



## 7 The restart of demantoid from Madagascar and its Twinning fire

The demantoid garnet mine in Madagascar was restarted by Prosperity Earth LLC. Their mining operation is well examined and planned, unlike the previous work. Also, the rough gems are well sorted and cut to accentuate the attractiveness of the demantoid. Moreover, the iridescence on the twinning plane enhances the rainbow flash of the fire. Their mining activities and related support of the local community will be the ideal model for mining in developing country to realize true sustainable local prosperity.

One gemstone made its reappearance in Tucson this year. It was a demantoid garnet from Madagascar. We have previously reported on the reopening of the Detroit City portal, where rhodochrosite from the Sweet Home Mine in the United States was reopened through the use of newer, sophisticated mining techniques. I would also like to highlight the unique characteristics of demantoid garnets from Madagascar that have been discovered through the development of this new mine.

### 1) Previously produced from Madagascar for only 9 months

Demantoid garnets were first discovered in Madagascar around 2009. The site, discovered near Ambanja in northwestern Madagascar, was located on the intricate estuary coast. The production was quite large, and I have the impression that many vendors at gemstone shows at the time were selling various qualities of Madagascar demantoid. Soon, however, the market for demantoid began to dwindle. The first reason was because the previous mining activity in Madagascar was so unplanned as to make it unsustainable. This mining area is located near the coast at an elevation of 0 m above sea level, and the tidal range in this area is about 1.5 to 6 m. Here are some photos that tell the story of the mining at that time.



The previous mining of demantoid garnet in Madagascar in 2009  
(Photo courtesy: Vadim Fedder)

As we can see in this photo, a tremendous number of miners are gathered in close proximity, and you can see a series of tunnels dug by their hand, tightly packed together. The miners would dig one hole, pump water into the next hole as they mined garnets from there, and when they were finished, pump water from the hole where they had stored water into the hole they were digging, and then mine that hole. Such ad hoc mining could not continue for long, and when it was high tide or a storm hit, the mine shafts were filled completely, and mining operations were

halted. It is said that the mine was in operation for only about nine months (from April to December 2009).

We believe the second reason is that the value added to the demantoid was not maximised. The samples we received at the time were poorly cut, with crooked girdle and unsightly polish lines. This was probably due to the fact that the stones were supplied to the market in such large quantities in such a short period of time (9 months) and were therefore poorly handled. Of course there were some stones that were carefully cut to bring out their true beauty, but on the other hand there were many stones like our sample that were cut so roughly that their true beauty was not revealed and they were sold on the market as inferior gems. For these reasons, Madagascar's demantoid garnets disappeared from the market because they were not highly valued and the miners could not continue to work due to a poor mining plan.

### 2) Mining in Madagascar reopened

It was the American company Prosperity Earth LLC that recently reopened the mine. The company planned to reopen the mine in 2018. The company partnered with Dr. Federico Pezzotta, a mineralogist with extensive knowledge of Madagascar. Many may know him from the discovery of Pezzottaite, the first gemstone of the 21st century, which bears his name. With his help, Prosperity Earth investigated the property and became convinced of its potential. Then, in 2018, it began the redevelopment.

The challenge for this mine, as it was before, is the water due to the low elevation of the land, 0 meter above sea level, and its proximity to the ocean. In the next photo you can see that a 6 meter high dam around the mining area prevents water from entering the mine. This made it possible to use heavy machinery and to mine on a larger scale through a large open pit, rather than the dangerous small-scale tunnel mining of the past.



Current Prosperity Earth demantoid mine in Madagascar  
The current mining of demantoid garnet by Prosperity Earth LLC

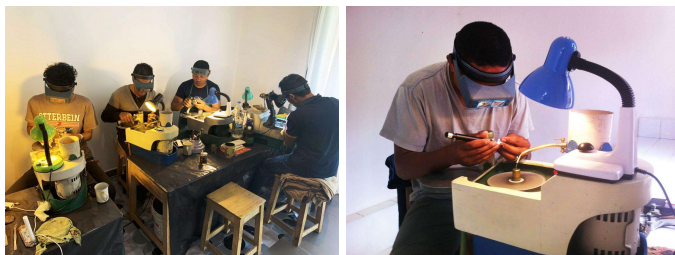
Demantoid garnets from this deposit were formed from a hard skarn deposit. The skarn deposit was altered by intense heat generated during the intrusion of Permian-Triassic lamprophyre dikes into sedimentary layers of sandstone and limestone. Demantoid garnets are randomly

