GJEPC INDIA

GEM TESTING LABORATORY

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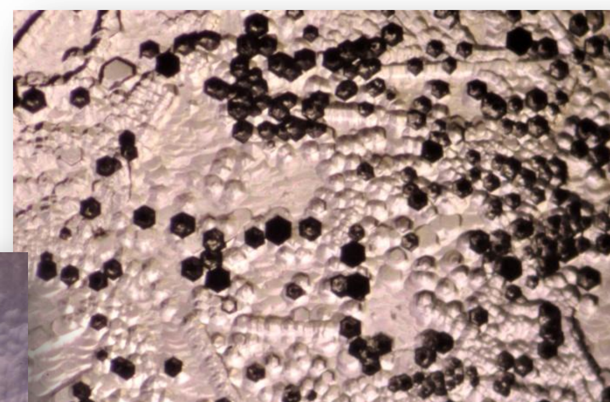
SYNTHETIC MOISSANITE AS 'FAKE' DIAMOND ROUGH

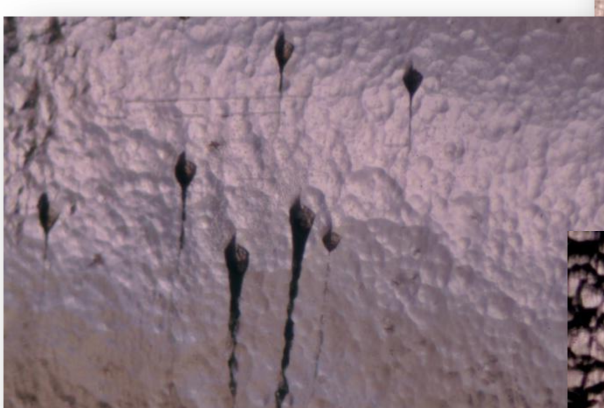
Since the later part of 2017, synthetic moissanite presented as rough diamond crystals, fashioned in the form of octahedrons (mostly distorted), has been a regular feature at the Gem Testing Laboratory, and that too, in impressive sizes of up to 16.51 carats. Recently, we received a light yellow sample (figure 1) of synthetic moissanite weighing 4.88 ct, fashioned as octahedron with flattened and rounded corners, displaying a frosty surface, typically associated with diamond rough.

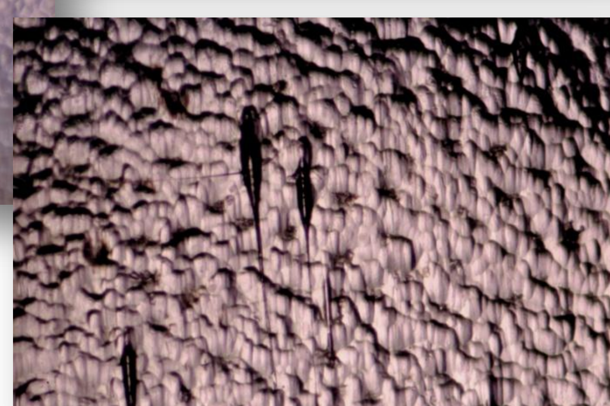
__1.__ This 4.88 ct light yellow synthetic moissanite, fashioned as octahedron with frosted surface was presented as diamond rough.

Closer examination of the sample indicated that the angles and patterns of the crystal were not consistent with that of a diamond. The surface features (responsible for the frosty appearance) ranged from hexagonal to pyramidal to rectangular on different faces (figure 2), whereas, a similar pattern of growth features is expected in a diamond crystal, because of its cubic nature. It was interesting to note that two opposite faces displayed hexagonal patterns (etch pits as well as growth hillocks), while the faces oriented perpendicular to these, displayed rectangular patterns; the intermediate areas displayed pyramidal patterns. This sample further displayed conical tube-like inclusions oriented in one direction, along the length of the rectangular growth patterns or perpendicular to the hexagonal patterns. Such growth features are often seen in crystals belonging to hexagonal or trigonal crystal systems.

