

Gold mine shines again

Reopened Lamaque mine revs up

By Marilyn Scales

High gold prices have many hopefuls re-examining old mines. Here is the story of one such project done right.

The former Lamaque gold mine in Val d'Or, QC, has a proud history going back to 1937. The Lamaque mine produced 4.6 million oz of gold in the next 40 years. Both the Lamaque and Sigma (4.3 million oz) properties changed hands in 1997, and the new owner expanded the mill and redeveloped the mines as large-scale open pits. The property was briefly in production in 2003, but suspended again.

Century Mining came on the scene in September 2004 when it acquired the Sigma-Lamaque complex, and began making plans to take advantage of the strong gold price. Century restarted the Sigma pit in May 2005 to create cash flow. The next year it began underground exploration at Lamaque. A bulk sample was taken from the Lamaque project in 2008.

Then the global financial crisis and



Visible gold is often seen in the quartz veins in the Lamaque mine.

PHOTO CREDIT: Century Mining Corp

lack of access to capital forced Century to put underground development on hold. Finally, in January 2010 the company raised \$60.75 million to bring the Lamaque project back into production and expand capacity at its other gold pro-

ducer, the San Juan mine in Peru.

The first gold from the reopened Lamaque underground mine was poured at the Sigma mill on April 30, 2010, and everyone is looking forward to an average annual production of 100,000 oz in each of the planned 11 years of mine life.

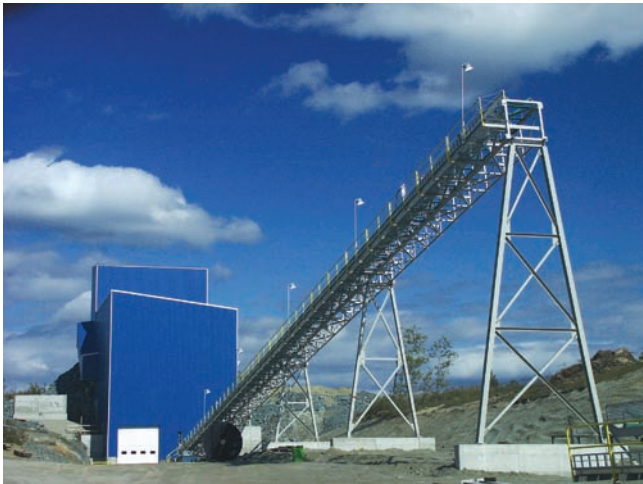
A short geology

The Val d'Or region of northern Quebec is aptly named; the Sigma-Lamaque complex is one of a multitude of successful gold producers. It is the largest of a group of shear-zone related quartz vein deposits within the Cadillac Tectonic Zone. From Century Mining's website: *The network of veins is hosted by andesitic flow and volcanoclastic rocks intruded by an irregular mass of subvolcanic porphyritic diorite. High level porphyry dykes, striking east-west and dipping steeply to the south, overprint both rock types, and are in turn locally cut by steeply plunging non-porphyritic stocks that are associated with*



The low-profile Atlas Copco single-boom jumbo has mechanized the recovery of narrow, flat-lying veins.

PHOTO CREDIT: Century Mining Corp



Metso supplied the new jaw crusher and Hydrocone at the Lamaque mine. They are housed in this building.

PHOTO CREDIT: Century Mining Corp.



The Sigma mill that treats Lamaque's gold ore offers considerable flexibility and scalability as the throughput rate changes.

PHOTO CREDIT: Century Mining Corp.

mineralized veins.

Mineralogical assemblages for the major lithological units indicate that greenschist facies metamorphism was attained during various stages of regional deformation with the amphibole facies attained at the lowest levels of the underground mine. All intrusive rocks are overprinted by conjugate reverse oblique shear zones, striking east-west and dipping moderately to steeply north or south, with which mineralized veins are associated.

In light of such complex formations, it is a blessing that the host rock is non-acid-generating and free of such harmful compounds as arsenic. Piles of unsightly waste rock are being reduced thanks to a local contractor who is crushing the waste for road construction projects. Part of the deal was that Century could use his crushing plant for Lamaque ore until it upgraded and expanded its existing crusher station.

The numbers for the Lamaque underground mine include proven and probable reserves of 7.7 million tonnes at 4.6 g/t Au (1.1 million contained oz), measured and indicated resources of 8.3 million tonnes at 4.8 g/t (1.3 million oz), and inferred resources of 19.6 million tonnes at 5.0 g/t (3.1 million oz).

Three-phase mining plan

The Sigma and Lamaque mines lie next to each other, and both were originally developed with shafts to depths of 1,825 and 1,100 metres, respectively. Neither of the shafts is in use now, rather the stopes are reached through portals in the Sigma pit walls.

When *CMJ* visited the minesite in August, mining was underway through #2 portal in an area of flat-lying veins. "In this area, productivity has increased significantly since the introduction of low-profile equipment at the operation. A previous 60-ton jackleg round taking a shift to drill, blast bolt and slush out can now be done in much less time. The low-profile equipment can drill off twice the development or stope round in the room and pillar stopes in much less time and subsequently mucked out or extracted nearly five times as fast, and of course much cleaner, getting all the gold! It works out to nearly an eight- to ten-fold increase in productivity," said Century Director of Investor Relations Peter Ball, making the future of continued mining bright. The

mucking rate doubled each month since mining began, reaching over 820-t/d in July, with a record 375 tonnes in one shift by one low-profile equipment operator.