distributed within the skarn as vein networks. However, in earlier artisanal mining, the surface weathered layers were mainly mined, but the crystals in these layers were often cracked or had many inclusions due to weathering. On the other hand, many crystals that escaped weathering remained in the deeper layers protected by hard rock, and it was necessary to mine through the hard rock to obtain high quality mineralization. The current larger scale mining with heavy equipment is one of the reasons why the quality is different from the previous rush, although the deposit is the same as before.

### 3) SDGs Mining Development in Madagascar

Prosperity Earth's current mining operation, as the company's name implies, is dedicated to bringing prosperity to the local community. Previous mining was truly unplanned and ad hoc, resulting in a short, unsustainable mining rush that lasted less than a year. The current operation is well planned and vertically integrated. Their gemstones are cut to a very well defined brilliant cut, which is done in their own factory in Madagascar. The company established a cutting factory in Antananarivo, the capital of Madagascar, where it has become not only a factory but also a precision cutting lapidary. Currently, all cutting at this factory is done by local staff. In the future, the company aims to increase production and further improve its technology by training more cutters.

I was very pleased to see that the polishing machines were made by Imahashi Seisakusho of Japan, as shown in the photo of the lapidary workshop. The author has a special feeling for Madagascar because my father and I were involved in sapphire mining in Ilakaka around the year 2000. At that time, gemstones were not widely recognized as an industry in the region, and local cuts were terrible. However, when I look at the company's cuts today, I see beautifully polished brilliant cuts, which makes me feel happy about the country's development and even grateful for how hard the company has worked to cultivate its skills. I felt that the ideal gemstone producing country has realized the highest value-added polishing process in the distribution of gemstones produced in this country.



Propelity Earth's polishing plant in Madagascar  
Lapidary of Prosperity Earth LLC in Madagascar (Photo: Prosperity Earth)

In addition, at such a large scale, the development of local infrastructure also plays a role in the productivity of a mining operation. This includes the maintenance of roads to the mine and the living environment for local employees. The company also provides basic medical facilities for the residents of the mining camps, which are also necessary. In addition, the company subsidizes educational facilities at local schools and works with the local government to subsidize women's participation in society.



The school was rebuilt with the help of the company and an agricultural project by women supported by Prosperity Earth LLC

While these activities may have a CSR aspect, they are also necessary for the stable continuation of mining activities in the long term. The author was involved in sapphire mining operations in Ilakaka, Madagascar, but due to the lack of various infrastructures in this developing country, the heavy equipment brought in from Japan and the local staff could not ensure a stable workforce, and mining operations declined dramatically. CSR and SDGs may sound like nice words, but in reality they are the foundation that supports day-to-day mining operations. We have high expectations for the company's mining operations, which are ahead of other companies. Incidentally, mangrove trees have been planted on the former mine site where mining was conducted, just as they were there before. The number of mangrove trees planted at the site of the former mine is said to have reached 20,000, a figure that shows the magnitude of the mining operation.

### 4) Demantoid Garnet Features and Twinning Fires

The Madagascar demantoid is from the same type of skarn deposit as the Namibian, and is not derived from chromium-bearing ultramafic and serpentine as in Iran and Russia, so it has a paler green color, probably due to iron and titanium rather than chromium. However, as with the Namibian demantoid garnet featured in Gem Information Vol. 46, it can be said that the color has a very strong fire (light dispersion) that is hidden in darker colored demantoid garnets from Russia and other countries.