The crystal pattern and growth features were sufficient enough to rule out the possibility of diamond rough, while identity of this specimen was established on the basis of its doubly refractive nature under crossed-polars, hydrostatic specific gravity of 3.20, infra-red and Raman spectroscopy.







__2.__ The moissanite crystal displayed hexagonal etch pits and growth hillocks on faces perpendicular to 'c' axis (top, right), rectangular hillocks on faces parallel to 'c' axis (bottom, right), and pyramidal patterns at intermediate faces (top). Also note the conical tubes oriented along the 'c' axis (top).

'GARNET-TOPPED DOUBLET' RESURFACED

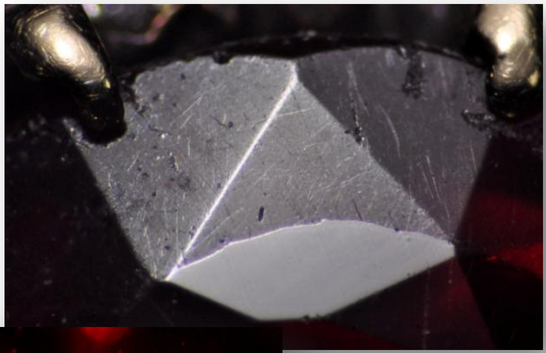
Garnet-topped doublets, commonly referred to as 'GTDs, were probably one of the oldest composites made to imitate expensive gems, especially rubies and sapphires. These doublets are in existence, dating from the Victorian era, where a thin slice of almandine garnet was fused over a piece of coloured glass; the two sections of these composites namely, garnet and a blob of glass were placed in a heated mould and fused together, to be cut and polished later, as per the need. The high lustre and refractive index (1.77) of garnet makes it a suitable material for table, especially when imitating corundum. In addition to rubies and sapphires, GTDs were also produced to imitate other common gems, such as emerald, peridot, topaz, etc.

3. This brownish-red 'garnet-topped doublet' specimen was recently submitted for identification at the Gem Testing Laboratory, Jaipur

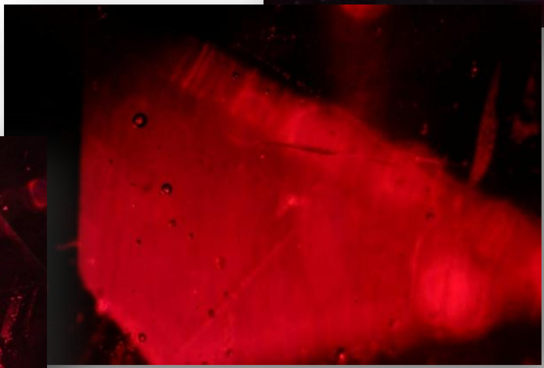
Today, these GTDs are rarely encountered in gem trade as well as laboratories, due to the availability of wide range of composites in fancy colours and patterns. However, recently we had an opportunity to examine a pin, mounted with a brownish red specimen of GTD (figure 3), thought to be a ruby. When viewed under reflected light, the red sample displayed a bright vitreous lustre on the table, however, some areas on crown had a duller lustre. Careful examination under the microscope revealed a sharp junction between dull and bright areas (figure 4), indicating presence of two materials with different refractive indices and hardness. The dull areas were also scratched showing signs of wear and tear, while the bright areas still carried a good polish. In addition to the lustre difference, the pavilion part displayed scattered gas bubbles along with flow lines or swirl marks (figure 5), while several planes of gas bubbles were present along and near the junction plane, giving fingerprint-like appearance (figure 6). Just to remind that the junction plane in GTDs usually does not follow the girdle edge, and can be positioned anywhere on crown or pavilion.

Measurable gemmological properties revealed single refractive index of 1.765 at table, lower crown and pavilion areas displayed a chalky fluorescence under short-wave ultraviolet, while table facet remained inert. Under desk-model spectroscope complete absorptions of wavelengths from violet to orange was visible, which is usually observed in selenium-coloured red glass; no almandine-related features could be seen. Identity of components as garnet and glass was further established on the basis of Raman spectroscopy conducted on both areas.

