GIT

LAB NOTE

The Gem and Jewelry Institute of Thailand (Public Organization)

SOME CHARACTERISTICS OF "MOZAMBIQUE" RUBY

GIT Gem Testing Laboratory (GIT-GTL)
November 19, 2009

Introduction

Since the beginning of 2009, the GIT-GTL has received a number of rubies for certification from dealers said to originate from Mozambique (Lichinga area). Unfortunately, the exact location of these rubies has not yet to be determined with certainty. Based on gemological data collected from those stones and GIT's reference collection of two untreated and five flux-assisted heat-treated stones (Figure 1), some characteristic features typical of these rubies are described below.

Figure 1: GIT's collection of Mozambique ruby. Front row: Unheated, 2.22 ct and 2.32 ct. Back row: heat-treated, from 1.12 ct–2.57 ct. (Photograph by Wimon Manorotkul)

Color and other features

These rubies range in color from purplish red to red and look very similar to those of Myanmar materials. Microscopic examination of unheated stones revealed prominent lamellar twinning planes along the rhombohedral faces with long boehmite needles intersecting from 3 directions. Clouds of minute particles are present with some look like tiny needles and most are small platelets typical of rubies from this region. (see inclusion pictures in Figure 2–6).

Heated samples examined showed twinning planes with broken tube-like needles. Dense cloud of platelets still present along with partially resorbed silk. Certain samples show syrup-like red concentrations around melted crystals. Most of these heated stones have a fair amount of veil-like healed fracture. All five showed moderate red luminescence in LW UV and weak red in SW UV.

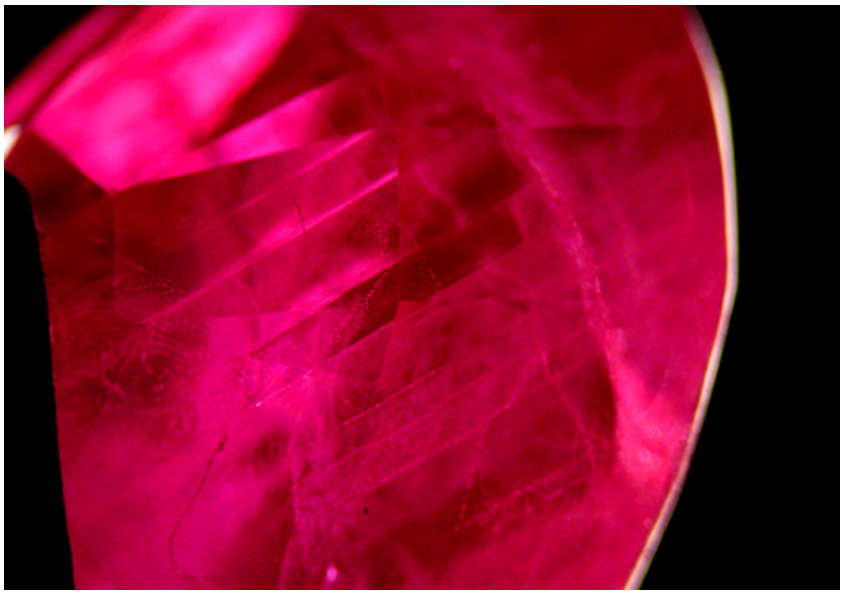

Figure 2: Lamellar twinning in heat–treated Mozambique ruby. Dark Field (DF) 25x (Photograph by Wimon Manorotkul)

