LAB NOTE

"Faceted Purplish Orange Dumortierite"

By GIT-Gem Testing Laboratory

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Introduction

Dumortierite was described in 1881 by Gonnard for an occurrence in Chaponost, in the Rhône-Alps of France, and named for Vincent Eugene Dumortier (1802-1873), a French paleontologist (Gaines *et al*., 1997). Dumortierite is an alumino-borosilicate mineral, $Al_7BO_3(SiO_4)_3O_3$, and is known as a polycrystalline blue ornamental stone, often mixed with quartz. The known sources of dumortierite are Antarctica, Argentina, Australia, Austria, Bolivia, Botswana, Brazil, Bulgaria, Canada, Chile, Czech Republic, Finland, France, German, Hungary, India, Italy, Japan, Kazakhstan, Madagascar, Mozambique, Namibia, New Zealand, Norway, Peru, Poland, Russia, Slovakia, South Africa, South Korea, Spain, Sri Lanka, Sweden, Switzerland, UK, Ukraine, USA and Zimbabwe (https://www.mindat.org/min-1329.html).

The new material from Tunduru of Tanzania was transparent and colored violetish-gray and brownish-pink (Hänni, 2007). In the gemstone market, almost all colors of dumortierites are deep blue to violet and are commonly found as aggregate inclusions in other gemstones. The normal cutting style is cabochon, tumbling, or carving because of its massive form. GIT-GTL has recently had a chance to identify a rare single-crystal gemstone species, called 'faceted purplish orange dumortierite' in this communication.

Gemological properties

The sample is a facet-fancy-shaped transparent purplish orange stone weighing 0.24 ct measuring 5.06 x 3.28 x 1.96 mm in size (figure 1). The gemological properties of this stone showed a doubly refractive index from 1.684 to 1.724, a birefringence of 0.040, specific gravity (SG) of 3.37, and displayed strong pleochroism dark brown to light brown under polarized light.

Figure 1: The transparent faceted stone with a weight of 0.24 ct, fancy shape, and purplish orange color, its size is 5.06 x 3.28 x 1.96 mm. (photo by C. Kamemakanon)

Microscopic features

The few internal features observed in this stone were growth line, fingerprint, and fracture (figure 2).

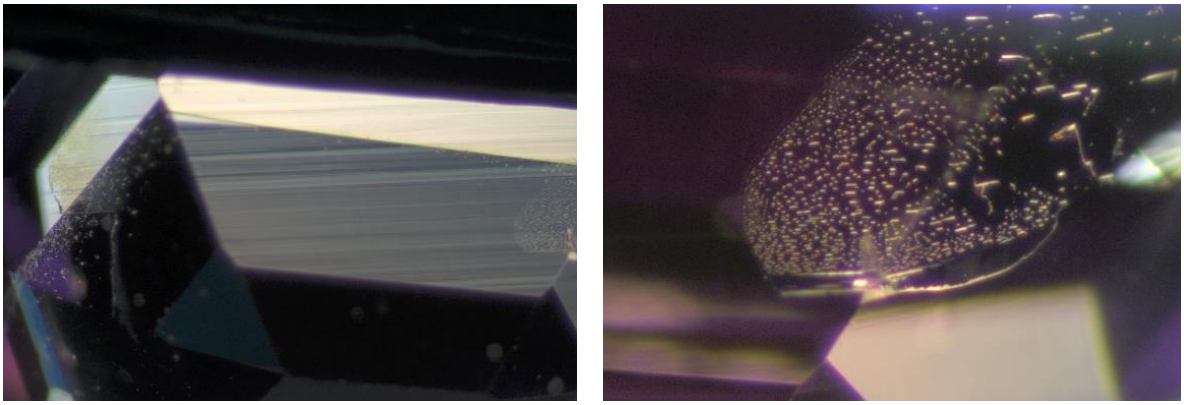

Figure 2: Growth line, fracture (left), and fingerprint (right) in purplish orange dumortierite. Photomicrograph by N. Susawee; field of view 3.5 mm (left) and 1.3 mm (right)

Advanced spectroscopic analyses

The semi-quantitative chemical analyses by EDXRF reveals Al and Si as the major component with minor amounts of Ti and other trace elements such as Fe, V, Cr and Mn (table 1).

