LAB NOTE

“BLUE RICHTERITE”

By GIT-Gem Testing Laboratory

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Introduction

One of the GIT’s primary duties as the national gem institute is to provide a high standard gemstone testing service to the country’s gem and jewelry industry. Our gem-testing laboratory (GIT-GTL) has constantly monitoring any new gem material or treatment that comes in the market. Once it was found, we then make a preliminary investigation and quickly disclose its intrinsic properties and proper name of such material to the gem community.

In March of 2019, one cut stone mounted in a pendant was submitted to GIT Gem Testing Laboratory by a gem trader for identification (Figure 1). Standard gemological testing revealed a refractive index of 1.60 (spot reading). Raman spectra collected on blue and white minerals matched with the Richterite and Feldspar reference spectra, respectively.

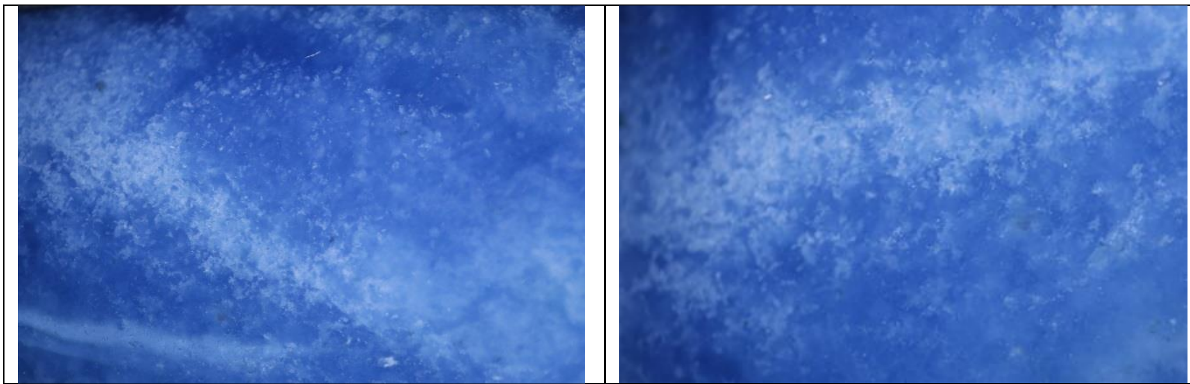
Figure 1: *A blue marquise-cabochon cut stone mounted in a pendant for identificatiom, photo by C. Kamemaganon*

Richterite is a sodium calcium magnesium silicate mineral belonging to the amphibole group. Its chemical formula is $Na(NaCa)Mg_5Si_8O_{22}(OH)_2$. Colors of richterite range from brown, grayish-brown, yellow, brownish-red, pale to dark green, dark green blue and grey blue.

Richterite can be found as transparent to translucent crystals. Its Mohs scale of hardness is about 5 to 6 depending on the composition, with a specific gravity of about 3.0 to 3.5 (Anthony *et al*., 1990). Richterite occurs in thermally metamorphosed limestones in contact metamorphic zones. It can also be found as a hydrothermal product in mafic igneous rocks, and in manganese-rich ore deposits. Localities include Canada, Sweden, Western Australia and US (see Wikipedia). The mineral was named in 1865 for the German mineralogist Hieronymous Theodor Richter (1824–1898) (Bonewitz *et al*., 2008).