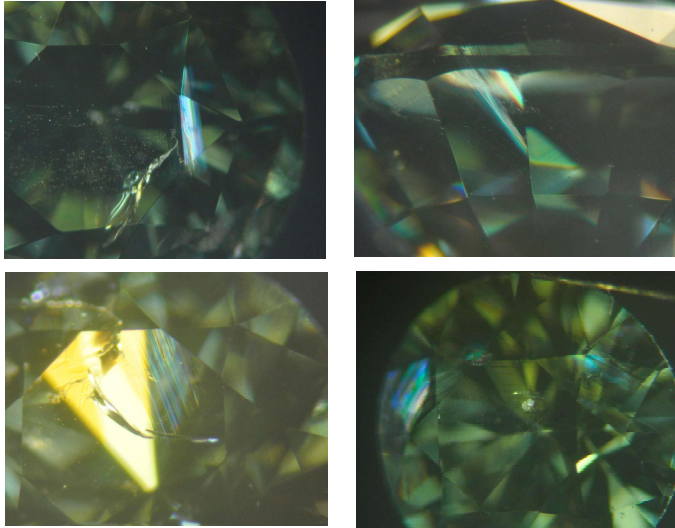
Strangely enough, there were also many stones in the samples we examined that showed particularly strong fire. Some of the stones from the Green Dragon mine in Namibia have a special cut (Super square™) that emphasizes the fire, and the fire is clearly visible, while the Madagascar stones here have a normal round brilliant cut, similar to diamonds, but the fire is more intense. The Madagascar piece here is a normal round brilliant cut like a diamond, but the fire is very strong.



Outstanding fire in demantoid garnet from Madagascar

The cause was found by examining the inclusions, not by fire, but by iridescence. In the stone where the fire appeared to be strong, inclusions were identified on planes with iridescence. This is the iridescence seen in the twinning planes along the crystal structure. As shown in the photos below, they are moderately sized and can be

seen on their own, reflecting light off other facets. Furthermore, because they are twinning planes and not large voids (liquid) like the liquid inclusions in iridescent quartz, they are only visible from certain angles and do not interfere with the transparency. The rainbow-colored light from the iridescence was visible when the demantoid was viewed closely, as if it were superimposed on the fire.



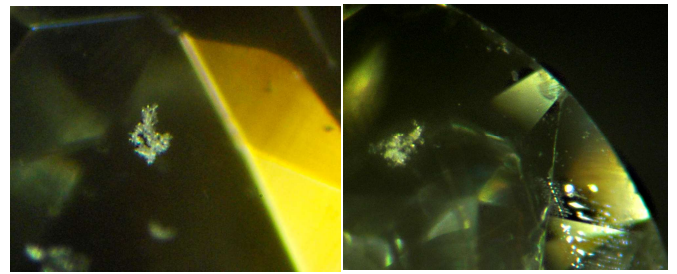
Twinning planes with iridescent effect in Malagasy demantoid

Such twinning is not common in demantoids from other localities. Some Pakistani demantoids show bright iridescence under polarized light due to severe distortion of the crystals, but these are rainbow-colored lights that can only be seen under polarized light. The Iranian variety also has distorted growth lines due to severe distortion, but they are not on a straight plane and few of them produce iridescence. This seems to be a characteristic unique to Madagascar. I suggested to Mr. John Ferry of Prosperity Earth that it should be called "Twinning Fire" because it looks like a fire due to the twinning.

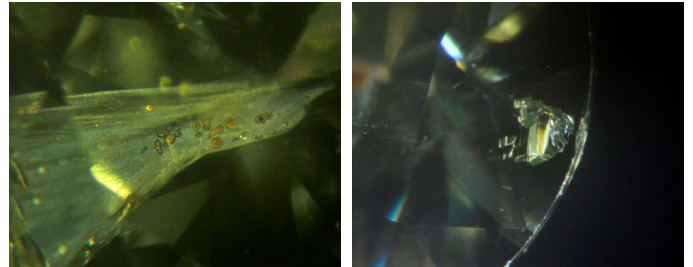
### 5) Gemological characteristics of demantoid from Madagascar

In terms of gemological characteristics, Madagascar demantoid does not differ significantly from those of other localities. The refractive index is 1.81 or higher, which cannot be measured with a standard gemstone refractometer, but data indicate a refractive index of 1.880-1.889. Specific gravity is 3.80-3.89 (average 3.84) and hardness is 6.5-7.0. There is no fluorescence in either short or long wave UV light. As a cubic (equiaxed) garnet, it is not polychromatic, but has a dispersion of 0.057, higher than that of diamond (0.044), and has a strong fire. Again, the dispersion itself is the same in the darker green Russian and Iranian garnets, but the darker base color of these stones makes it difficult to see the fire, while the lighter base color of the Madagascar garnets makes the fire appear as strong as the dispersion specification.

