GEM TESTING LABORATORY
(Project of the Gem & Jewellery Export Promotion Council)

LAB INFORMATION CIRCULAR

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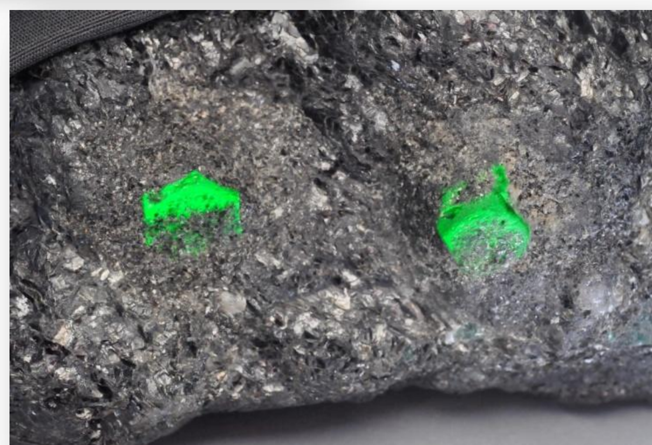
FAKE EMERALD ROUGH - GLASS FILLED IN MICA-ROCK

Reaching directly to the miners for procuring rough has always been profitable, but involves a huge amount of risk unless one has enough experience in buying at the source, deep knowledge about the stone being purchased, and handling the pressure thereof. Often, there have been cases when dealers tend to forget the possibilities of scams and frauds at mining sites or the markets nearby. The sellers at such locations often present glass, synthetic gems or other cheap natural gems as expensive gems in order to make some quick money. This practice is being followed at most of the major mining regions around the world for decades. At GTL, we routinely encounter such cases, some of which have also been discussed in past issues of Lab Information Circular.

Recently, we witnessed yet another example of such fraud, which although was not shocking to us, but definitely an interesting one. A 1075gm black micaceous rock was presented for identification (figure 1). Initial observations with unaided eyes from different angles suggested presence of several crystals, with hexagonal profile, embedded in the rock. Such rock formation is a common sight for those dealing in emerald rough, especially from locations where emerald is associated with mica (phlogopite) schist, such as Zambia.

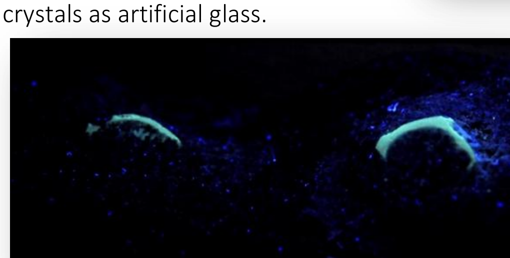
1. This 1075 gm micaceous rock (top and left) was embedded with elongated "hexagonal" crystals of artificial glass (marked with arrows). Note the difference of texture around embedded crystals and rest of the rock.

Careful observation using strong fibre-optic light surprised us! Under reflected light, only small areas or corners of the embedded crystals appeared green, while rest of the areas appeared dark, due to the presence of black mica on and around crystals. However, when light was transmitted through these crystals, they appeared bright green (figure 2), which raised suspicion about their origin. Such bright green colour under transmitted light, that too in an embedded crystal was never seen before. Further examination revealed a granular texture around these embedded crystals, while rest of the rock appeared flaky (again, figure 1 and 2); this supported our suspicion. These features suggested that micaceous rock was first drilled, then filled with green "hexagonal" crystals artificially, and the joints were covered with a mixture of glue and black mica. When observed under ultra-violet light, corners of the embedded crystals (mica-free areas) fluoresced chalky-yellow green (figure 3). Raman analysis confirmed these embedded crystals as artificial glass.



2. Under transmitted fibre-optic light, the embedded crystals appeared bright green, raising suspicion about their origin. Note the granular texture around embedded crystals.

Although, careful observations can detect such frauds, one has to remain alert while dealing with such rocks.



3. Edges of the embedded crystals, which were free from mica, fluoresced chalky yellow green under ultra-violet(long-wave and short-wave) light.