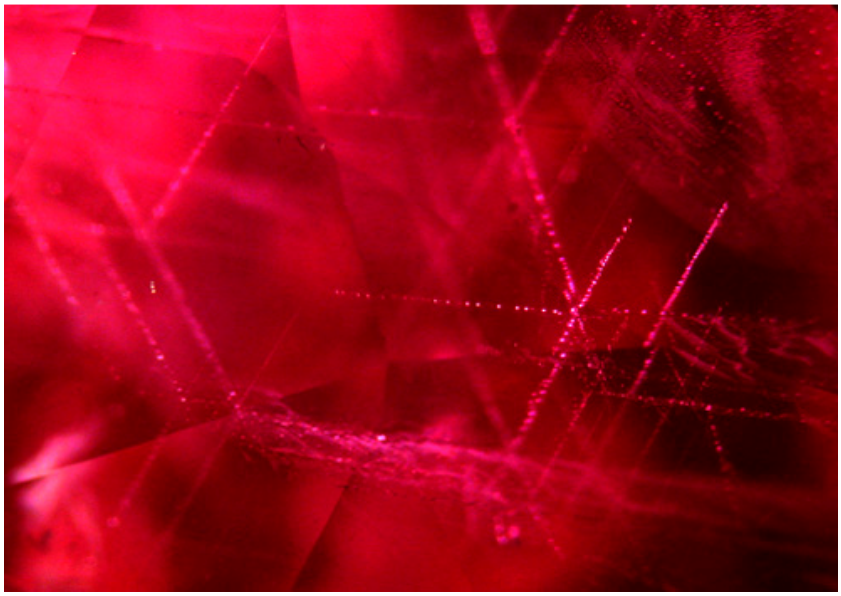

Figure 3: Partially melted boehmite needles in a heat-treated sample. Fiber Optic (FO) 50x (Photograph by Wimon Manorotkul)

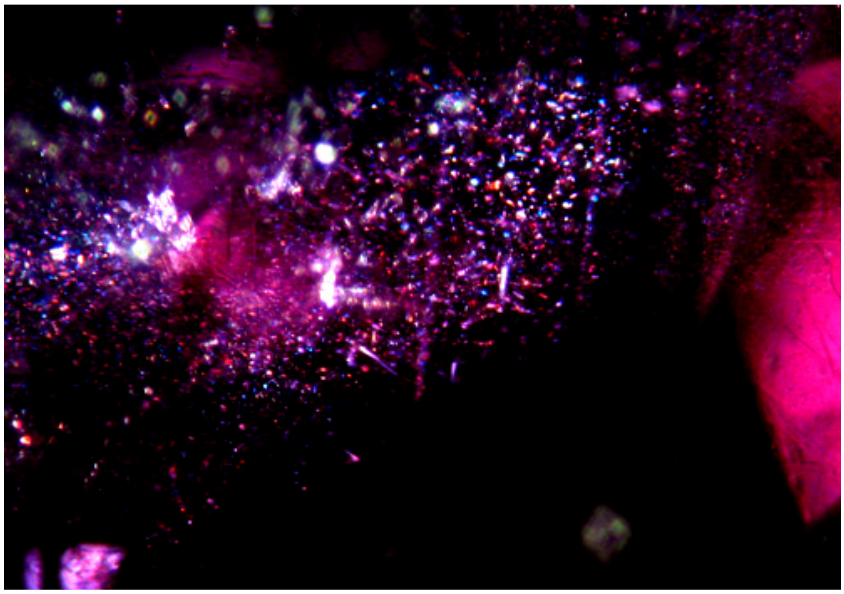

Figure 4: Clouds of tiny rutile needles and reflecting platelets in unheated sample. FO 50x (Photograph by Wimon Manorotkul)

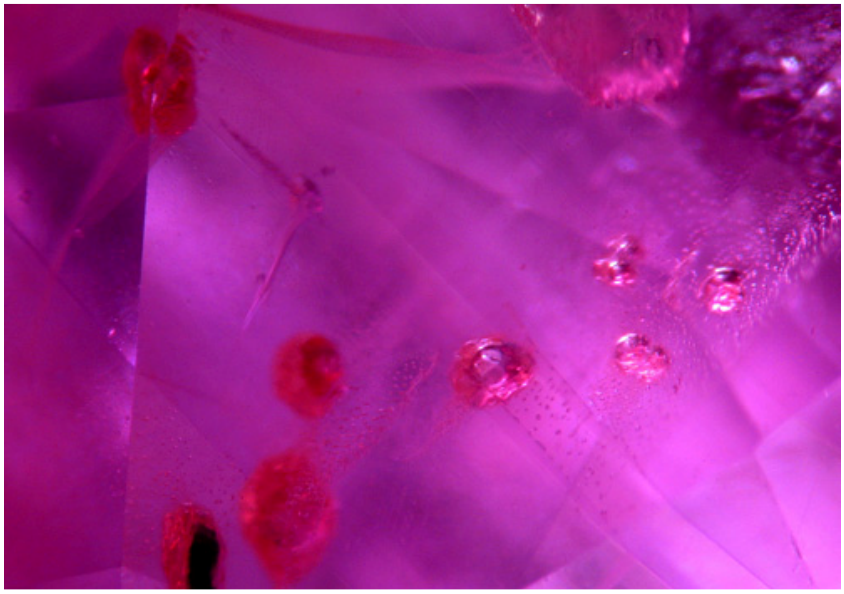

Figure 5: Gas bubbles in partially melted crystals. Notice the red concentrations around the crystals in the heat-treated sample. FO 50x(Photograph by Wimon Manorotkul)