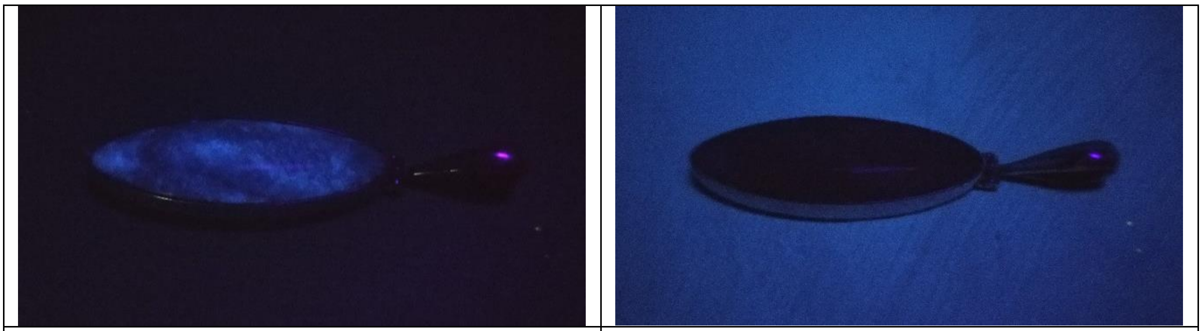
Gemological properties

This stone has a refractive index of about 1.60 (spot reading), Microscopic observation showed a granular aggregate of translucent blue and white-colored minerals (Figure 2). The white mineral grains (i.e., feldsapar, see Raman result) fluoresced moderately chalky blue, while the blue mineral grains(i.e., richterite, ditto) displayed weakly blue in long-wave UV light (Figure 3a). Both white and blue mineral grains were, however, inert in short-wave UV light (Figure 3b).



(A) (B)

Figure 2: *Microscopic observation of the stone showing granular aggregate of blue and white minerals, overhead illumination, magnification 1.25x (A) and 2.0x (B), Photos by B. Srisataporn*



(A)	(B)

Figure 3: *The stone in UV radiation: the white mineral grains fluoresce moderately chalky blue while the blue mineral grains show weakly chalky blue in LWUV (A), and the stone is inert in SWUV (B), Photos by B. Srisataporn*

Advanced spectroscopic analyses

Raman Spectroscopic Analysis

The Raman spectrum of the blue mineral grains shows a dominant peak at 683 cm-1 and serveral other smaller peaks that were perfectly matched with the Richterite reference spectrum (Figure 4). Whereas, the Raman spectrum of the white mineral grains is similar to the feldspar reference spectrum (Figure 5).

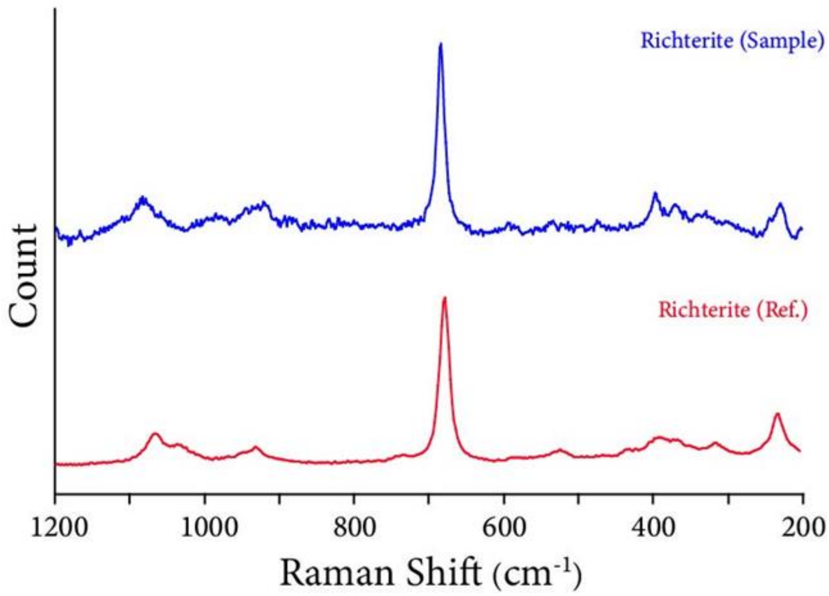


Figure 4: *Raman spectrum of the blue mineral grain is matching with the richterite reference spectrum.*

