls, Rondoni says he has over 4,000 tons broken in that stope, and that he will have over 10,000 tons broken when the mill is ready to run”.

Note (WDH): The floor of the Lower Tunnel from near the Queen vein to the mine face is covered with broken rock that has not been mucked. This area is difficult to squeeze through and likely has 2 to 3 feet (or more) thickness of ore mined from the stope near to the manway (Hoff stope?). I’m unaware of assays on this material, but it could represent a sizable potential gold resource that has already been mined and waiting to be mucked and hauled to a mill. The tonnage mentioned in the Cushwa letter is notable.

1911 Report on the Giant King Group to the Washington Mining & Milling Company (Gold Price - $18.92/ounce) – L.C. Gilliam

L.C. Gilliam spent 15 days at the Giant King mine in 1911 and collected 71 samples for assay. These are listed on a mine map provided by Giant King Mines, LLC (see Figure 8). Gilliam’s report is found on the Giant King website in the same section as the Cushwa letters.

Gilliam writes, “We took 71 samples from the different workings of the mine ... We find from these samples a growing condition of better value at depth...”

**Upper Tunnel.** “We find ... assay numbers 1 to 5... taken at 10-foot intervals in the hanging wall drift, very low values averaging 28 cents per ton (0.015 opt Au)”. Numbers 6 to 14 inclusive represent 9-foot channel samples taken along the length of the tunnel ... to average $0.75 per ton (0.04 opt Au). ... Numbers 15 and 16 ... gave $0.70 (0.037 opt Au)”.

Note (WDH): These are very low-grade for underground operations. Even so, the values could be looked at as a near surface resource that is 91-feet wide (or more) which could be recovered in open...
cut. If the first five samples (1-5) are included, this would increase to a 141-foot wide, low-grade mineralized zone from 0 to ~200-feet deep. It is unclear as to where samples 15 and 16 were located in the upper tunnel (see Figure 8).

**Number 2 Tunnel. “Hanging wall vein: “... we took 11 samples including numbers 17 to 21 and numbers 43 to 48 inclusive, ... all in the same orebody, which gave an average of $5.6/ton (0.3 opt Au) and an average width of 3.1 feet”.

Note (WDH): Sample 45 assayed 0.81 opt Au and sample 17 assayed 1.18 opt Au. These are high-enough grade that they likely exhibited some visible gold. I am not clear where they got a width of 3.1 feet, as the samples on the assay map suggest a width of more than 9 feet.

“Sample numbers 22, 23 ... give an average of $2.79 (0.15 opt Au) and has a width of 12 feet”. “As these numbers rightfully belong to the west stope we have included them with numbers 24, 25, 34, 35, 36, 37 and 38, which gave an average of $3.13 (0.17 opt Au); average width 4.15 feet”.

Note (WDH): The assay map suggests the width of these samples totaled 41-feet rather than 4.15 feet.

**Hanging Wall Stope. “Numbers 26 to 33 inclusive (east stope) are from the hanging wall stope in number 2 tunnel and average $2.7 in value (0.14 opt Au) and 3.56 feet wide”.

Note (WDH): Again the width of the mineralized zone, based on the assay map, appears to be much greater. Possibly Gilliam is suggesting each sample averages 3.56 feet wide. The total width of this zone appears to be 30.5 feet. Gilliam stated that in one place in this stope he saw some very rich ore with gold visible to the naked eye.

**Queen Vein. “We took three 10-foot sections on what is called the Queen vein along the No. 2 tunnel, which gave an average of $2.47 per ton (0.13 opt Au) across 30 feet.

**Lower Tunnel, King Vein. Numbers 60 to 71 inclusive, are from what occurs...to be a spur of the main King vein – locally called Lenze, which gave ... an average of $2.60 (0.14 opt Au) and an average width of 5.5 feet.

Note (WDH): Again the width does not match what is shown on the assay map. The assay map shows a total width of 20 feet. If one takes this as being the lower portion of the Queen Vein, it can be projected upward into Tunnel 2 to the Queen vein and up to the Upper Tunnel to the low-grade zone giving a vein with an apparent dip of 76° to 80° westerly. In future reports, the mineralized zones should all be referred to with specific names to help alleviate problems (See Figure 8).

**RECOMMENDATIONS**

(1) Assays & Sampling. A sampling program for the Giant King Mine for gold and silver should be scheduled to verify the historical assay reports. Sample locations need to be identified and in most cases samples should be channel or composite chip samples taken over identified lengths (Figure 7). The low-grade zone near the portal of the Lower Tunnel needs to be sampled as does the Queen, Central and King
Veins in all three tunnels to establish what values these veins have. Duplicate assays should be completed by a reputable lab in the mining industry.

The Giant King vein (shear zone) is exposed in the crosscut at the mine face in the Lower Tunnel (No. 1) (Figure 6). This is a shear zone (ductile fault) with numerous quartz veinlets in mylonite (crushed rock) with no record of sampling or assay results that I’m aware of. The width of the structure is unknown as the hanging wall of the shear does not appear to be exposed. It dips 65° or greater easterly and may be cut by Tunnel 2 above (between the dam and mine face) and the Upper Tunnel No. 3 near its mine face based on projections using dips measure in the mine. The mylonite with veins implies this zone has similarities to MFZ. I recommend channel sampling this structure to determine if it has value. If it does, the attitude (strike and dip) of the structure with thickness (width) needs should be determined.

