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Crystal Gazing - Magnesiotaaffeite

Figure 1 - Crystal to be Analyzed

Introduction

Having an extensive gem-material database of more than 300 mineral species including very rare ones (such as poudretteite and hibonite to name a few), allows us to provide a reliable gem-mineral identification for collectors and gem suppliers wishing to identify rough or cut gemstones.

Recently, a customer brought a flat orangey-pink crystal with a pearly lustre (Figure 1) to our attention. Although this translucent crystal looked like corundum, the owner felt the crystal needed a definitive identification.

Material and Method:

1. Sample: A 4.24 ct flat orangy-pink crystal with a pearly lustre (Figure 1).

2. Visible-NIR spectrometry obtained with an Ocean Optic USB 4000 spectrometer equipped with a home-made setting with an integration sphere. The software rendering was set in transmission %.

3. Fourier Transform Infrared (FTIR) spectrometry was performed with a Bruker Alpha spectrometer using a low noise DLaTGS detector, equipped with a diffuse (or specular in this case) reflectance type (DRIFT) signal capture module and was run at 4 cm^{-1} resolution.

4. Specific gravity was determined with a homemade set up involving a Dendritic gem scale.

5. Reactions to ultraviolet radiation (shortwave and longwave) were evaluated in a dark box lit with 6W UV tubes.

Results and Related Comments:

At first glance the crystal looked like a flat shiny corundum crystal.

Due to the fact that there were no polished or flat crystal faces, it was impossible to measure the refractive index on a standard refractometer.

Under the polariscope, the stone proved to be translucent with a constant light restoration (aggregated and/or strongly included and/or with strong abnormal polarization effect).

The measured specific gravity of 3.5 did not match the one we had expected for corundum (i.e. ~4.0).

Under SW ultraviolet light, the crystal displayed a medium chalky orangy-red fluorescence while under LW ultraviolet light, it exhibited a medium chalky reddish-orange fluorescence.