EUDIALYTE - AN UNKNOWN GEM

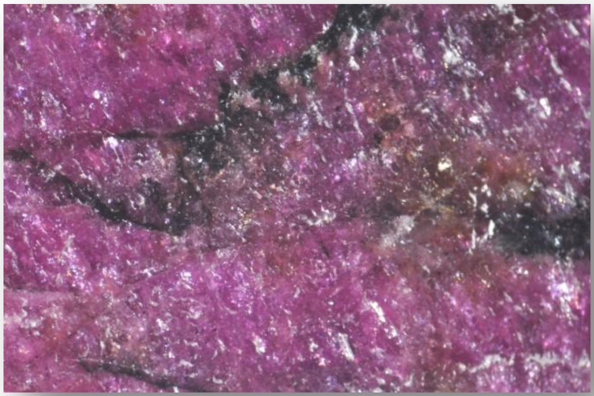
Not known to the gem and jewellery trade, but eudialyte is highly prized by mineral collectors. An extremely rare and complex silicate mineral, eudialyte can have multiple replacements of elements giving rise to a complex chemical formula - $Na_4(Ca,Ce)_2(Fe,Mn)ZrSi_8O_{22}(OH,Cl)_2$. Other than cerium, the structure also incorporates rare earth elements (REE) such as zirconium and yttrium.

Eudialyte ranges in colour from yellow, brown, red, pink, violet, orange, purple to even blue. Transparent facetable crystals of eudialyte are extremely rare, and is usually found in massive forms with granular appearance, suitable for making cabochons or beads; when found, facetable transparent material is usually small, mostly less than half a carat.

4. A 36.04 ct specimen of eudialyte, associated with dark brown veins of aegirine.

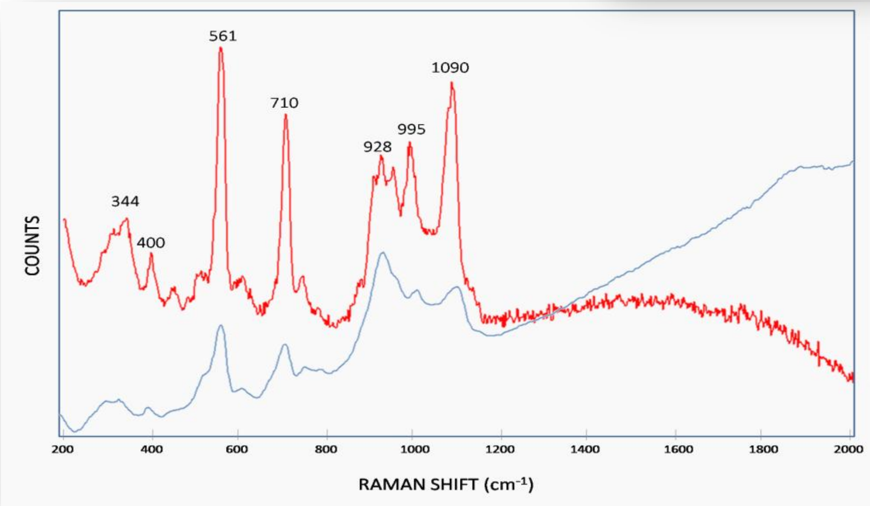
Recently, we at the Gem Testing Laboratory, Jaipur have seen few purplish pink faceted specimens of this rare mineral, mostly in massive form. The largest specimen weighed 36.04 ct, and was associated with some dark brown mineral, present as veins as well as crystals (figure 4). Refractive index for all the specimens was measured at ~1.610 with very low birefringence, hydrostatic specific gravity ranged from 3.05 to 3.10. Under desk-model spectroscope, weak lines were visible in the yellow-orange and green regions at ~ 595 and 525 nm, while they remained inert under ultra-violet light. Under microscope, the samples displayed parallel reflecting films (figure 5), transparent brown crystals and fluid inclusions, in addition to the dark brown crystals visible to the unaided eyes, mentioned above.