Prior to 1987 when "chasing flats," engineers applied a jackleg and slusher method. As miners followed veins farther and farther from the drift, the distance was greater than a single pulley system could operate the slushers. Multiple slusher systems were added to a single stope, and that resulted in high labour demands and excessive dilution as the broken ore was remucked several times in succession. One miner is noted to have spent his entire 27-year career in one stope underground in the complex.

Today, mechanized room and pillar mining is being practiced using Atlas



A worker gives scale to the low-profile Atlas Copco Scooptram that boosts productivity in the Lamaque mine.

PHOTO CREDIT: Canadian Mining Journal

Copco low-profile equipment. Veins are followed making openings with backs less than 2 metres high. Results are showing that assigning two Scooptrams and one single-boom jumbo per stope, rates of 500 t/d can be achieved in active stopes. Muck is hauled up the ramp by 30-t Atlas Copco trucks.

The mine has yielded a couple of pleasant surprises. Chasing flats can create stopes as long as 2 km, much of the ore coming from outside the resource model. Thus reserve tonnage is maintained. And in the 108 stope, where some of the veins dip to the south rather than the north as predicted, drilling returned high-grade assays including one at 100.5 g/t Au over 1.7 metres in the Bedard dyke (named for chief geologist Paul Bedard).

The Bedard dyke will be the second mining area development. This is a porphyry dyke striking southwest and dipping steeply to the south. It outcrops on the west wall of the Sigma pit. Mineralization is found in flats both within the dyke and in the adjacent volcanic host rocks. The structure is suitable for longhole stoping.

The North Wall portal in the pit was marked and collaring was imminent in August. This is the third area of underground development and is also suitable for longhole mining.

In late July, the connection of the power grid was finalized to the underground workings, eliminating the need to generate electricity on site. This is expected to be a considerable cost savings and will assist in the long term to achieve the "life of mine" cash costs of US\$450-\$550 per ounce.



The North portal in the Sigma pit wall will access the third mining area planned for the Lamaque underground development.

PHOTO CREDIT: Canadian Mining Journal



During *CMJ's* tour, there was a short discussion about how competent the ground might be in the Lamaque mine.

"It's pretty good," said Bryan Bishop, corporate mining and planning engineer, "We are going back into the areas from years past and the ground looks like it did back 30-40 years ago."

"It's excellent," chimed in Allan McNutt, chief operating officer and acting mine general manager.

Mineral processing

Run-of-mine ore is trucked to the rebuilt crusher plant. Because the underground mining rate is currently only approximately 1,000 t/d, compared to 5,000 t/d when the Sigma pit was active, Century chose Metso to supply a new, smaller plant. There is a 865 by 105 mm jaw crusher and a HP400 Hydrocone crusher. They are followed by a triple-deck Tyler screening plant. Material goes to the

Sigma mill at nominally less than 12.5 mm, and the head grade has been approximately 4.0 g/t Au during startup. As the operation ramps up to full production, the company expects the life-of-mine head grade will be closer to 4.77 g/t Au.

The great advantage of using the Sigma mill is its flexibility and scalability, Mill Superintendent Norm Kock explained. The semi-autogenous (SAG) mill has been sold and removed. Four of the seven old leach agitators have been reconfigured to suit carbon-in-pulp (CIP) processing methods. Only one of the two high-capacity thickeners and two of the five leach tanks are required to be in service at this time until production is increased again in 2011.

There is no need to purchase new equipment or rework the piping to scale up the rate. "The first year we'll be using about one-third capacity," he said, "and





The low-profile Atlas Copco Scooptram is key to the efficient mining of flat-lying veins.

PHOTO CREDIT: Canadian Mining Journal

Looking ahead

The Lamaque mine looks to have a lengthy life ahead of it. Century is in the enviable position of having perhaps 5.0 million oz of gold in the ground and the technology to extract it safely and profitably. **CMJ**

maybe two-thirds over the life of the mine.”

The flowsheet is based on standard CIP recovery. The grinding line consists of one rod and one ball mill with a second ball mill on standby. The slurry is thickened and leached before passing through the CIP circuit. The carbon is stripped with hot caustic soda. An acid wash and carbon reactivation facilities are planned for the near future. The pregnant solution containing 30-40 g/L Au is plated on steel wool cathodes and then refined.

Kock explained the decision to use liquid sodium cyanide. The solution arrives in tanker trucks from Cyanco Canada and is pumped directly into a holding tank. This eliminates the need for manual handling of this toxic substance.

Gold recovery was running 95.6% in July and is expected to easily top 96% as the mill ramps up to its planned 1,200 t/d for 2010 and 2,000 t/d in 2011.



Only a rod mill and ball mill are used to treat Lamaque ore. There is a spare ball mill, but the SAG mill was sold and removed.

PHOTO CREDIT: Century Mining Corp.

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