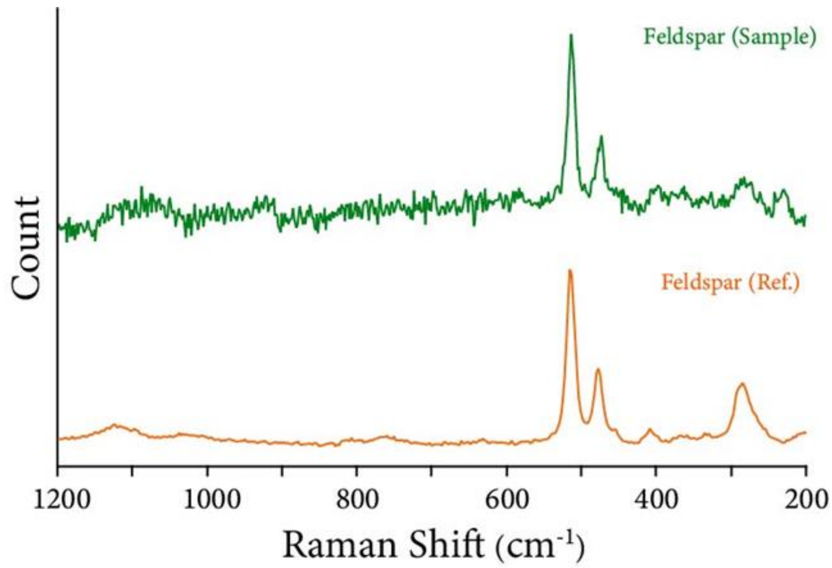


Figure 5: *Raman spectrum of the white mineral grain is similar to the feldspar reference spectrum.*

EDXRF Analysis

The semi-quantitative chemical analyses of the blue richterite grains by EDXRF revealed high contents of SiO_2, MgO and Na_2O (see Table 1) that are consistent with a richterite composition (Liao and Jin, 2001).

Element oxide	*Concentration (wt%)*
Na_2O	5.32
Mg_2O	19.20
SiO_2	65.28
K_2O	3.51
CaO	1.23
BaO	0.61
MnO	0.13
Fe_2O_3	3.52
ZnO	0.05
SrO	1.15

Table 1: *Chemical composition of the blue richterite grains in the stone by EDXRF technique.*

UV-Vis Spectra

The UV-Vis spectrum displayed prominent absorption peak at 435 nm and a abroad absorption band about 500 - 700 nm with absorption maxima at around 600 nm (Figure 6) that give rise to its blue coloration.

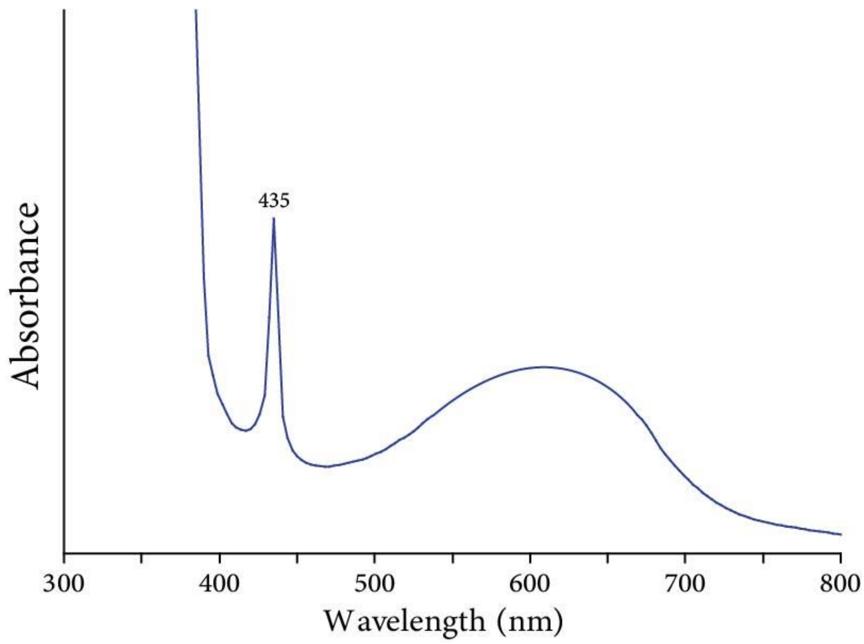


Figure 6: *Unpolarized UV-Vis spectrum of the blue richterite-rich rock in the pendant*