Standard gemmological properties were consistent with that reported for eudialyte in literature (e.g. M. O'Donoghue, *Gems: Their Sources, Descriptions and Identification*, 6th ed., Butterworth-Heinemann, London, 2006), however, identity of these specimens as eudialyte was established using Raman spectroscopy, which revealed major peaks at ~ 344, 400, 561, 710, 928, 995 and 1090 cm^{-1}, with smaller side peaks (figure 6). This spectral feature is consistent with that given for eudialyte in RRUFF database. In addition, Raman spectroscopy identified the brown veins / crystals as aegirine, a common associated mineral for eudialyte.



5. Parallel reflecting films in eudialyte.

Eudialyte has been found in Greenland, Norway, Russia, Sweden, Canada and USA. With the increasing demand for newer materials and continuous exploration of new regions and mining thereof, it will be interesting to observe the quantities of this rare gem being encountered in the gem trade in future.



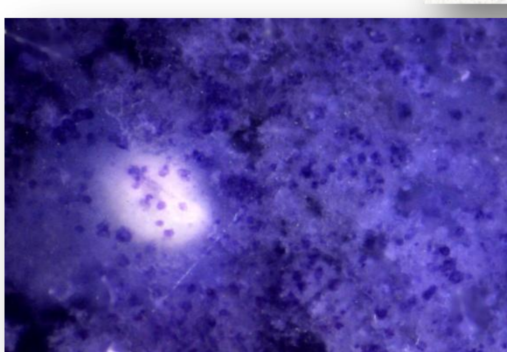
6. Representative Raman spectra of tested eudialyte samples (red trace) were consistent with that given in RRUFF database (blue

MORADO OPAL

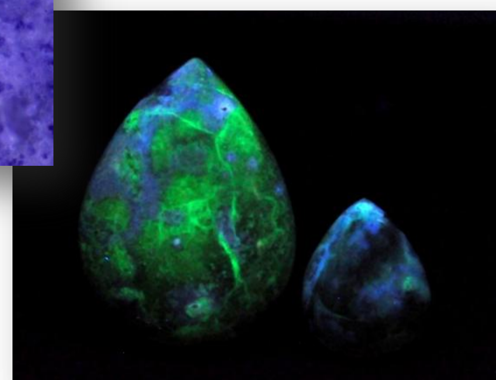
7. *Representative specimens of morado opal, displaying white and purple areas.*

Also known as "purple opal" or "opal royale", this variety of opal, classified as common opal is found in central Mexico. Morado opal is characterized by its purple to violet coloured patches, veins or bands against white background, forming an interesting ornamental material. In the past 3-4 years, this material has become quite popular amongst jewellery designers because of its subtle colour patterns and low costs. At the Gem Testing Laboratory also, we have seen many specimens (figure 7) of this material being submitted for testing, mostly as cabochons and beads.

All submitted specimens gave higher specific gravity measurements in the range of 2.20 to 2.30, while standard values for opals are usually lower than 2.20. Under higher magnifications, the purple areas appeared to be composed of tiny purple grains with a square profile (figure 8). Raman spectroscopy confirmed these grains as fluorite. This also suggests the cause of higher SG range for this type of opal. Another interesting feature of these opals is their strong patchy fluorescence under long-wave as well as short-wave ultra-violet light; the purple areas show blue fluorescence while white areas appear green (figure 9), indicating presence of uranium.



8. *Purple areas in morado opal appeared to be composed of tiny grains of fluorite. Note the square profile of these grains.*



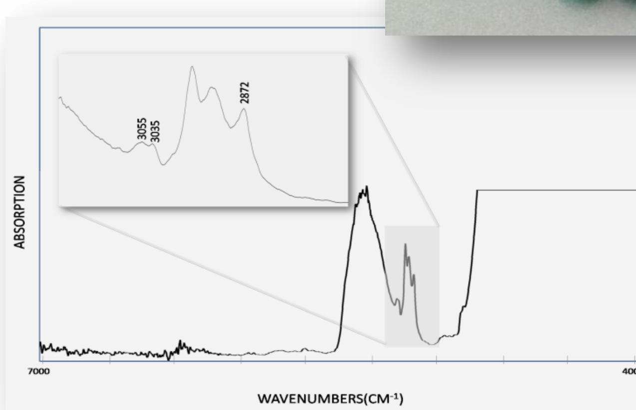
9. *Strong patchy fluorescence of morado opals illustrated in figure 7, under short-wave UV*

