



The Gem and Jewelry Institute of Thailand (Public Organization)

GIT GEMSTONE UPDATE

Preliminary Investigation of Purple Garnet from a New Deposit in Mozambique

By GIT-Gem testing laboratory

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Introduction

In March 2016, a group of Thai gem dealer led by Mr. Pichit Nilprapaporn paid a visit to the GIT and informed us about a new garnet deposit in Mozambique, that was discovered near the western border with Zimbabwe. They also displayed a large parcel of rough and a few cut stones claimed to be the material found in this new deposit (Figure 1). According to the stone's owner, these garnet specimens were unearthed from an unconsolidated sediment layer, just a few meters below ground surface. This brief report is our preliminary investigation on the interesting vivid purple garnet from the new deposit in Mozambique.



Figure 1: Mr. Pichit Nilprapaporn (center), the stone's owner, showing a large parcel of purple garnet roughs claimed to be from a new deposit in Mozambique to the GIT director (left).

Samples and Testing Procedure

The stone's owners donated some specimens (one 6.10 ct oval-faceted stone and 13 rough samples weighing from 3.83 to 9.43 cts) to the GIT Gem Testing Laboratory for studying. The cut stone was firstly recorded for the standard gem properties by using basic gem instruments, namely polariscope, refractometer, hydrostatic balance, gem microscope, Long and short wave UV lamps. These stones then chemically analyzed by Energy Dispersive X-ray Fluorescence spectrometer (EDXRF) model EDAX Eagle III.



Figure 2: A 6.10 ct oval-faceted purple garnet (front) and the rough pieces (behind, weighing from 3.83 to 9.43 cts) reportedly from a new deposit in Mozambique. Photo by T. Sripoonjan

Standard Gem Properties

Our impression when we first looked at these stones was their stunning color of homogeneously vivid purple and strong vitreous luster (see Figure 2). The surface features of almost all rough stones showed angular shape and sharp edge with conchoidal fracture suggesting that these materials were transported at relatively short distance from their primary host rock (Figure 3).



Figure 3: The rough samples show sub-angular shape (a) and conchoidal fracture (b).

The standard gemological properties obtained from the faceted stone revealed anomalous double refraction (ADR), a constant refractive index (RI) value of 1.764 and the specific gravity (SG) value of 3.89. This samples are inert to long and short wave ultraviolet. The RI and SG values fall within the range of pyrope-almandine series (so-called Rhodolite) of gem garnet group. The stones have no optical reaction to the Chelsea filter. The absorption spectrum obtained by handheld-spectroscope yield strong absorption bands at around 500-570 nm. The internal features are composed of cluster of crystals with tension halo, liquid-like inclusions, needles and thin film (see Figure 4).

Table I Gemological properties of the purple garnet from Mozambique.

Sample	Grt_Mozim_01
Weight	6.10
Colour	Purple
RI	1.764
SG	3.89
UV luminescence	None
Absorption spectrum	Bands at 500-570 nm