FTIR Spectra

The mid-IR spectra of this stone showed two broad absorption bands in the 3700 - 1500 cm^{-1} range with weak absorption peaks at approximately 3788, 3842, 3939, 4069, 4128, 4317, 4798 and 5208 cm^{-1} (see Figure 7).

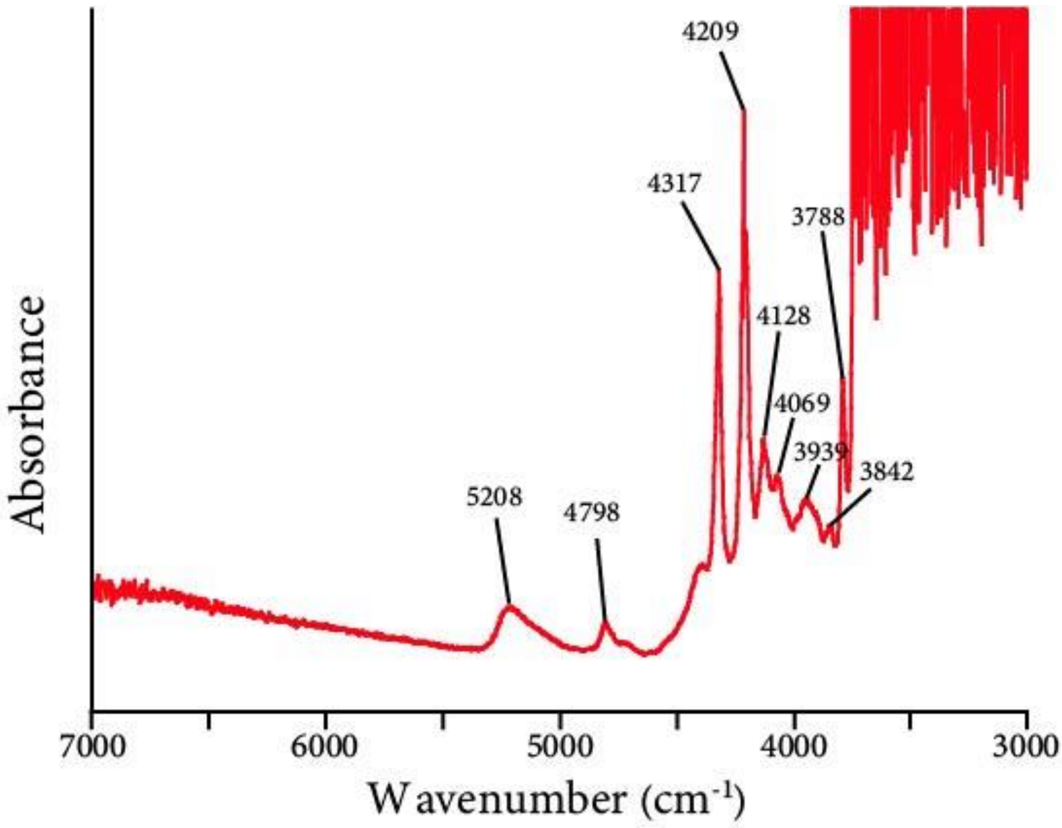


Figure 7: *Mid-IR spectrum of the blue richterite from the pendant*

Conclusion

Based on the above evidiences, i.e., the gemological properties, internal feature, Raman spectra and chemical composition, this stone is a rock composed mainly of blue richterite and feldspar. Furthermore, this rock is also called "Dianite" or "blue Jadeite" or "blue Nephrite" as its trade names in the market (Johnson and Koivula, 2000; Olav, 2012).

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