Figure 7. Location of 1911 channel sample in the Central Vein in east stope of Tunnel 2. Note the abundant quartz and limonite (tawny-colored stains) in the mine rib. The limonite likely originated from oxidation of primary sulfides.

It is possible that the upper part of the Central and King veins were not sampled in the Upper Tunnel (see Figure 8). This needs to be investigated. It is possible that the King Vein is exposed in the Middle Tunnel (No. 2) and also not sampled. If it was cut by Tunnel 2, the vein would likely be near the mine face past the dam, otherwise, it should lie a short distance past the mine face.

It appears that the Central Vein and the King Vein were not sampled in the Lower Tunnel (No. 1). This needs to be done.

(2) Geological map. When time permits, a geological map of mine tunnels should be completed to provide insight into vein, wallrock, fault, rock type, and wallrock alteration relationships.

(3) Surface exploration. It is recommended to explore the surface above the Giant King mine using the Alpha road to dig a long trench (backhoe or dozer) easterly from the Upper Tunnel to search for hidden veins as well as surface exposures of the Queen, Central and King veins. Immediately west of the mine portals (west side of Washington Creek) should be explored for veins in the MFZ.

(4) Guides to gold along MFZ (mariposite, quartz, and/or sulfides). A search for guide minerals might be valuable in the King Vein and in the MFZ west of the mine portals. The presence of mariposite (chrome mica) is a guide to high-grade gold in the Mother Lode belt. It should be distinct in the King Vein if found, but will be more difficult to recognize in MFZ rocks because of their similar color.

(5) Drilling. A drilling program is needed to determine if the three veins continue at depth to at least 1,000 feet to prove continuity and increase tonnage. If the King Vein proves to have assay values of good
grade in the crosscut drift of the Lower Tunnel (No. 1), the width of the shear would need to be determined by drilling into the mine face on the Lower Tunnel.

(6) Any placer samples taken in the nearby drainages adjacent to serpentinite (or MFZ) should be examined for diamonds, sapphire, palladium, platinum and benitoite along with gold.

(7) Ore on the floor of Lower Tunnel (No. 1). Broken ore stored on the floor of the Lower Tunnel near the mine face could represent a resource of ready-to-mill ore (See page 8, Nov. 12, 1939). I’m unaware of assays on this material, but, this tonnage could represent an already mined gold resource that could assist in start-up costs at the mine. The material should be sampled and assayed at some point.

Figure 8. Cross-section and sketch map of mine workings at the Giant King with my notes and vein projections. There appears to be three parallel veins (targets) in the mine as well as a lack of samples in the Upper and Lower Tunnels on both the Central and King Veins. The King Vein may have been cut in the Central Tunnel just past the dam near the mine face. Otherwise, it may be just beyond the mine face.
References Cited


Saucedo, G.J., and Wagner, D.L., 1992, Geological map of the Chico Quadrangle, California (1:125,000)

*Looking towards the mine portal within the Giant King mine.*
W. Dan Hausel was a member of the 7-man discovery team of the Donlin Creek gold deposit in Alaska in 1988 and 1989. NovaGold and the Northern Miner (2012) suggested this discovery is “possibly the most important project in the world today”. Containing at least 41-million ounces of gold, Donlin Creek stands with the giants in history, including the Homestake mine that produced 40 million ounces over its 125 year history. For this discovery, these seven geologists were awarded the top honor in economic geology and presented the Prospectors and Developers Association of Canada’s 2009 Thayer Lindsley Award for an International Mineral Discovery. The PDAC is the largest hard rock mining association in the world.

Hausel has developed a reputation for mineral discoveries that only a handful of geologists in the world have achieved. In 1981 he found significant gold in the Seminoe Mountains greenstone belt. In 1982 he discovered the Rattlesnake Hills gold district: an entire gold district with Kalgoorlie- and Cripple Creek-type gold deposits. This district has yielded fabulous drill intercepts as it appears to host another gold deposit comparable to the rich Cripple Creek deposit.

His discoveries include numerous colored gemstone and diamond deposits. In fact, PlanetNews recently noted so many gemstone discoveries were made that the State of Wyoming was transformed from a little known gem hunting region to having the most diversified cache of gemstones in the US with potential to produced considerable deposits. At least one of these is now considered as a world-class (undeveloped) gemstone deposit. A list of many of these discoveries is available on the GemHunter website.

For his work (which includes more than 1,000 publications and mapping of more than 1,000 square kilometers of complex geological terrains), he has been presented with many awards.

Hausel graduated with BS and MS degrees in Geology from the College of Mines at the University of Utah in 1972 and 1974. He was employed by the University of Utah to research lunar samples, employed by the University of New Mexico as an assistant instructor in geology, worked for the US Geological Survey, was employed as a research geologist at the Wyoming Geological Survey (University of Wyoming) and VP of US Exploration for DiamonEx Ltd.