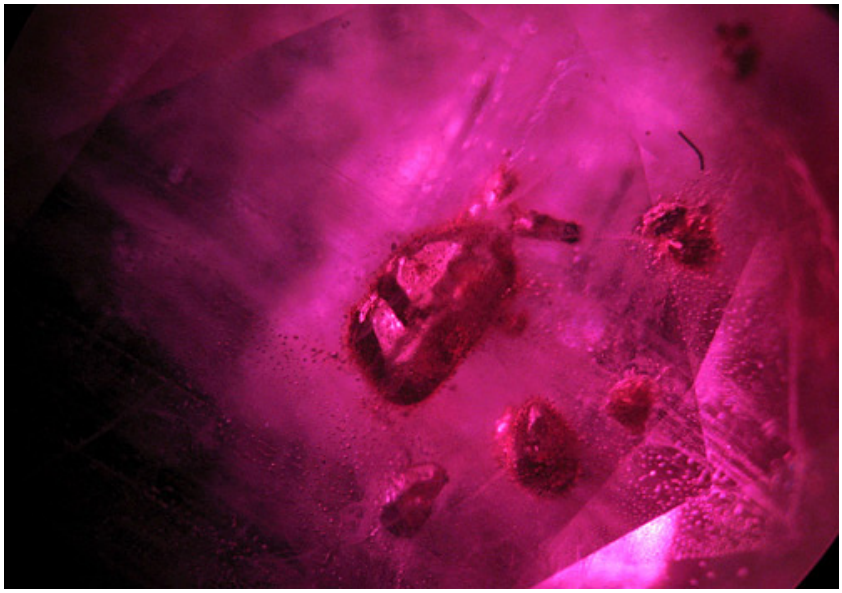

Figure 6: Partially melted crystals in a heat-treated stone. FO 32x(Photograph by Wimon Manorotkul)

Semi-quantitative EDXRF analyses indicate moderate contents of chromium (0.203-0.675 wt% Cr_2O_3) and iron (0.404-0.620 wt% Fe_2O_3), very low-to-low contents of titanium (40–171 ppm TiO_2) and vanadium (bdl–44 ppm V_2O_5) and low to moderate gallium contents (30–100 ppm Ga_2O_3). The chemical compositions are similar to those of Winza ruby and also appear to be in the range of the chemical characteristics of ruby from many localities in East Africa. (Abduriyim and Kitawaki, 2008; Hanni, 2008a,b; GIT, 2008) Trace amounts of boron, magnesium, and tin were also detected by LA-ICP-MS at the GIT-GTL.

The presence of boehmite in unheated samples is readily detected by distinct mid-IR absorption bands at 3079 and 3309 cm^{-1} (Smith, 2006) while those bands are absent in heated stones (see Figure 6 and 7). In fact, these features have also been reported in unheated ruby and sapphire from many localities worldwide.

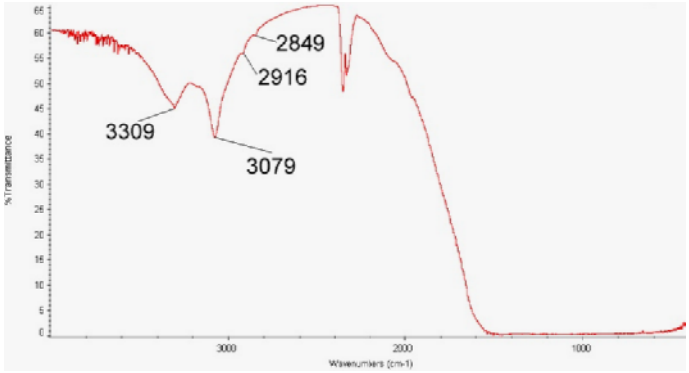

Figure 7: A representative mid-IR absorption spectrum of the untreated sample.