Table 1: The chemical analyses of the purplish orange dumortierite by EDXRF

Element Oxides (wt%)	Al_2O_3	SiO_2	TiO_2	V_2O_5	Cr_2O_3	MnO	Fe_2O_3	Ni_2O_3	CuO	As_2O_3
Purplish orange dumortierite	58.39	34.09	6.51	0.23	0.16	0.07	0.27	0.10	0.03	0.15

Raman spectrum of the sample was obtained by using 532 nm laser excitation. Based on a reference from the RRUFF online database (R060069), peaks at 286, 510, 755, 844, 943, 997, and 1175 cm^{-1} indicate that the sample is dumortierite (figure 2).

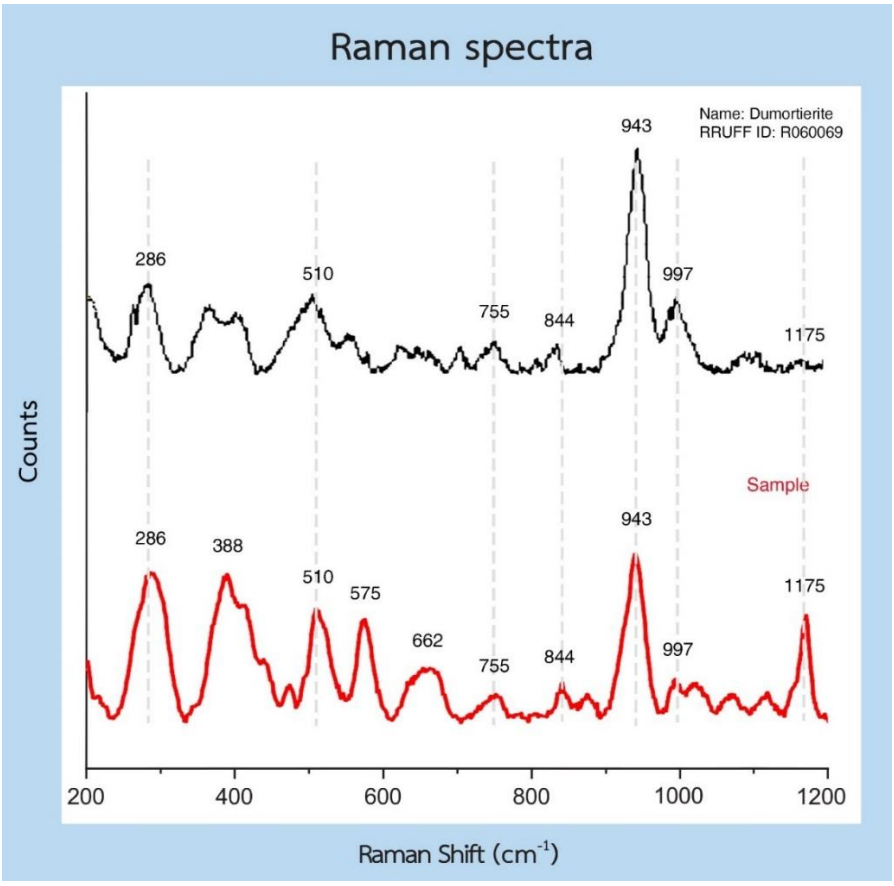

Figure 3: Raman Shift of a purplish orange sample (red line) in the range 200 – 1200 cm^{-1} shows peaks at 286, 510, 755, 844, 943, 997, and 1175 cm^{-1} that match very well with dumortierite of the RRUFF database (R060069) reference (black line).

The polarized UV-Vis-NIR spectrum of the stone for the dark brown pleochroic color displayed a continuous increase in absorption from around 900 nm toward the UV with small humps at approximately 388, 550, and 710 nm, whereas the spectrum for the light brown pleochroic color also showed a continuous increase absorption from around 650 nm toward the UV with small humps at about 388 and 550 nm (figure 4). These absorption features do not show significant transmission windows in the visible range, thus giving rise to the brown hues for both pleochroic colors.