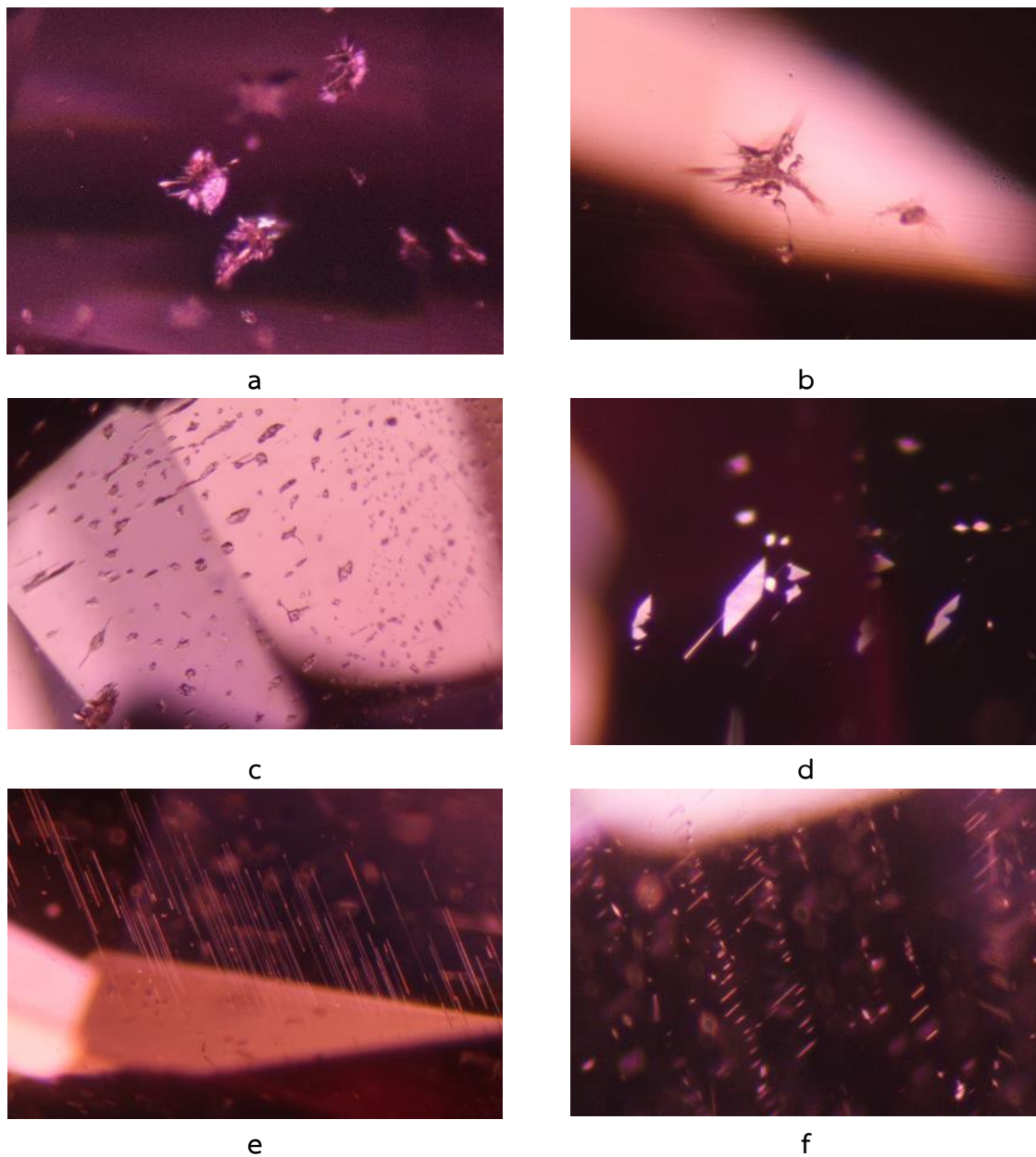


Figure 4. Internal features consisting of crystal clusters with tension halo (a and b), fluid inclusions (c), thin film (d) and needles (e-f).

Chemical analysis

The chemical composition of the cut stone analyzed by EDXRF showed rather high content of iron (21.91 wt% Fe_2O_3) and magnesium (12.28 wt% MgO), minor content of calcium (0.50 wt% CaO), and trace amounts of manganese (0.23 wt% MnO_2) and chromium (0.02 wt% Cr_2O_3). The

chemical composition confirmed that this gem material is a rhodolite garnet, a solid solution between pyrope (Mg) and almandine (Fe) end members (Table II).

Table II: Chemical composition of purple garnet from Mozambique analyzed by EDXRF as compared with those from other sources.

Element (Oxides: wt%)	Grt_Mozim_01 (this study)	Rough stones (average from 7 samples) (this study)	3237 ^a (Catandica Mozambique)	Pyrope 11 ^b (Tanzania?)
SiO ₂	44.33	43.42	40.23	41.08
Al ₂ O ₃	20.65	23.35	23.01	25.32
FeO	21.91	19.45	24.03	4.35
MgO	12.28	12.83	12.72	20.07
CaO	0.50	0.65	0.77	2.57
MnO	0.23	0.17	0.21	5.58
Cr ₂ O ₃	0.02	0.03	-	0.10
TiO ₂	0.05	0.04	-	0.06
Total	99.97	99.94	100.97	99.13

^a Rossman et al. (2015); ^b Sun et al. (2015)

Final Remarks

This new gem material is actually a rhodolite garnet as indicated by its RI and SG values as well as its chemical composition. Further study on the geology of the deposit, the internal features, UV-Vis, FTIR and caused of color are ongoing with close cooperation with the stone's owner.

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References

Rossman G.R., Laurs B.L. and Hoover D. 2015. Purple Garnets from East Africa. *Journal of Gemmology*, 34(8), 656-658

Sun Z., Palke A.C. and Renfro N. 2015. Vanadium- and Chromium-Bearing Pink Pyrope Garnet: Characterization and Quantitative Colorimetric Analysis. *G&G*, 51(4), 348-369