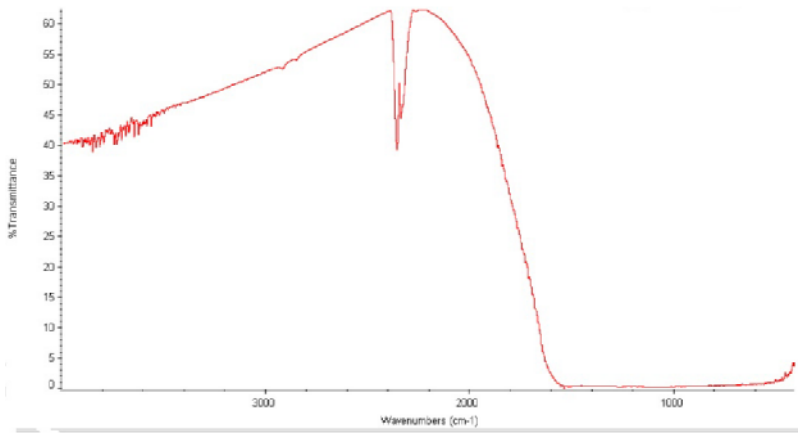

Figure 8: A representative mid-IR absorption spectrum of the heat-treated sample showed no absorption band at 3309 or 3079 cm.

The UV-Vis absorption spectrum typically shows the Cr absorption line and bands together with iron absorptions (379/387 and 450 nm with an elevated background toward the UV region) as normally expected from many African rubies such as Madagascar, Tanzania and Malawi (see Figure 8).

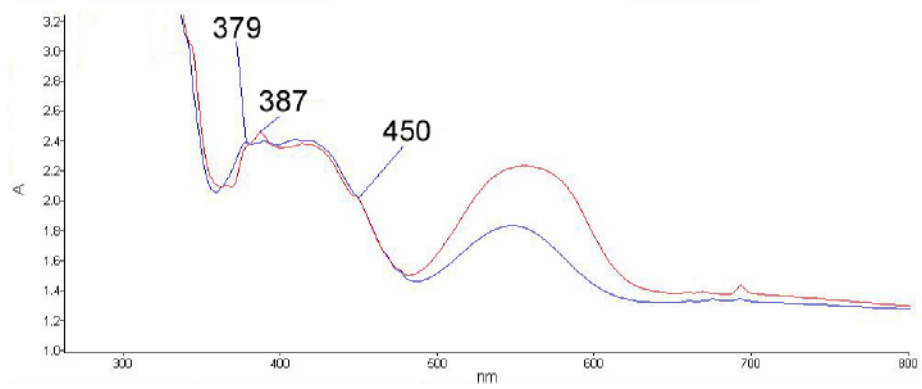

Figure 9: A representative UV-Vis absorption spectrum of a ruby from Mozambique.

Conclusions

Based on the data collected to date, the specific internal characteristics typical of rubies represented to us as being from Mozambique are strong lamellar twins, and intersecting growth tubes. Up to now these rubies fall into three treatment categories, namely, untreated, heat-treated and fracture-filled. Unheated stones are relatively rare (usually less than 3 cts). Most common are flux-treated materials (sizes up to 10 cts). Finally, we also found low-quality stones, most of which were filled with lead glass.

References

Abduriyim, A. and Kitawaki, H. (2008) New geological origin: Ruby from Winza of Tanzania. <http://www.gaaj-zenhokyo.co.jp/researchroom/kanbetu/2008/2008_08en-01.html>

GIT (Gem and Jewelry Institute of Thailand) Gem testing Laboratory (2008). Ruby form a new deposit in Tanzania. *GIT Lab Review,* Issue 1, August 2008, pp. 1–6.

Hänni, H.A.(2008a) New rubies from central Tanzania . *GIA Insider*, May 2, 2008

Hänni, H.A. (2008b) New rubies from Tanzania . *SSEF Swiss Gemmological Institute Newsletter*, May 3, 2008.

Smith, C. (2006) Infrared spectra of gem corundum. *Gems & Gemology*,Vol.42, No.3, p. 92.

Bibliography

Pardieu, V., Thanachakaphad, J., Jacquat, S., Senoble, J.B and Bryl, L.P (on-going research from March, 2009) Rubies from the Niassa and Cabo Delgado regions of Northern Mozambique: A preliminary examination with an updated Field Report Annex. <http://www.giathai.net/pdf/Niassa_Mozambique_Ruby_September13_2009.pdf>