GJEPC INDIA

GEM TESTING LABORATORY
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LAB INFORMATION CIRCULAR

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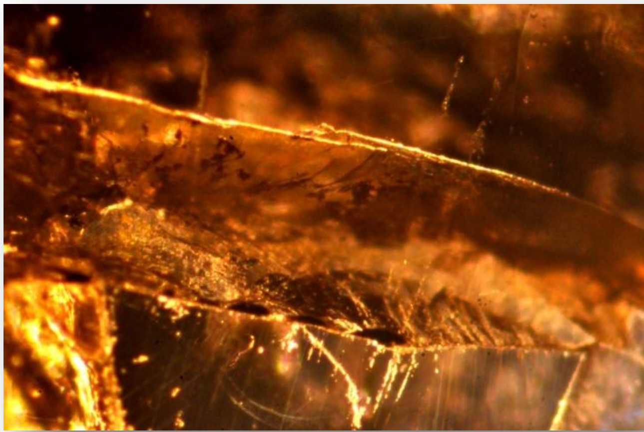
POLYMER-TREATED HESSONITE

1. These three rough hessonite samples (17.92 grams total) are joined by a polymer, which is also found in surface cavities and joints. The treatment is evident from the rough's "oily" look. Also note the visibility of fractures in the 5.31 ct (left) and 5.35 ct (right) cut samples.

Early in 2016, gem merchant Abdul Hafiz (Jaipur, India) showed us a parcel of orangy brown rough hessonite he had purchased, said to be “glass-filled” hessonite. Upon initial observation, the specimens appeared to be treated, as individual crystals were stuck together (figure 1). This is commonly seen in glass-filled corundum rough; however, the typical glassy surface was absent. Rather, the surface appeared greasy, as if it was heavily oiled. Since the crystals were stuck together, it was obvious that some more stable form of treatment has been performed. Further testing was conducted to identify the treatment.

Under 10× magnification, the joints and cavities showed a concentration of a foreign substance that was readily indented with a metal pin, ruling out the presence of glass. Because of the unpolished surface, we could not see the filler, but the stone was transparent enough for infrared spectroscopy. The spectra showed strong features at approximately 3060, 3032, 2923, and 2871 cm^{-1}; these peaks are associated with polymer. Other absorption features were consistent with grossular garnet, specifically hessonite and tsavorite, according to the laboratory’s database.



2. Fractures of the cut samples display thick and cloudy patches, suggesting uneven filling

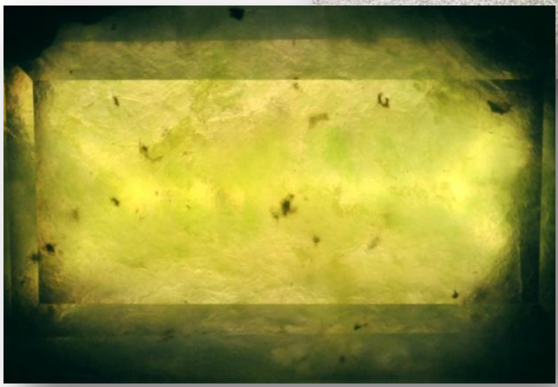
To check for a polymer filler and record gemmological properties, two specimens were faceted, weighing 5.35 and 5.31 ct, respectively (again, see figure 1). Both specimens gave an RI of 1.745 and a hydrostatic SG of 3.60, within the range for hessonite (M. O’Donoghue, *Gems: Their Sources, Descriptions and Identification*, 6th ed. Butterworth-Heinemann, London, 2006). Both displayed a strong roiled or “heat wave” effect and numerous transparent rounded to elongated colourless crystals, features consistent with hessonite. The stones had obvious fractures visible to the unaided eye. When magnified, these fractures displayed thick and cloudy patches (figure 2), suggesting that a foreign substance was used to create an uneven filling. None of the iridescence or colour flashes typically associated with a filled fracture were visible. Both faceted stones also displayed characteristic polymer-related peaks in IR spectroscopy.

This was our first encounter with a polymer-treated hessonite. Because the fractures were eye-visible, it is unclear how much value the treatment adds to these low-grade stones. According to Mr. Hafiz, the treatment is performed to stabilize the rough for cutting and polishing; otherwise the highly fractured material crumbles while processing. He added that hundreds of kilograms of such rough (reportedly African) have been sent to China for treatment.