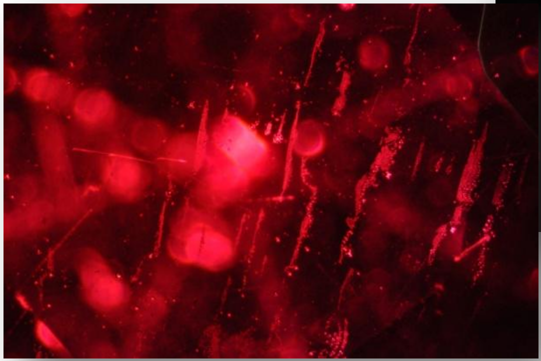
This GTD specimen was nothing unusual in itself, but its encounter after a long period of time was definitely a refreshing change, especially when so many new and weird types of gemstone simulants are a regular feature at the lab.



4. Sharp junction between glass (dull) and garnet (bright) areas. Also note the scratches on duller area, indicating lower hardness.



5. Scattered gas bubbles and swirl marks in glass portion on pavilion.



6. Planes of gas bubbles along and near junction plane, giving fingerprint-like appearance.

SAUSSURITE – A JADE SIMULANT

Recently, we received a 458 grams white-green 'mottled' carving (measuring 17.00 x 10.80 x 4.00 cm), which interestingly turned out to be saussurite – a known, but rarely seen jade simulant (figure 7). Waxy to vitreous lustre, along with green veins against a white base made us think about jadeite, hence, the carving was directly observed through the desk-model spectroscope for the characteristic 'jadeite' absorption line in the blue region at ~437nm, but no such feature was present. In addition to this, spot RI at ~1.69 was measured for white areas, while no distinct shadow edge could be see for green areas. Conclusive identification of the carving was established on the basis of Raman spectroscopy, which revealed peaks dominantly for zoisite from white as well as green areas; due to the large size of the carving, presence of other minerals could not be determined. Such type of zoisite rock has been described as saussurite, being used as a jade simulant in the past.

Saussurite is classified as a mineral aggregate formed as a result of hydrothermal alteration of plagioclase feldspar, and the process of alteration is known as 'saussurization'. The aggregate thus formed primarily comprised of zoisite with chlorite, amphibole, feldspar and carbonates.

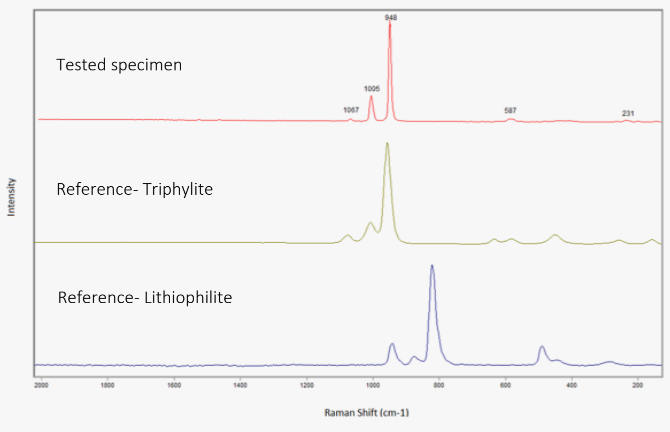
7. This 458 gm carving was identified as 'saussurite' - a zoisite based rock.

ORANGE TRIPHYLITE-NATROPHILITE

8. This 4.66 ct cabochon was identified as triphylite-natrophilite.

Triphylite – a primary phosphate mineral is one of the rare gemstones, which can alter into several secondary phosphate minerals such as dickinsonite, eosphorite, fairfieldite, fillowite, heterosite, hureaulite, phosphoferrite, purpurite, reddingite, salmonsite, sicklerite, stewartite, strengite, triploidite, vivianite, and wolfeite. Triphylite is a group of minerals consisting of three mineral species: triphylite – $Li(Fe,Mn)PO_4$, lithiophilite – $Li(Mn,Fe)PO_4$, and natrophilite – $NaMnPO_4$. Due to the presence of Fe, triphylite is commonly found in blue, grey, brown or black colours, while lithiophilite (due to Mn) in pink to brown to yellow colours, and natrophilite in deep yellow. As a result of isomorphism, properties of these members of the series tend to overlap.