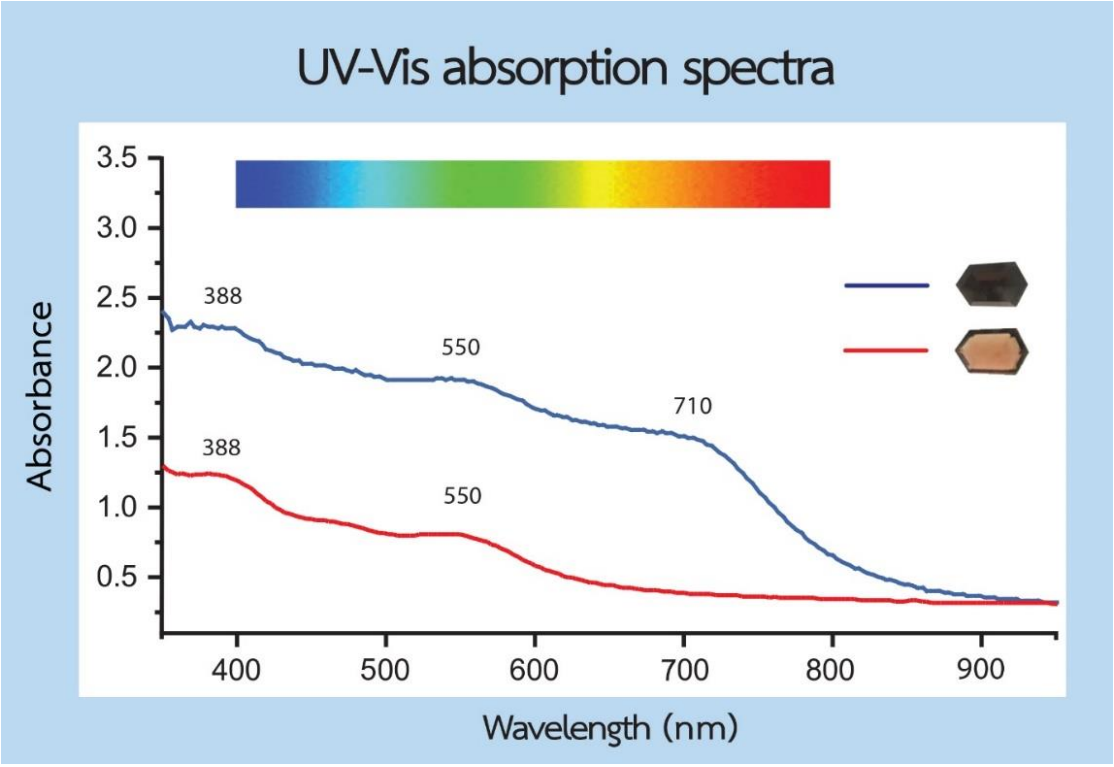

Figure 6: Polarized UV-Vis-NIR spectra of purplish orange sample in the range 350 – 950 nm of the two pleochroic colors (dark brown and light brown).

Discussion and conclusions

The gemological properties of this stone, such as refractive indices and SG value, are consistent with the dumortierite's properties reported by Gaines et al. (1997) and Hänni (2007). Raman spectroscopy is a precise technique for quick and non-destructive identification as its spectrum matches very well with the reference RRUFF online database of dumortierite. The combination

of gemological and advanced analyses suggests this purplish orange stone is a rare gem-quality natural single-crystal dumortierite.

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References

Gaines, R. V., Skinner, H. C. W., Ford, E. E., Manson, B. and Rosenzweig, A. (1997). *Dana's New Mineralogy (Eighth Edition)*. John Wiley & Sons, New York, pp.1117-1118.

Hänni, H. A. (2007). Gem News International: Transparent dumortierite and sapphirine from Tanzania. *Gems & Gemology*, 43(4), 379.

Mindat.org. Jolyon Ralph [Internet]. 2000 [cited 2022 Dec 21]. Available from: https://www.mindat.org/min-1329.html

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