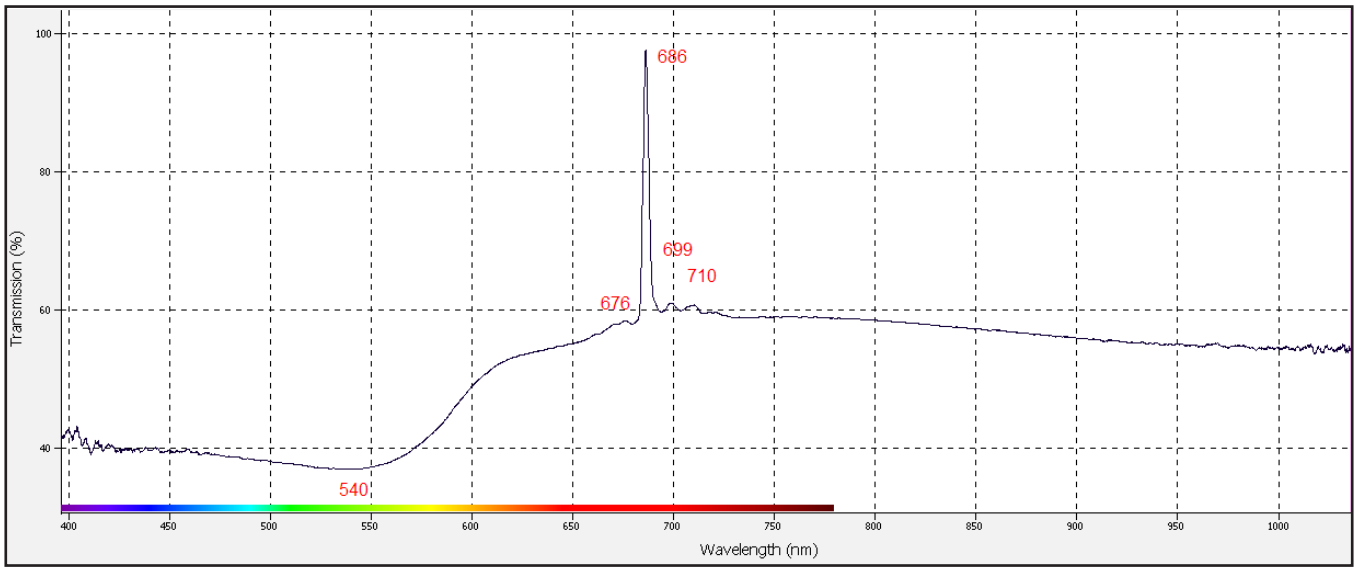

Figure 2 - Vis-NIR spectrum of the crystal

The absorption spectrum (Figure 2) showed a broad absorption band centered on 540 nm. Emission lines were also seen at 676, 686, 699 and 710 nm. Although this emission pattern was similar to the one found in chrome bearing corundum, the line's displacements did not match with those expected for corundum (chrome's emission lines in corundum are at 682, 694, 706 and 714 nm).

However when searching through our gem-material database (specular reflectance FTIR identification database) a perfect match was found with Magnesiotaaffeite (Figure 3).

This being said, a question arose during the evaluation process that the magnesiotaaffeite was actually the 2N'2S polytype (often named Taaffeite) or the 6N'3S polytype (often named Musgravite).

We are currently investigating the possibility of differentiating Taaffeite from Musgravite by the means of specular reflectance measurement since certain clues were found indicating that it could be possible to make this separation by this method. We now have to collect and analyze a statistically representative quantity of verified samples so as to validate this polytype separation method.

Conclusion:

The crystal has formally been identified as Magnesiotaaffeite.

This identification has demonstrated how important it is not to judge a stone by appearance alone. This case also demonstrates the importance of evaluating each peak displacement in the spectra without judging only the overall curve aspect.

Finally this study definitely demonstrates that several analysis methods must be used and their results cross-referenced in order to reach an accurate gem-material identification.

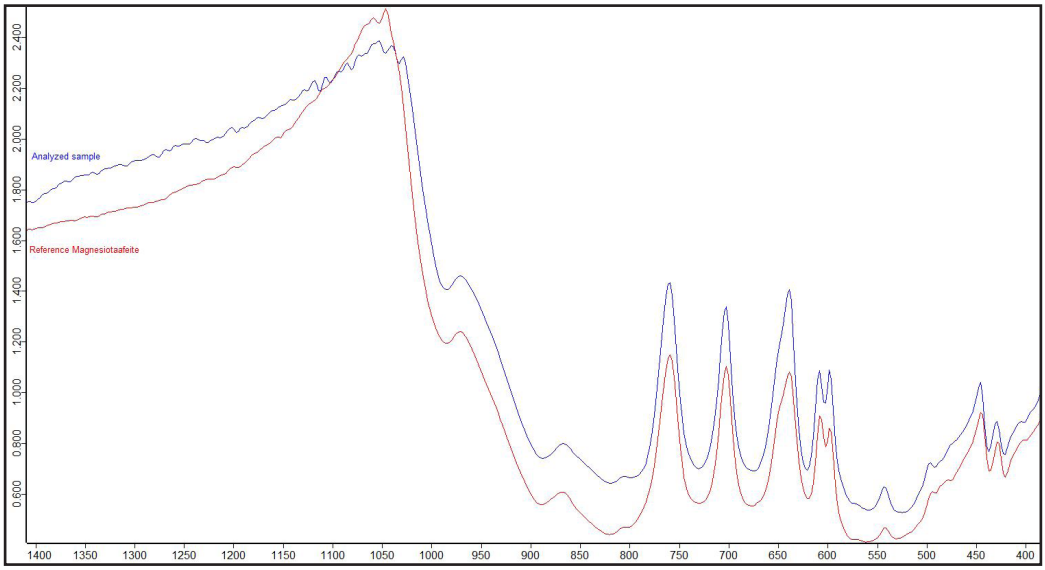

Figure 3 - FTIR specular reflectance spectrum of the crystal (blue trace) compared to the one of Magnesiotaaffeite reference (red trace). Measured spectra had a very good matching with the database references.