YELLOW-GREEN OPAL

Green 'prase' opal coloured by nickel impurity has been in the trade for quite long and enjoys a good popularity. Few months back, we received a 1.46 ct yellow-green specimen (figure 3) which was identified as opal, although the colour and appearance was quite unusual for this gem. Refractive index was measured at 1.43, while hydrostatic specific gravity at 2.05 - the properties consistent with that of opal. Under magnification, whitish cloud-like inclusions were present throughout the sample, along with some banding. With transmitted diffused light, clusters of yellow-green crystals were visible (figure 4), which appeared to be the cause of colour in this opal. The exact nature of these mineral inclusions could not be concluded even with the Raman spectroscopy, but the spectra indicated some clay mineral.

__3.__ This 1.46 ct opal was unusual for its yellow-green colour, which appeared to be caused due to some mineral inclusions.

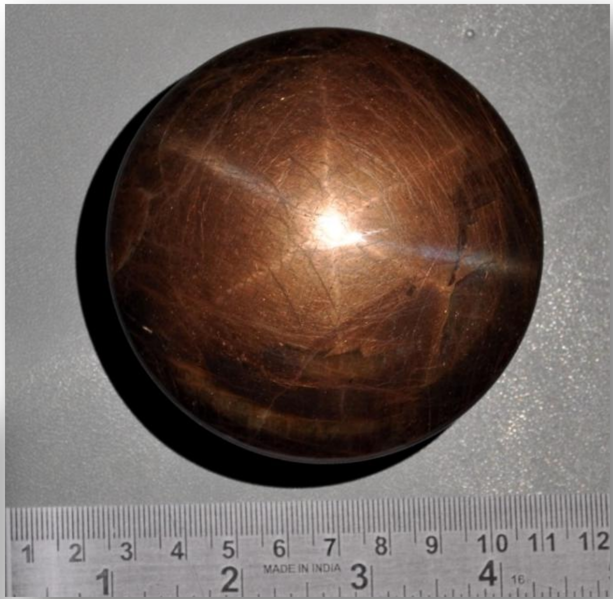


__4.__ The yellow-green colour opal contained clusters / clouds of yellow-green mineral.

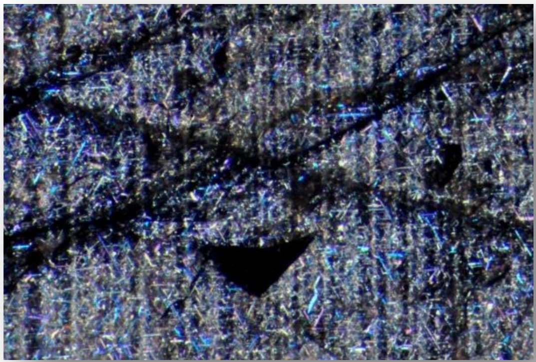
Qualitative EDXRF analysis revealed the presence of Cr, Fe and Ni in addition to Si. Presence of Cr was further supported by the peak at ~682 nm in UV-Vis spectra. Therefore, on the basis of microscopic features, Raman, EDXRF and UV-Vis spectra, the cause of colour in this yellow-green opal appeared to be Cr and Ni bearing mineral inclusions.

663-GRAMS STAR SAPPHIRE

We had an opportunity to examine a star sapphire (figure 5) which was exceptional for its size - it weighed 663 grams and measured approximately 86 mm across. The sapphire displayed a fine but distinct 6-rayed star, with a 'coppery' body colour. The cause of star was (unidentified) short silk and platelets oriented in three directions (figure 6), usually seen in brown star corundum. Although, the origin of this specimen is unknown, its colour is typically not associated with those originating from Thailand.