Because the inclusions are not of serpentine origin, they do not include Although the Prosperity Earth specimens in this issue have good transparency and do not show too many inclusions, J. C. (Hanco) Zwaan in Journal of Gemmology 38(1), 2022, pp. 64-79 also reports fluoapatite, dolomite, calcite, quartz, pyrite, bismuth and wollastonite.

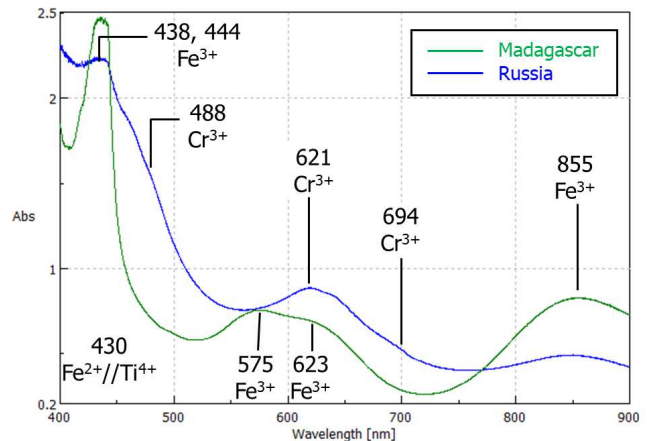


Inclusions in the diopside cluster  
Diopside grains inclusion in demantoid from Madagascar



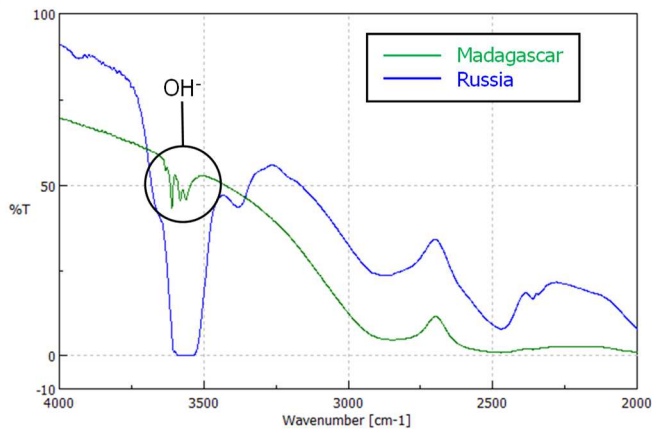
Goethite in liquid(L) and negative(R) inclusion in demantoid from Madagascar

The spectral characteristics of Madagascar demantoid show no chromium lines and absorption that may be due to iron or iron and titanium. The following spectra show absorption characteristics compared to those of Russian demantoid samples, which are rich in chromium. There are various theories as to the cause of the color, such as charge transfer between iron or iron and titanium, but there are still many uncertain factors. Some of the beautiful demantoids from Russia have almost no detectable chromium, and the author is unable to explain the color of many of them. In addition, the green (blue) color of Madagascar demantoid cannot be intensified by reductive heating as is the case with Russian demantoid. We have tried this but have not seen any improvement in color. Conversely, it is a gemstone that does not need to be heated.



Absorption spectra of Madagascar and Russian demantoid  
Visible spectra of demantoid from Madagascar and Russia

FT-IR does not have the intense absorption due to OH- of serpentine origin because it is not of serpentine origin as in Russia. This OH- absorption is also a characteristic found in a wide range of serpentine-derived Russian, Iranian, Pakistani, Italian and Turkish demantoids.



FT-IR spectra of demantoid from Madagascar (skarn related)  
and Russia (serpentine related)

Unlike the previous Madagascar demantoid garnet, this mining operation by Prosperity Earth is being conducted in a rational manner in accordance with the SDGs, and can be said to be the type of gemstone mining required in this day and age. In addition, I have the impression that the previous Madagascar demantoid garnets were not handled well, with some being cut roughly, but this time they were handled with care, cut beautifully, and their true beauty was brought out. In particular, stones with few inclusions show the strong and beautiful fire inherent in demantoids, and the interference of seven colors of light due to iridescence creates a "pseudo-fire" and accentuates it. We hope you enjoy the beauty of this characteristic fire.

From **GEM INFORMATION VOL.49**

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