Recently, we received a 4.66 ct translucent, bright yellow-orange cabochon which was identified as triphylite (tending towards natrophilite). Spot RI was measured at ~1.67 with low birefringence blink, while hydrostatic SG was measured at 3.38; a weak absorption in blue region under desk-model spectroscope was further seen. Under microscope, the specimen displayed multiple directions of cleavage planes along with numerous liquid films. Identification of the specimen was established on the basis of Raman spectra, which revealed peaks associated with triphylite – natrophilite.



9. Raman spectra of the tested specimen (top trace) revealed peaks associated with triphylite-natrophilite (centre trace), ruling out the possibility of lithiophilite (bottom trace)

'SCHALENBLENDE' – BANDED SPHALERITE

Sphalerite or zinc blende $(Zn,Fe^{2+})S$ commonly occurs as transparent crystals in yellow, orange, brown and red colours, displaying tetrahedral and dodecahedral forms. It is known for its high dispersion (0.156) and high refractive index (2.370 to 2.430), resulting in adamantine lustre, however, the hardness is quite low at 3.5 - 4. Sphalerite is also found as banded variety, commonly occurring with minerals like wurtzite, marcasite, pyrite and galena, forming 'botryoidal' masses – such fine-grained and banded sphalerite is termed as 'schalenblende', typically found in brown to beige colours. This term is occasionally incorrectly used as a synonym for wurtzite $(Zn,Fe)S$. Schalenblende is believed to form as stalactites, through rapid crystallization of low-temperature sulfide-rich fluids.

Due to its botryoidal growth structures, it shows concentric rings at cross-sections of stalactites, similar to those seen in agates, but majority of schalenblende used for jewellery displays only wavy bands.

10. A 17.28 ct cabochon of 'schalenblende' displaying bright lustre and wavy bands

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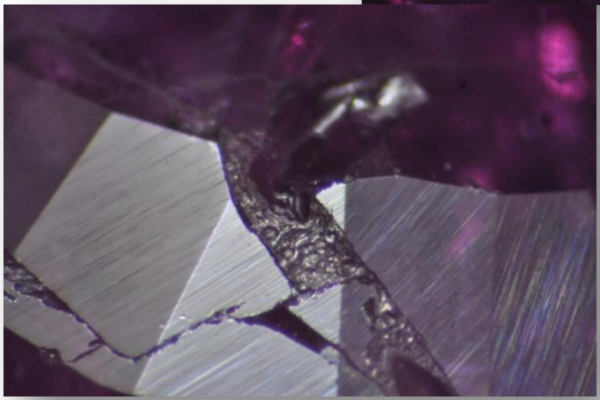
POLYMER-FILLED RUBIES

Recently, we received a parcel of rubies, which was identified as unheated, but majority of the specimens had large cavities filled with a colourless polymer. Most of the rubies in this parcel contained relatively large and wide fractures, connected to cavities, making these rubies susceptible to breakage. Visual effect of filling in these rubies was quite obvious, and visible even under a 10x loupe – the filled areas showed a dull lustre with uneven surface, indicated that a very crude method was used to fill these cavities. We believe that the purpose of filling cavities and wide fractures in these rubies was to prevent them from further breakage, thereby providing stability to rubies.

However, from laboratory's perspective all types of filling and treatments are disclosed on our identification reports, and the same was followed in this case too. Such reports typically carry a comment, "Cavity filling with colourless polymer" along with suitable quantification classification i.e. minor (C1), moderate (C2) or significant (C3).



11. Dull lustre and uneven surface of polymer-filled areas in encountered rubies.

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