__5.__ This 663-gram star sapphire was exceptional for its size. Also note its 'coppery' body colour.



__6.__ Three-directional short silk and platelets in the 663-gram star sapphire.

CONTRASTING FLUORESCENCE IN SYNTHETIC CVD DIAMONDS

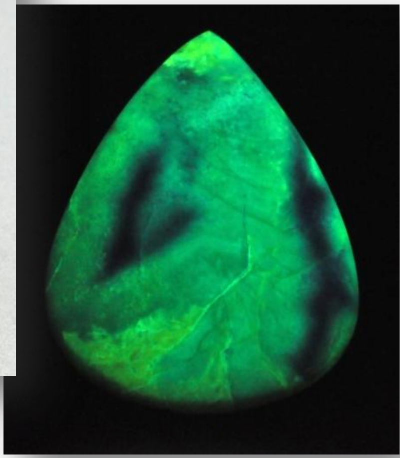
Recently, we received a necklace-set (figure 7) containing 29 pear and one marquise brilliant diamonds in the colour range of light grayish brown, and in sizes of around 0.60 ct. Only few pieces contained some minute particles, in otherwise clean pieces. Standard UV lamp (LW & SW) displayed a range of fluorescence from bright yellow-orange to yellow-green (figure 8) of varying intensities. This reaction was further confirmed by DiamondView imaging. In addition to this striking fluorescence, these diamonds also displayed moderate to strong blue phosphorescence - a feature typically associated with synthetic CVD diamonds. Infra-red spectroscopy confirmed these diamonds as Type IIa, which were then checked for Si-V defect at 737 nm under photoluminescence spectroscopy. Interestingly majority of diamonds showed feature under (room temperature) at 737 nm, of strong to moderate intensity, typically seen in synthetic CVD diamonds.

7. All 30 diamonds (size ~0.60 ct) in this necklace were identified as synthetic, grown by CVD process.

8. The most interesting feature of this necklace was contrasting 'yellow-orange' and 'yellow-green' fluorescence of the diamonds, even though they were of a similar body colour, type and 'probably' from the same manufacturer. Representative images of the body colour (right) and their strong fluorescence (top).

DYED AND STABILISED ALUNITE PRESENTED AS 'GASPEITE'

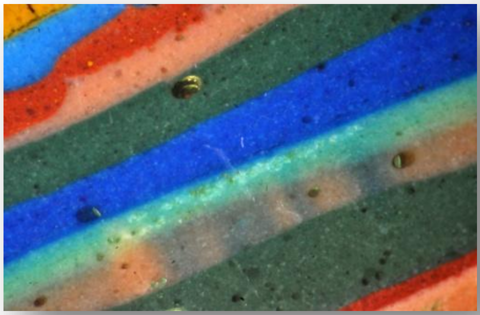
Alunite, a hydrated aluminium potassium sulphate mineral dyed and stabilised in yellow-green colour was recently seen at the laboratory (figure 9). The depositor submitted the specimen with the information that this material has been bought as 'gaspeite' and in large quantities. Preliminary observations under the microscope revealed concentrations of green dye and polymer -like substance within the surface cavities and fractures. Presence of dye was also confirmed by the specimen's bright yellow-green glow under the UV lamp (figure 9, right). Much lower specific gravity of 2.49 further ruled out the possibility of gaspeite. EDXRF analysis detected peaks for Al, Si (due to quartz), K, S, Fe, Cu (dye) and Sr, while the identity of the specimen was established through Raman spectra displaying characteristic peaks at ~ 237, 343, 382, 485, 506, 564, 652, 1027, 1079 and 1187 cm^{-1}. So far, we have seen this material in only yellow-green colour, but its presence in other colours cannot be ruled out.



9. This 79.53 ct dyed and stabilised alunite was presented as gaspeite. Image on the right shows its bright yellow-green fluorescence.

CALSILICA

Also known as 'rainbow calsilica', this colourful material is a man-made product with vibrant colour bands (figure 10, right). Calsilica has been sold as a natural material, claimed to be mined in Chihuahua, Mexico but analysis has proved it otherwise. This artificial product is made from powdered limestone (calcite) held together with a polymer and coloured by various 'man-made' pigments. The most obvious feature to separate this material from other natural 'banded' materials is sharp separation between the colour bands; most natural materials display a 'fuzzy' separation. It's smooth and even granular structure (figure 10, left) is typically associated with other ceramic products, which also has trapped gas bubbles, suggesting the presence of polymer-like substance as binding agent.



10. 'Rainbow calsilica' is known for its bright and bold colour bands (right), which is composed of fine calcite grains held in a polymer. Also note the hemispherical pits (left), representing gas bubbles.

PLASTIC WITH 'FLAME-LIKE' STRUCTURE

Although, pink is the most common and celebrated colour of 'conch' pearls, it is also available in white, yellow, brown, orange and red colours. This pearl type has gained a lot of popularity in the recent past, and hence, its imitations are also on the rise. Recently, we received a plastic bead (figure 11, right) which reminded us of this non-nacreous pearl, not because of the colour, but for its typical 'flame-like' structure - the plastic bead displayed this characteristic feature, along with some swirls. Identification of the bead as plastic was straightforward, but its 'flame-like' structure warrants a mention here.

11. This plastic bead (above) with distinct 'flame-like' structure (left) can become an effective imitation of 'conch' pearl in orange-pink colours.

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