RESIN-FILLED AMAZONITE

Since the past three months or so, there has been a significant increase in the number of amazonite specimens being submitted for identification at the laboratory, that too with uniform translucency and colour. Only few of them displayed white veins or mottling effect, typically associated with amazonite. Most of these specimens are fashioned as beads or cabochons, while the colour ranged from blue to green-blue to blue-green.

10. *This string of amazonite, showing uniform colour was filled with resin.*

Gemmological properties along with EDXRF data were consistent with potassium feldspar such as microcline, but their uniform colour and transparency raised a doubt regarding presence of some form of treatment. Microscopic observations did not reveal any colour concentrations; only some cleavage planes and whitish cloudy patches were present. However, FTIR spectra revealed strong features associated with resin.



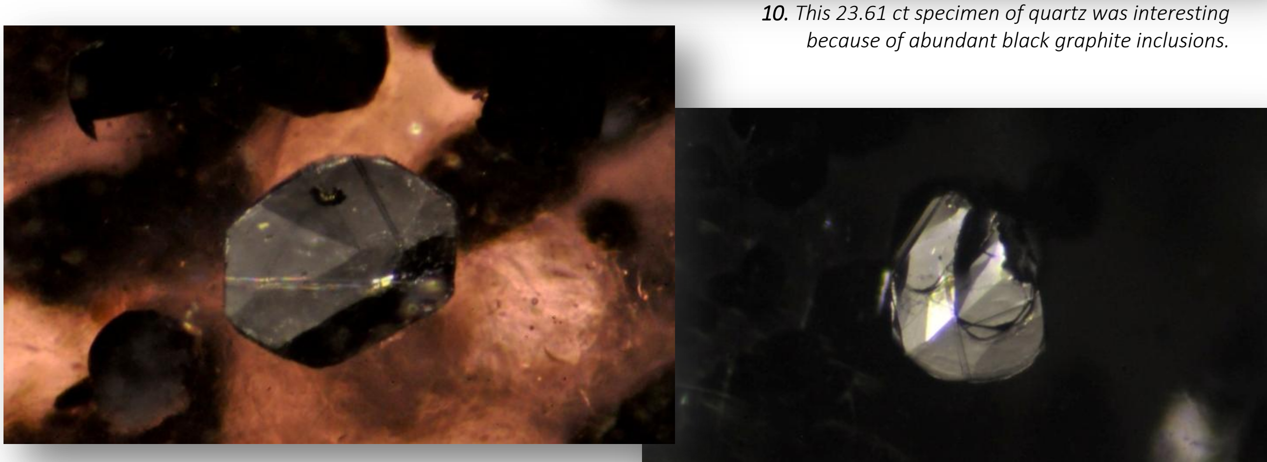
11. *FTIR spectra of amazonite displaying strong resin-related peaks at ~3055, 3035 and 2872 cm-1.*

QUARTZ WITH GRAPHITE INCLUSIONS

Recently, we received a 23.61 ct cabochon with numerous eye-visible black to gray inclusions. The cabochon was identified as quartz (rock crystal), while Raman spectroscopy identified black inclusions as graphite. These black inclusions appeared platy and opaque, with some complex pattern of crystal forms or faces; under reflected light, they appeared metallic, giving a silvery reflection.

Graphite, as inclusions have been observed in various other gems also such as garnets, quartz, spinel, diamond, corundum, topaz, zoisite, etc; they are often found as a component of phase inclusions in many gems too. However, such abundant quantities of graphite inclusions in this quartz made it an interesting specimen.

10. This 23.61 ct specimen of quartz was interesting because of abundant black graphite inclusions.



11. Black graphite inclusions appeared platy and opaque with complex crystal forms. Under reflected light they silvery (right.)

IN PHOTOS - GEMS FROM NAMIBIA

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