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Modern Mining of Primary and Secondary Gem Deposits in Mogok, Myanmar

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The Mogok Stone Tract of central Myanmar has a long tradition of gem mining, exploiting both primary and secondary deposits. The main gems are ruby, sapphire, spinel, peridot, tourmaline and topaz, and the area is famous for producing some of the world's finest examples of many of these gem varieties—especially ruby. Mogok was closed to foreigners for decades until it was reopened in 2012; a special permit from the Burmese government is needed to visit there. In December 2014, a team from Gem-A visited the Mogok area, guided by Swiss gem dealer/collector Federico Bärlocher (for a general description of this trip, see [1] and [2]).

Numerous hard-rock (primary) ruby mines explore the 'marble ark' in the mountainous terrain of the Mogok area [3]. We visited the Mogok Pride mine in the Bapawdan area, located approximately 5 km northwest of Mogok. Geologic mapping by mine personnel showed the presence of two main marble units that are locally separated by a lens of garnet-sillimanite gneiss, leucogneiss, and schistose gneiss. This entire package is contained within garnet-biotite±sillimanite gneiss. One of the marble layers is mostly fine-grained and contains spinel mineralization, while the other is coarse-grained and hosts ruby. Leucogranite is locally present along the contact between the ruby-bearing marble and the host gneiss. The marble layers dip steeply to the south, and the mineralization locally occurs along specific horizons in the marble that follow the general trend of a natural karst system. The active workings consisted of a series of inclines and declines that follow the ruby-bearing horizons. Pneumatic drills were used to prepare the marble for explosives. The blasted marble was immediately placed into heavy-duty bags and secured with a theft-resistant tie. The bags were transported to the nearest adit using a cable-and-pulley system, and then to the surface in ore cars. Ruby mineralization is encountered only occasionally in the marble, and it is very rare to see gems in the mine exposures. In the brief time that we witnessed the processing of the ore, only one small ruby specimen was recovered.

We also visited a secondary gem deposit located 7.6 km northwest of Mogok, near the village of Ingyauk (or Injauk) in the Bernardmyo area. The large open pit is situated in a valley that contains material weathered from a variety of metamorphic and igneous rocks (e.g. marble, gneiss, and granitic pegmatites). At the time of our visit, mining was taking place approximately 15–20 m below the surface. Water cannons were used to wash material into a sump, and the slurry was then pumped out of the pit to a washing plant. Larger stones (+1 inch or 2.5 cm) were discarded, and the remainder of the material flowed into a jig. At the end of each day the miners removed the concentrate by hand. During our visit, only a small amount of gems were recovered. Most consisted of low-quality ruby, sapphire (colorless to yellow or blue), and spinel (pink-to-red, purple-grey, yellow, blue, or black), with some pale brown topaz, smoky quartz and black tourmaline. The corundum and spinel from this deposit are only rarely of gem quality, and typically consist of waterworn broken pieces, or less commonly as tabular pseudo-hexagonal crystals. By contrast, the topaz is mostly transparent and shows extremely variable degrees of rounding from alluvial transport. Some of the smoky quartz crystals recovered from the operation have sharp crystal faces and attain relatively large sizes (20+ cm long), suggesting that their original source rock was nearby.

In the future, more effort, equipment, and money (e.g. for laborers, fuel, explosives, maintenance, etc.) will be necessary to recover Mogok's gems from both primary and secondary deposits. Therefore continued success will require a combination of utilizing current technology, furthering geological knowledge, and employing expertise gained through years of mining experience.

References:

- [1] Laurs B (2015a) *Journal of Gemmology* 34(5): 387-388
- [2] Laurs B (2015b) *Journal of Gemmology* 34(5): 389-390
- [3] Themelis T (2008) *Gems & Mines of Mogok*. Self-published, 352 pp

